Toolkit for Risk-based pensions supervision

INTERNATIONAL ORGANISATION OF PENSION SUPERVISORS

Case Study

Mexico

Risk-based Pensions Supervision provides a structured approach focusing on identifying potential risks faced by pension funds and assessing the financial and operational factors in place to mitigate those risks. This process then allows the supervisory authority to direct its resources towards the issues and institutions which pose the greatest threat.

The IOPS Toolkit for Risk-based Pensions Supervisors provides a 5-module framework for pensions supervisors looking to apply a system of risk-based supervision. A web-based format allows: a flexible approach to providing updates and additions; users to download each module separately as required; and a portal offering users more detailed resources, case studies and guidance. The website is accessible at www.iopstoolkit.org.

This document contains the **Mexico Case Study.**

MEXICO[1]

I. Background

A. Pension System

The Instituto Mexicano del Seguro Social (IMSS), or the Social Security Institute, has operated a mandatory, funded, individual account system since 1997 for workers in the private formal sector. Workers affiliated to ISSSTE, the Social Security Institute, which provides benefits for public sector workers who opted in, were added into the individual account system. Contributions are from employers, employees and from government. A minimum pension is also provided by the state, if the worker makes a minimum number of contributions during his working life. Voluntary personal accounts, with and without tax incentives, also operate.

In 2010 the mandatory private pension system had around 41 million members (97.4% are workers affiliated to IMSS, 2.13% are workers affiliated to ISSSTE and 0.44% are independent workers), and 15 pension fund management companies (known by their Spanish acronym AFOREs). Individuals are free to choose their AFOREs, which are regulated and supervised by the National Commission for the Retirement Savings System (CONSAR). The main responsibility of CONSAR is to coordinate, regulate and oversee the Retirement Savings System (SAR, henceforth). This Defined Contribution (DC) system is comprised of a mandatory defined contribution pension scheme with employees' individual accounts, which are managed by AFOREs). CONSAR´s ultimate goal is to protect workers' retirement funds, particularly in unusual situations in the financial markets, by creating a competitive and transparent environment that allows the enrollees to be informed of their legal rights in order to obtain an adequate pension.

As part of the recent reforms in the SAR, a law passed in 2007 instituted an individual retirement account programme for civil servants and created a special AFORE, called the *PensionISSSTE*, to exclusively manage the scheme for its first three years. Public employees may switch to another AFORE only once the three-year period has elapsed.

Since 2008, each AFORE has been allowed to offer five different pension funds or SIEFOREs (SIEFORE 1 to 5) with different types of investment strategies and risk levels. There are no legal requirements for a minimum rate of return to be credited to a member's individual account.

In December 2010 pension fund management companies had accumulated assets equivalent to over MXN 1,384 billion (USD 112 billion), or 10.8% of Mexico's GDP. At the end of 2010 around

---

[1] Case study taken from country report produced for the World Bank publication (Brunner et al 2008), with figures from CONSAR updated in May 2011

294,166 workers had signed up to voluntary savings accounts, with pension funds having accumulated assets equivalent to MXN 4.3.5 billion (USD 289 million).
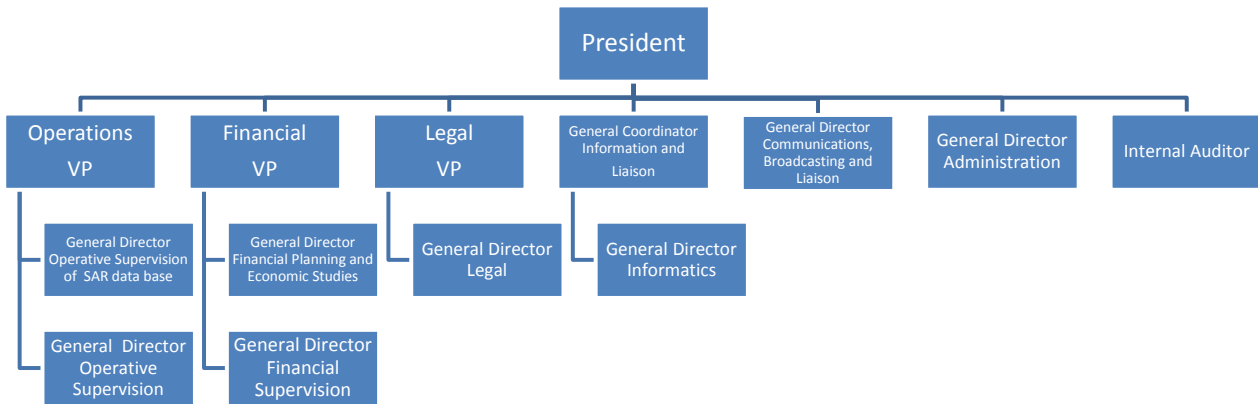
B. Risk-based Supervisory Approach

CONSAR is a specialized pension supervisory agency. Until 2003, CONSAR's supervision was focused on operational issues. Supervision was limited to determining if transactions in the different operational processes were done in accordance with normal practice. In response to the growing complexity of the system, a new approach was introduced in 2004, based on the management of operational and financial risks.

CONSAR's approach to risk-based supervision is different to other authorities as, although overseeing a defined contribution system (which does not offer guarantees), quantitative measures (Value at Risk –VaR – see below) and investment limits by asset class and by credit ratings are at the heart of their assessment. Prudential measures have been introduced as a way of controlling investment risk as quantitative investment controls are deregulated. CONSAR's methodology involves detailed regulation of the risk parameters and risk management architecture of pension funds – i.e. risk-based supervision has been implemented on top of heavy compliance-based regulation. A transitional approach has been adopted, with regulation expected to be gradually relaxed (especially for pension funds showing good risk management).

The RBS system is not related to any capital requirements. AFORES are not mandated to create reserves to match pension liabilities, since there are no formal or nominal pension liabilities in the accumulation phase. However, Afores are liable for losses incurred as a result of violations on the investment regime, in which case the Afore has to reimburse the loss to the fund, and for that purpose Afores are required to constitute and keep a special reserve and capital. These resources are linked to the size of the funds managed by the Afore but not to the risk of their investment, since the latter is bound by a maximum VaR. CONSAR is examining how to link capital requirements to risk levels in order to better align incentives (concerns about volatility of reserves, increasing operational costs and could be pro cyclical).

CONSAR undertook some internal changes to effectively implement its new risk-based approach to supervision. These included reorganization, the development of better practices to hire and train staff, improvements in information technology, greater financial autonomy and enhanced transparency. A clearer separation between the technical specialists and complementary and support functions have been put in place

Figure 1: Organisation chart of CONSAR

Source: CONSAR

II.   Risk-based Supervision Process

1. Risk Focus

Supervisory Objectives

CONSAR outline their vision as: a Mexico where pensioners can count on a social protection system with a broad coverage that provides them with the necessary elements to live with dignity, with a trustworthy, effective and independent regulator, effective and independent that guarantees an adequate administration of saving for retirement and contributes to the development of financial markets, promoting a retirement culture in an economic and socially stable environment.

Their mission statement is: to protect workers' savings for retirement, developing a competitive environment that allows for the informed exercise of rights, so that retirees can obtain adequate pensions.

Nature of Pension System

CONSAR oversees a DC pension system. The focus is therefore on risks borne by individuals – particularly operational and investment risk. Although the Mexican pension system is DC without investment guarantees (although there is a minimum pension guarantee), CONSAR's model to control risks uses quantitative measures to control investment risk and a balanced corporate governance of the Afores.

Risk Appetite

Investment regulatory requirements remain in place as the Mexican system is mandatory, although there has been a relaxation of most of the quantitative limits and the introduction of more prudential risk management elements within the Afores.

2. Risk Factors

A. Individual

CONSAR's model monitors operational, credit, liquidity and market risks, as well as assessments of internal checks and balances to make decisions. The supervision is divided into two main activities: the operational activities and the investment of the resources. The operational activities involve the monitoring of the following elements:

Table 1: operational activities of CONSAR

Operations	Internal Controls	Variables monitored
Registration of workers Transfer of resources among Afores Contributions collection Withdrawals (partial or total) Control of Individual account balances Attention to worker IT	Planning and implementation of annual supervision program Processes monitoring Identification of potential sanctions A score card is under development to rank Afores according to size and complexity	Self-Correction programs and policies Analysis of statistical data regarding the operations described and the sanctions imposed Financial results of the Afore (that is the pension manager not the pension funds)

The investment of resources monitoring involves a scoring system comprising the size of the funds, assessments of the corporate government, financial diversification of the portfolios, failures detected with daily surveillance, infrastructure in place to support financial activities, back office efficiency, risk unit systems, independence of the control units (risk unit and compliance officer), and internal communication (see section risk weighting below).

Each process is divided into sub-processes, and risk factors for each of the sub-process are identified. Risk factors are divided into three types of elements:

- *procedures* – to define, describe and evaluate the quality of the processes written down in manuals approved by committees (investment, risk or operational committees);

- *controls* – to evaluate the evidence with respect to the compliance with the manuals and with respect to quantitative regulation (the latter for investment activities only);

- *structure* – to consider the size, complexity of operations and organization, human capital and infrastructure of the Afores.

Internal controls are the main source of operational risk. Other significant risks in these activities arise from the receipt and dispersion of contributions and IT. In the investment activities the lack of independence of the control areas (the risk unit, and the compliance officer), deficient internal communication in the Afore, underdeveloped infrastructure and weak leadership are the most

important elements to be strengthened. The supervision processes have therefore focused on these most critical areas.

B. *Systemic*

CONSAR tracks liquidity built into investment portfolios as well as investments in illiquid assets, both in absolute terms and as a percentage of the portfolios. Positions in derivative instruments are monitored, along with the collateral agreements/requirements (CSA, recouponing). The evolution of the weighted average maturity (WAM, which is an approximation of duration) and VaR of the portfolio are tracked, the latter on a daily basis as a regulatory requirement. Stress tests, return and risk attribution analysis are performed on a periodic basis. Portfolio credit risk concentration is followed as well. All of these indicators are part of the regulatory requirements and their evolution is evaluated to identify changes and exposures to risks.

3. Risk Indicators

A. *Quantitative*

In terms of financial risks, CONSAR receives daily information about transactions and prices undertaken by Siefore.[2] CONSAR's model involves analysing transactional information and triggering alarms which result in questionnaires being sent directly to participants, requests for further information, inspection visits and/or notifications of potential violations of investment limits.

As the investment regime has allowed new asset classes and has relaxed the existing quantitative limits, CONSAR has put in place more prudential measures to be performed by Afores and also by CONSAR, based on a wider set of portfolio's tests. The investment and risk committees have to consider these tests when making their strategies, investment decisions and recommendations.

The primary quantitative financial risk supervision tool is the historical VaR. This is a market risk limit measured through the estimation of the maximum value of potential daily loss within a specified confidence interval.

The VaR limit is based on historical data utilizing risk factor information from the preceding 1000 days to estimate the potential daily loss of the portfolio. The VaR limits for the more conservative to the more aggressive funds are 0.6%, 1%, 1.3%, 1.6% and 2% of NAV respectively. There is a 95% confidence interval for all funds. If the VaR is violated or any other regulation is not complied with due to the Afore's own actions, and there is a loss to the fund, the loss must be compensated

---

[2] Daily checks include: checking compliance with investment limits; checking portfolios against the records of the Central Deposit (INDEVAL), computing the VaR, ensuring correct pricing of Siefore investments, and cross checking Siefores' NAV with Bolsa Mexicana de Valores (BMV).

In addition some activities are carried out less frequently, including reviewing the policy and procedure manuals for risk management, investments and compliance officer's annual plan of actions, reviewing the information provided by Afores to affiliates and requesting risk management, infrastructure and accounting assessments from external auditors.

using the resources of the special reserve that the Afore invests in each Siefore, equivalent to 0.8% of the assets under management.

Afore's have to compute and comply with the VaR limit daily and also have to complete a stress test using parametric VaR and Monte Carlo VaR to further evaluate and monitor risk and to make investment decisions. Additionally, Afores must have stop-loss rules, such that specific measures would be taken if losses are incurred above certain level. The regulation is not specific with respect to prudential policies to manage risks, but it imposes portfolio re-composition when any quantitative limit is exceeded including the historic VaR limit. However, CONSAR has introduced a certification process for both AFORES technological infrastructure and employees capabilities to master derivatives instruments requiring proper risk management. Each Siefore must have a manual (checked by CONSAR) describing all the procedures, including computing marginal VaRs for assessing the risks of investing in specific types of instruments.

The Var tool is useful to control the leverage of the fund, particularly the leverage that stems from derivative transactions based on non-exotic swaps, futures, puts and calls. The VaR calculation was modified in order to account for systemic volatility and this is useful to avoid portfolio recomposition of pension funds due to the rise of market volatility.

A reserve has to be created by the Afore equal to 0.8% of the assets under management. If a loss for the fund arises due to the violation of current investment limits, the Afore's reserves are automatically used to compensate affiliates for that loss. The penalties are proportional to the losses incurred. Afterwards Afores have to reconstitute the reserves within the following 45 days.

The VaR is computed by using historical information on risk factors. Information from the price vendors and valuation agencies play an important role in this process. The price vendor provides information on risk factors in order to determine price histories for the instruments in which pension funds actually invest. The 1000 days previous to the day at which the VaR is computed are the scenarios considered, and a price distribution is obtained from these scenarios. The valuation methodology provided by price vendors is overseen by the CNBV (Comisión Nacional Bancaria y de Valores) and Afores can make observations on it, especially for sophisticated instruments. For each instrument in the investment portfolio there can be k risk factors, F1, F2, ..., Fk, which may be, for example, inflation, interest rates, exchange rates, stock market prices, etc. which determine the price of the securities. The price of the allowed instrument j at day h is expressed in terms of the risk factors through the valuation formula:

$$P_j^h = f(F_1^h, F_2^h, ..., F_k^h)$$

The specific daily procedure to compute the VaR is the following:

- Historical information for all risk factors is collected and has to be available when the VaR is computed. This information is provided by the price vendors. An example of a risk factor would be the 91-day interest rate CETES (Mexico's benchmark interest rate), which is used to find the price of that CETES, and therefore values of the interest rate for 1000 days are needed. When a new instrument enters the portfolio, it might embody a

new specific set of risk factors. In that case historical information would have to be collected before computing the VaR.

- Afterwards it is necessary to find the daily variation of each of these risk factors for the 1000 days before the valuation date. In the example the ratio of the risk factor values for consecutive dates, multiplied by the interest rate corresponding to the date of the computation of the VaR would give the daily value simulated for the interest rate. That is, the interest rate at date t between the interest rate at date t-1, multiplyed by the value of the risk factor at the date of valuation provides 1000 simulated values for the risk factors. This procedure is done by the price vendor. The following table shows these calculations.

Table 2: daily variation of risk factors calculations

Risk Factor	Variation	Simulated risk factor
F_1^h		
F_1^{h-1}	$F_1^h \big/ F_1^{h-1}$	$\dfrac{F_1^h}{F_1^{h-1}} \times F_1^h$
F_1^{h-2}	$F_1^{h-1} \big/ F_1^{h-2}$	$\dfrac{F_1^{h-1}}{F_1^{h-2}} \times F_1^h$
$\vdots$	$\vdots$	$\vdots$
F_1^{h-999}	$F_1^{h-998} \big/ F_1^{h-999}$	$\dfrac{F_1^{h-998}}{F_1^{h-999}} \times F_1^h$
F_1^{h-1000}	$F_1^{h-999} \big/ F_1^{h-1000}$	$\dfrac{F_1^{h-999}}{F_1^{h-1000}} \times F_1^h$

Source: Financial regulation 15-27

- The simulation of risk factors is performed for all factors involved in the whole set of instruments that comprises the investment portfolio. From the simulated risk factors a 1000 prices are computed for the whole investment portfolio. An analytic pricing formula is used at this stage for each instrument. These price formulas stem from theoretical valuation models and are chosen and sometimes modified by the price vendor.

- With the 1000 prices for each instrument a matrix of 1000 x n, comprised of daily price differences is constructed, where n is the number of assets in the portfolio of the Siefore. The (i,j) element of this matrix will be the following:

$$CP_j^i = P_j^i - P_j^h \text{ for i=1,2,...,1000 and j=1,2,...,n}$$

P_j^i : Price of the instrument j under the scenario i;

P_j^h : Price of the instrument j at day h;

CP_j^i : Difference between the price of the instrument j at scenario i and the price of the same instrument at day h.

- With the price differences and the portfolio shares in each instrument a 1000 portfolio valuation changes is obtained. That is, the matrix of price differences is multiplied by the number of instruments and derivative contracts each Siefore holds in its portfolio.

$$\begin{pmatrix} CP_1^1 & CP_2^1 & . & . & . & CP_n^1 \\ CP_1^2 & CP_2^2 & . & . & . & CP_n^2 \\ . & . & . & . & . & . \\ . & . & . & . & . & . \\ . & . & . & . & . & . \\ CP_1^{1000} & CP_2^{1000} & . & . & . & CP_n^{1000} \end{pmatrix}_{1000xn} \times \begin{pmatrix} NT_1^h \\ NT_2^h \\ . \\ . \\ . \\ NT_n^h \end{pmatrix}_{nx1} = \begin{pmatrix} PMV_1^h \\ PMV_2^h \\ . \\ . \\ . \\ PMV_{1000}^h \end{pmatrix}_{1000x1}$$

NT_j^h : number of contracts of the instrument j at day h.

PMV_i^h : increase or decrease in the portfolio value at scenario i for the portfolio at day h.

- Then the 1000 changes in the portfolio value are divided by the market value of the portfolio corresponding to the day the VaR is computed. This percentage change on the value of the portfolio is ordered from the lowest to the highest to get the distribution of returns/losses simulated with historical scenarios.

In order to account for external volatility that may be systemic, the confidence level of the VaR may be adjusted automatically when market volatility rises. The scenario value for the VaR is calculated according to the following methodology:

A benchmark (PR) is defined for each Siefore. That is, one is defined for Basic Siefore 1, one for Basic Siefore 2, and so on. Each of these portfolios will be identified as PR.

On date t a 1000 valuation scenarios (P&L) generated with the corresponding benchmark are calculated. These scenarios will be used to compute the variables described below.

Let:

X_t: On date t, is the number of scenarios that exceeds the regulatory VaR limit.

X_t^{30}: Considering the most recent 30 scenarios are generated with the PR at the time t, is the number of scenarios that exceed the regulatory limit of VaR.

X_t^{60}: Considering the 60 most recent scenarios are generated with the PR at the time t, is the number of scenarios that exceed the regulatory limit of VaR.

E_t: at time t is the number of VaR scenario corresponding to the type of Siefore in question.

This variable can not be less than 26.

H_t: Is the slack on day t.

This variable is defined as the difference between the number corresponding to the VaR scenario minus the number of scenario for the benchmark (PR) that exceed the regulatory limit of VaR. That is,

$$H_t = E_t - X_t$$

Then, the value E_t is determined with the following policy:

a)

1. If at the time the slack has a value less than 5 and in the last 30 days will generate more than 5 scenarios that exceed the regulatory limit of VaR, then the number corresponding to the VaR scenario increases by 5. Or,

2. If the slack is less than 3, then the number of scenarios for the VaR increases by 5.

3. If the slack is greater than 15 and less than 5 scenarios were generated in the last 60 days that exceed the regulatory limit of VaR, then the number corresponding to the VaR scenario is reduced by 5.

4. If conditions 1) or 2) do not prevail, then the number corresponding to the VaR scenario remains unchanged.

The policy can be described symbolically as follows:

$$E_1 = 26,$$
$$H_t = E_t - X_t$$

$$E_{t+1} = \begin{cases} E_t + 5, & \text{If } H_t < 3 \quad \text{or} \quad H_t < 5 \text{ and } X_t^{30} > 5 \\ E_t - 5, & \text{If } E_t > 26 \quad \text{and} \quad H_t > 15 \text{ and } X_t^{60} < 5 \\ E_t, & \text{in other case} \end{cases}$$

After having determined the value of E_t at date t, this parametre is used to calculate the VaR of the pension funds' investment portfolios for which the PR was defined. The Commission shall notify the Afores and, where appropriate, the valuation agencies, when in accordance with the procedure described above changes arise in the value of E_t . In any case, at time t, the value in force at time t+1 will be notified.

The PRs for each type of Basic Siefores are computed assuming that they fully exploit the equity limit allowed in each case and the rest of the portfolio is invested in a portfolio of fixed income instruments.

Specifically, PRs are built assuming that the percentage of the portfolio invested equities is fully realized in the Mexican Stock Market Index (IPC) of the Bolsa Mexicana de Valores. Similarly, it is assumed that the percentage of the portfolio invested in bonds is through a basket of government debt securities with each security weight defined as the percentage that such a value represents of the outstanding amount of government securities.

As a complement to the VAR, CONSAR has designed early warning measures, which trigger supervisory actions like internal reports or questionnaires to the Afores, and meetings and inspection visits to the Afore. These alarms are:

- *Preventive alarms:* These analyze the difference between the Monte Carlo VaR (which represents a parametric methodology that uses simulated scenarios through the instruments correlations and that adjusts rapidly to changes in the expected volatility) and the historical VaR. The size and direction of the difference can anticipate tendencies or possible inconsistencies in the VaR estimations.

- *Early alarms*: Estimate the probability that a new scenario generates a violation of the VaR limit, as a function of how much time has passed since the first 12 observations and the number of scenarios inside this group that violates the regulatory limit.

- *Stress tests:* Estimates of what would occur to the VaR (and portfolio losses) in case of a catastrophic historical scenario. This tool minimizes the probability of underestimation of the market risk in periods of stability or low market volatility.

- *Transactions indexes:* Provide various indicators which reflect the level of transactions done by a Siefore with a speculative objective during a certain period of time. Due to the fact that those transactions are not long-term oriented, as Afores' investment should be, a high index triggers a deeper analysis. This analysis may involve the solicitation of transactions records in order to find out their real purpose or questionnaires about the reasons for the transactions, among others.

- *Financial-accounting validations:* Figures reported by the Afores' and their custodians directly from their operational systems are checked daily and automatically with the accounting information reported to Consar. This permits Consar not only to verify the compliance with the investment regime and to identify potential problems, but also to verify the Net Asset Value (NAV) of funds.

- *VaR Attribution:* On a daily basis the VaR is disaggregated into the asset classes' contributions so that monitoring of the risks posed by each component of the portfolio can be identified.

- *Maximum drawdown:* On a daily basis a 1-day maximum loss is estimated for each fund so that extreme losses are estimated.

- *Liquidity measures:* The estimated cash flows stemming from portfolios' investments are estimated along with a measurement of highly liquid holdings (fixed income high credit rating instruments with less than 6 months to maturity).

- *Concentration risks:* A Herfindahl-Hirschman index is calculated daily for each portfolio and large changes that imply a higher concentration of portfolios are tracked. If necessary, onsite inspection is performed in order to discard serious weaknesses derived from conflicts of interests or operational risk like failures in systems that support the investment processes.

B. *Qualitative*

In terms of operational risk, CONSAR has built a series of early warning measures that consist of indicators of potential problems in different operational processes. CONSAR has implemented an automated system that allows it to supervise different operational processes, including:

- *Distribution of resources to individual accounts* – the automatic processes permit CONSAR to verify for each worker whether the employer has paid into the individual account, whether the amount contributed by the federal government (cuota social) is correct, and whether the commission charges are correct;

- *Afore's accounting* -with particular interest in the special reserve;

- Transfers amongst administrators.

No objection to operate derivatives: CONSAR has put in place a procedure to evaluate each Afore's capacity to manage derivatives. Through this process CONSAR confirms that the Afore has the proper systems and human capital to manage derivatives. The certification process is validated every 3 years. Operators have to take on examinations prepared by recognized college institutions in the country or may take and pass international certifications like CFA, PRMIA or GARP, among other possibilities. An Afore may be strip off of a no-objection if it is found to have unfulfilled any important requirement at any time.

CONSAR has an annual inspection plan to verify other qualitative variables: CONSAR makes annual inspection visits to all Afores. The topics reviewed and the depth of the review vary in each case depending on the reading of the risk posed by each Afore. Thus, the intensity of the supervision is based on the profile of the Afore, the size and complexity of its operations, previous problems or weaknesses identified in other onsite visits, the qualifications of its operators and incidents detected through the daily supervision of portfolios. Thus risks with higher potential damage are inspected with priority. A follow up of the observations and recommendations made is made and if necessary legal action is taken when serious weaknesses that were detected and are not attended within a period grated to correct them.

Corporate government assessments are reviewed periodically: Through onsite inspections CONSAR verifies that effective internal checks and balances for the investments and risk decisions are in place in the Afore. Regulation imposes that on a monthly basis the investment and risk committees have to meet in order to reassess their investment strategies and risk management recommendations. Independent advisors are required to emit favorable opinions in order for the Afore to invest in complex instruments, like private equity, stock picking and commodities. The compliance officer has to verify that all procedures are followed abiding by the corresponding manual and he has to opine regarding the weaknesses in the definition of those processes. He submits his assessments directly to the board of the Afore, CONSAR and to the CEO. Recommendations by the risk unit or by the compliance officer not attended are the subjects of meetings between CONSAR and the board and functionaries in charge of the corresponding activities. If a serious weakness is identified a recommendation is emitted by CONSAR and if considered appropriate when grave situations are detected, functionaries and/or operators can be removed and investment authorizations may be withdrawn.

IT, legal and outsourcing issues also form part of operational risks. Afore's operational risk management model (outlined by law) produces a report for CONSAR quarterly.

4. Risk Mitigants

CONSAR follows a regulation/supervision model based on quantitative limits, prudential regulation complemented by elements of risk based supervision (RBS), which implies the following: a quantitative risk control, a corporate government regime, the commitment to best corporate practices, daily and on site supervision strategies, certification processes and a scheme of fiduciary responsibility.

As to qualitative risk control, CONSAR has a daily follow-up of Afores' compliance to the investment regime and the controls for each risk type, on the Value at Risk (VaR); and on self-regulatory terms, it follows up on stress scenarios, back testing and the early warning systems.

The Afores must also have a corporate government on investments and risks, integrated by a Comprehensive Risk Management Unit (UAIR), a Financial Risk Committee and an Investment Committee. Each Afore is required to have the UAIR headed by a Chief Risk Officer who reports to the board. This unit provides support to the Financial Risk Committee. It identifies, measures, monitors and informs the Afores' board of directors of the risks faced by the Afore and Siefores. The UAIR informs CONSAR on a quarterly basis about the economic, financial and other consequences that the Afore would face if risks should materialize.

Risk officers, investment officers, the compliance officer and the person responsible for the back office have to be certified to master general financial knowledge. This certification is performed by independent agencies, and has to be validated every 3 years.

Each Afore is required to have a board of directors of at least 5 members appointed by shareholders, of which at least 2 members must be independent experts. The board has specific legal responsibilities and an important role in managing and controlling investment risks. It is responsible for the constitution of the Financial Risk Committee for the Siefore. This committee is responsible for the *Financial Risk Management Policies and Procedures Manuals*. The board must approve these policies, which must be sent to CONSAR for endorsement. The board also sets the level of financial risk tolerance for the Afore within the limits allowed by regulation.

The Financial Risk Committee must include one independent member of the board, one non-independent member and the person responsible for the UAIR. The General Director of the Afore chairs such a committee. Those in charge of financial risk and the compliance office also attend the committee meetings. The risk committee is responsible for determining risk tolerance levels and risk limits, for approving and reviewing models and measurement methods, ensuring policy and procedure manuals are up to date, checking compliance with risk policies and reviewing limit breaches and the corrective action taken.

The Investment Committee must be integrated by at least five members, among them should be considered an independent member, the Afore' General Director and other members or officers appointed by the board of the pension fund. The Investment Committee is responsible for determining the investment policy and strategy within the limits proposed by the Financial Risk Committee that have been approved by the pension fund board.

The Afores must abide by the secondary regulation issued by CONSAR on the investment regime, and additionally, their investment strategies must be approved by the Investment Committee and they must also listen to the opinion of the Financial Risk Committee. Also, in line with the best corporate practices, CONSAR requires the AFOREs to create investment handbooks, robust operational procedures with good operational infrastructure, as well as internal risk limits.

In terms of supervision, compliance to the investment regime is evaluated daily in an automated manner, on-site inspection takes place, AFOREs that show weaknesses in their risk and investment management are re-programmed; and during those visits, emphasis is made on the issues that represent weaknesses of the AFORE. Certification processes regarding specialized operations, derivatives, repos/repurchases, securities loans, international securities, operators certification, assessments made by independent third parties, infrastructure certification, processes: front, middle and back office straight through processes, are also verified.

Afores are required by regulation to have an independent compliance officer (with at least 5 years' relevant experience).

An external auditor evaluates risk management on an annual basis. CONSAR does its own assessment once a year and uses the results to assign resources for supervision. CONSAR weights the risk rating derived from these inspections by the size of the Afores to assess systemic risk.

All of the above contributes to CONSAR's comprehensive risk management focus, in which a defined scheme of fiduciary responsibility is established. This scheme has a well-defined investment regime, a clear penalties regime, a capitalization regime consistent with the previous ones, and the driving force behind competition are net returns.

5. Risk Weightings

The comprehensive risk management focus described above provides the following advantages:

1) Transparency for the pension funds, since quantitative limits are set and published in the secondary regulation.

2) Limited subjectivity, once the regulations are set, the authority cannot adjust them without a formal procedure.

3) Less discretionary, since the general rules are the same for all.

4) Within the supervision process, there are annual programs of financial inspection which include tours of inspection on investment issues, financial risks, conflict of interests, credit risks, verification of outstanding operations, and for the operation of derivative financial products.

5) At present, some tools are being developed with the aim of automating the Financial Inspection function through the connection of solid data bases, control and logic security of the information generated by the inspection activities.

6) Mexican regulation considers various elements of the risk based supervision as a complement to the set limits, and not as a substitute approach. The scoring done on the quality of the investment and risk management of the pension funds is used to detect weaknesses in the AFOREs, and if necessary, to make new inspection visits. The following table shows in detail the elements of the indicators score of the inspections undertaken:

Table 3: Elements of the indicators score

Afore	Assets under management	Financial Diversification	Incidents-Surveillance	Incidents-Inspection	Corporate Governance /1	Back Office /2	Investments /3	Risks /4	Normative Auditor /5	Evaluate Average
1	0.3	5.50	7.90	7.7	9.7	8.0	2.2	4.0	8.6	6.9
2	0.5	3.98	4.67	4.3	8.2	6.0	2.2	5.3	6.7	5.3
3	10.0	9.68	7.58	8.5	10.0	9.0	8.9	9.3	9.3	8.9
4	9.1	9.55	7.82	8.4	9.3	8.0	7.8	10.0	5.3	8.1
5	3.7	8.81	9.14	9.6	9.7	8.0	5.6	6.7	7.3	8.0
6	1.5	7.64	9.09	8.6	9.7	6.0	4.4	4.0	8.8	7.2
7	1.6	7.43	8.42	8.3	9.0	8.5	2.2	4.0	8.5	7.0
8	5.1	7.3	7.40	6.6	8.3	7.0	5.6	4.0	7.7	6.6
9	8.0	8.73	8.20	8.9	9.6	7.0	5.6	4.0	8.2	7.3
10	2.1	9.09	8.52	8.8	8.9	7.0	3.3	2.7	5.7	6.4
11	1.4	9.29	9.24	8.9	9.6	8.5	4.4	2.7	7.0	7.2
12	3.4	4.92	7.80	7.8	10.0	9.0	10.0	8.0	8.4	8.7
13	2.5	8.12	8.84	8.3	9.7	8.5	2.2	8.0	8.4	7.7
14	6.3	8.90	9.20	8.8	8.8	8.5	6.7	6.7	7.3	8.0
15	3.9	8.38	8.15	8.6	10.0	9.0	6.7	6.7	9.3	8.3
System Average	**4.0**	**7.8**	**8.1**	**8.1**	**9.4**	**7.9**	**5.2**	**5.7**	**7.8**	**7.5**

[1] Considered formality and frequency of meetings of the Board of Directors, technical skills and moral integrity of the Independent Directors, Senior Management Commitment and Proper segregation of functions

[2] Consider operational processes related to the accounting registration, BMV and Indeval crossings and Financial Statements

[3] Consider the area strcuture, the analysis prior to determining the investment strategy, adherence to investment strategy dictated by the committee, online alerts and position reports.

[4] Evaluates the independence of the UAIR, the area structure, the models and the parameters for the measuring and monitoring the different types of risk, valuation methodologies, reports, contingency plans and Guarantees monitoring.

[5] Evaluates the independence of the normative auditor, the prevenction of conflicts of interest and misuse of privilege information, the depth of the reviews and the follow of the auditor and CONSAR observations

Source: CONSAR

CONSAR supervises separately the operational activities and the investments activities. CONSAR has two specialized divisions each one focused one activity. The risk assessment and the ensuing inspection of each of these two main activities of the Afore is programmed and executed independently. Notwithstanding, CONSAR is developing an integrated score system.

6.   Probability

At this stage CONSAR is gathering the information necessary for, and creating the data bases indispensable for the assessment of objective probabilities of failures during the execution of operational and investment activities.

7.   Impact

Even though each Afore is programmed with at least one annual onsite inspection, that is there is no discrimination among Afores supervision according to their size, the length, the variety of topics to be reviewed and the depth of the analysis are based on scale of the operations and on their complexity.

8.   Quality Assurance

CONSAR bases its risk assessments on a combination of quantitative measures and qualitative evaluations. This provides the risk assessments with certain quality assurance. Regarding the

quantitative measures, CONSAR considers the whole set of stress tests based on objective quantitative results (although model dependent) along with the matrix of weaknesses and vulnerabilities previously described. With regard to the qualitative assessment linked to corporate governance, evaluation of the operational risk, the infrastructure in place and the human capital that the Afore has in hand, CONSAR supports its assessment on comparison with other industry participants, including other Afores, and on international standards. When available, CONSAR uses external expert opinions, for instance from external auditors, IT standards, specialized bodies in financial training, etc. CONSAR also exchanges views with other regulatory bodies, both in Mexico and oversees in order to self evaluate the strictness of its standards. Nevertheless, this task has inevitably an important component that is subjective.

9. Supervisory Response

Traditional on-site tools for RBS are used, such as certifications including simulations and stress testing, onsite inspections, and development of clear risk assessment procedures.

There are three types of inspection visits:

- *Risk visits* – verify the existence of an independent unit capable of measuring, evaluation and managing financial risks

- *Investment visits* – verify that the investment operations function under the best international standards and practices

- *Conflicts of interest visits* – determine if there are potential or actual conflicts of interest particularly with other companies with equity relations.

During the conduct of these visits the fund's monitoring, certification, risk analysis and evaluation procedures are documented to determine that the required internal controls are present in each area and functioning to ensure the quality of the products.

Additionally, CONSAR verifies by means of onsite supervision, compliance with other requirements: new regulations, proper transfer to workers, measures and procedures in place to detect and prevent money laundering, alignment of the fee structure with regulations, effective functioning of the risk unit, operational systems to work with derivatives; and correct payments of benefits.

ANNEX 1: VAR EXAMPLE[3]

Working out an example of the Historical VaR

There is a portfolio composed by 100,000 Cetes (treasury bills) with an expiration date of 91 days. The current interest rate in the market is 7%. The object is to calculate the historical daily VAR of the portfolio at a confidence level of 95%, taking in account 500 scenarios.

Solution:
First, the actual price of the security, and the value of the portfolio, are calculated as follows:

$$P_{CETE} = \frac{10}{(1 + \frac{.07}{360} * 91)} = 9.826 \implies VPort_{(actual)} = 100,000 * 9.826 = 982,613.21$$

Market Rate — Time to maturity

NV — Num.Titles — Price

57

Working out an example of the Historical VaR…(Cont.)

a) The first step to calculate the VaR is necessary have historic information of the interest rates, exchange rates etc. which influence the valuation of the instruments of the portfolio (called risk factors).
    In our example we need 500 days of history only of the CETE rate of interest (with the same time to maturity, the 500 days).

Scenario	Date	Cete Rate
Current date	04/07/2002	7.00%
1	03/07/2002	6.50%
2	02/07/2002	6.30%
3	01/07/2002	7.10%
4	28/06/2002	7.15%
	.	.
	.	.
	.	.
499	07/07/2000	14.00%
500	06/07/2000	13.00%

58

---

[3] Presentation given by Luis Mario Hernandez of CONSAR, at the 4th Contractual Savings Conference: Regulatory and Supervisory Issues in Private Pensions and Life Insurance, held in Washington D.C. 2-4th April, 2008, organised by the World Bank with the support of the IOPS.

CONSAR **Working out an example of the Historical VaR...(Cont.)**

b)   Now we have to simulate the variations in the risk factors using the 500 scenarios at hand. This manages to divide the rates corresponding day by day.

Interest rate variations are created with information from consecutive dates on the interest rate observations.

Scenario	Date	Cete Rate	Percentage change
Current date	04/07/2002	7.00%	
1	03/07/2002	6.50%	1.07692
2	02/07/2002	6.30%	1.03175
3	01/07/2002	7.10%	0.88732
4	28/06/2002	7.15%	0.99301
	.	.	.
	.	.	.
	.	.	.
499	07/07/2000	14.00%	0.92857
500	06/07/2000	13.00%	1.07692

$= \dfrac{7.00\%}{6.50\%}$

$= \dfrac{7.10\%}{7.15\%}$

$= \dfrac{14.00\%}{13.00\%}$

59

CONSAR **Working out an example of the Historical VaR...(Cont.)**

c)   The interest rate scenarios will be created by applying the interest rate variations to the current level of interest rates.

The percentage changes are multiplied by the rate of current day to get the new rates

Scenario	Date	Percentage change	New Historical Rate
Current date	04/07/2002		7.00%
1	03/07/2002	1.07692	7.54%
2	02/07/2002	1.03175	7.22%
3	01/07/2002	0.88732	6.21%
4	28/06/2002	0.99301	6.95%
	.	.	.
	.	.	.
	.	.	.
499	07/07/2000	0.92857	6.50%
500	06/07/2000	1.07692	7.54%

$= 7.00\% * 1.07692$

$= 7.00\% * 0.99301$

$= 7.00\% * 0.92857$

60

21

Working out an example of the Historical VaR…(Cont.)

d) Using the interest rate values we compute 500 values for the CETE security.

Scenario	Date	New Historical Rate	New Prices
Current date	04/07/2002	7.00%	9.82613
1	03/07/2002	7.54%	9.81301
2	02/07/2002	7.22%	9.82071
3	01/07/2002	6.21%	9.84542
4	28/06/2002	6.95%	9.82733
	.	.	.
	.	.	.
	.	.	.
499	07/07/2000	6.50%	9.83835
500	06/07/2000	7.54%	9.81301

Formula to Evaluate a CETE

$$= \frac{10}{(1 + \frac{0.0621}{360} * 91)}$$

NV

Rate

TTM

61

Working out an example of the Historical VaR…(Cont.)

e) Then, with the individual prices we obtain 500 values for the portfolio.

In our example, this manages to multiply the number of CETEs titles by the prices obtained before.

Scenario	Date	New Prices	New value of the portfolio
Current date	04/07/2002	9.82613	982,613.21
1	03/07/2002	9.81301	981,300.77
2	02/07/2002	9.82071	982,071.14
3	01/07/2002	9.84542	984,542.00
4	28/06/2002	9.82733	982,732.69
	.	.	.
	.	.	.
	.	.	.
499	07/07/2000	9.83835	983,835.04
500	06/07/2000	9.81301	981,300.77

$$= 9.81301 * 100,000$$

Price   # of Titles

62

22

Working out an example of the Historical VaR...(Cont.)

f)   Subsequently we calculate losses and profits of the portfolio relative to the current value.

Scenario	Date	New value of the portfolio	Profits and Losses
Current date	04/07/2002	982,613.21	-
1	03/07/2002	981,300.77	- 1,312.44
2	02/07/2002	982,071.14	- 542.07
3	01/07/2002	984,542.00	1,928.79
4	28/06/2002	982,732.69	119.49
	.	.	.
	.	.	.
	.	.	.
499	07/07/2000	983,835.04	1,221.84
500	06/07/2000	981,300.77	- 1,312.44

Subtract the value of the current portfolio from the value of the portfolio of each scenario

$$= 982,732.69 - 982,613.21$$

Value of the port #4   *Value of the port today*

63

Working out an example of the Historical VaR...(Cont.)

g)   This losses or profits are computed as a percentage of the current value of the portfolio.

Scenario	Date	Profits and Losses	Distribution of the returns
Current date	04/07/2002	-	-
1	03/07/2002	- 1,312.44	-0.134%
2	02/07/2002	- 542.07	-0.055%
3	01/07/2002	1,928.79	0.196%
4	28/06/2002	119.49	0.012%
	.	.	.
	.	.	.
	.	.	.
499	07/07/2000	1,221.84	0.124%
500	06/07/2000	- 1,312.44	-0.134%

Profits and Losses of the port 3

$$= \frac{-1,928.79}{982,613.21}$$

Value of the port. today

64

23

CONSAR Working out an **example** of the Historical VaR…(Cont.)

h) And then we sort in descending order the changes in percentage of the value of the portfolio. The regulatory VaR is the 13th worst result.

Returns in order

1	-3.5229%
2	-1.8844%
3	-1.3071%
4	-1.1986%
5	-1.1762%
6	-0.9392%
7	-0.9188%
8	-0.8883%
9	-0.8616%
10	-0.8354%
11	-0.7440%
12	-0.7234%
13	-0.7159%
14	-0.5868%
15	-0.5636%
16	-0.5326%
17	-0.4237%
18	-0.4155%
19	-0.3976%
20	-0.3319%

In our example, As we use 500 scenarios and looking for a confidence level of 95%, the VaR Portfolio will be the 13° worst scenario ((0.05/2)*500=13), ie. VaR will be 0.7159%
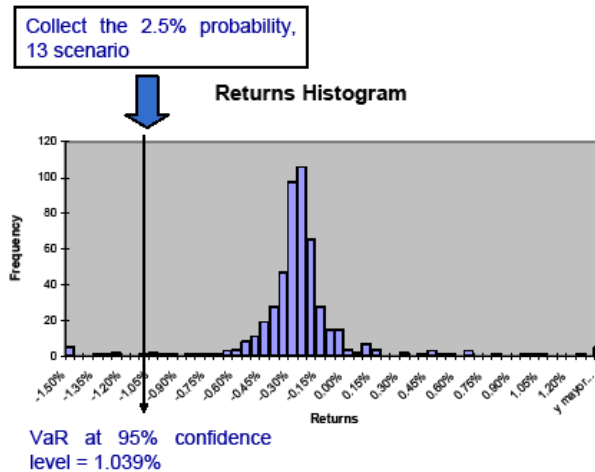
VaR at 95% confidence level

65

CONSAR Working out an **example** of the Historical VaR…(Cont.)

A histogram of the changes in the value of the portfolio is shown below:

Collect the 2.5% probability, 13 scenario

Returns Histogram

VaR at 95% confidence level = 1.039%

66

IOPS Toolkit for Risk-based Pensions Supervisors
www.iopsweb.org/rbstoolkit