CONSAR
Comisión Nacional del Sistema de Ahorro para el Retiro

SECRETARÍA DE HACIENDA
Y CRÉDITO PÚBLICO
SHCP

Mexican Pension Funds:
Var and Risk Management

April 2008

En tu Afore
Siembra y Cosecha

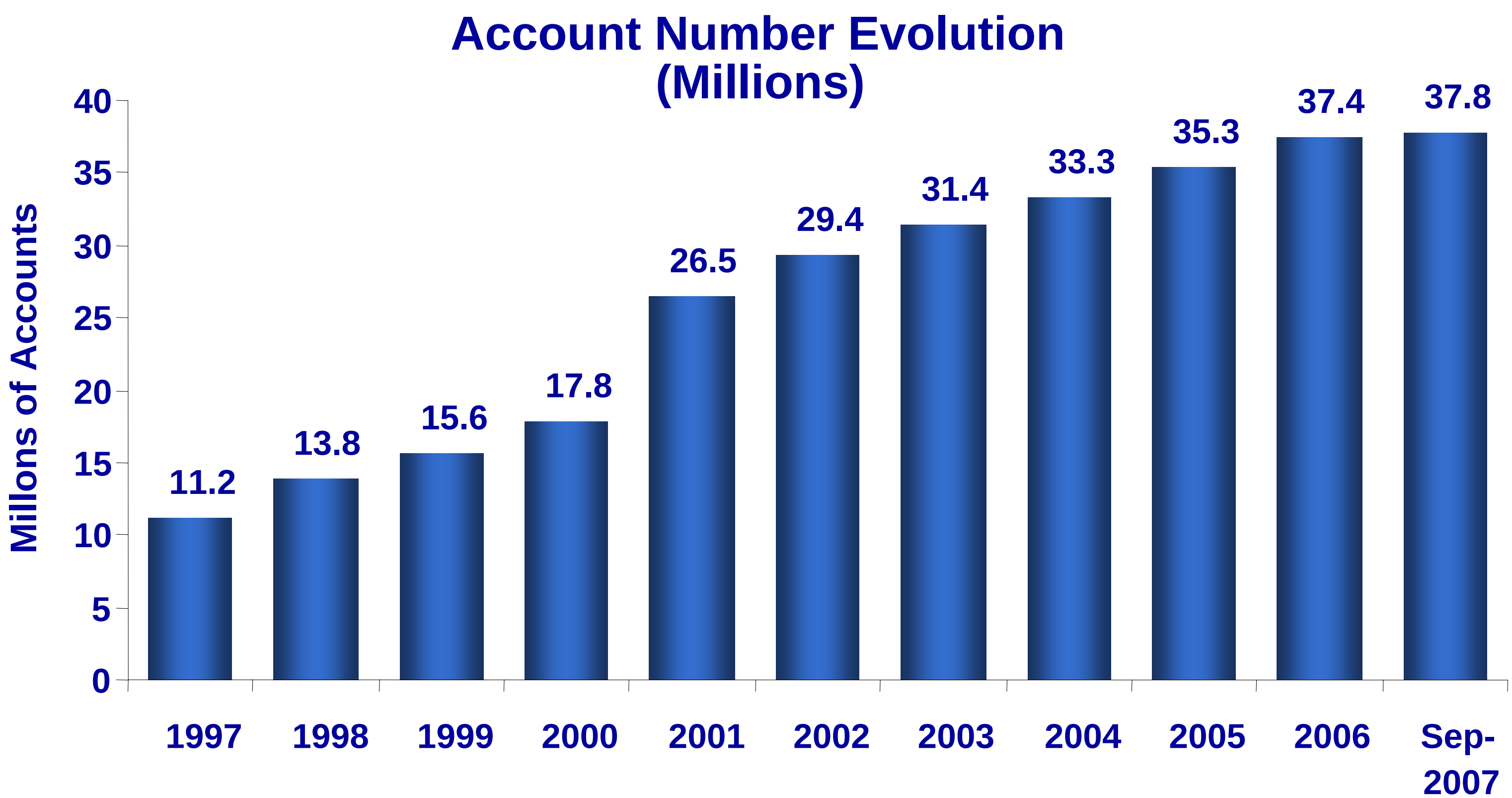
Comisión Nacional del Sistema de Ahorro para el Retiro

Camino a Santa Teresa # 1040 8o. piso, Col. Jardines en la Montaña
Delegación Tlalpan, C.P. 14220, México D.F.
Tel. +52 (55) 3000-2608 y 3000-2548 www. consar.gob.mx

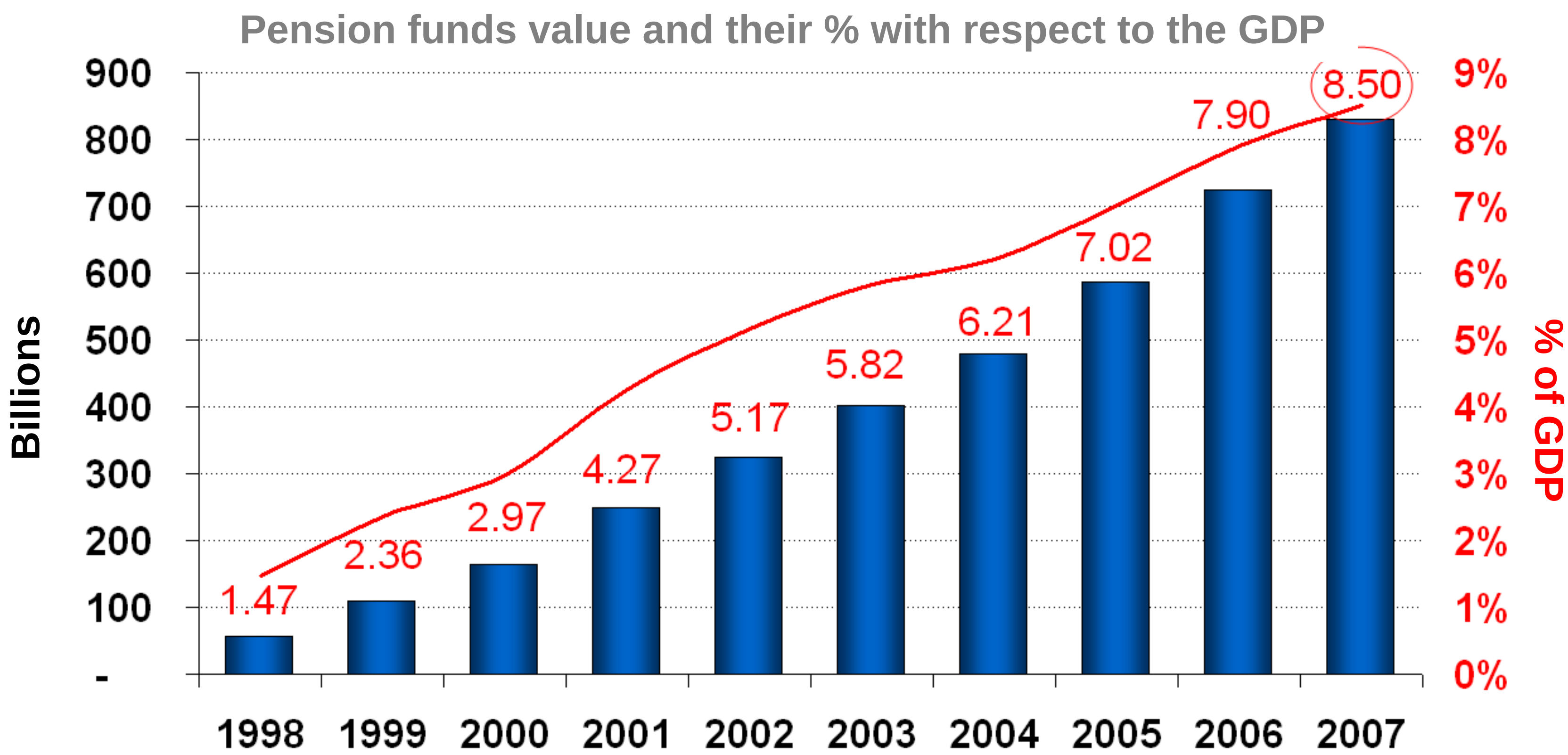
Index

The Mexican pension system, established in 1997, has shown a great deal of dynamism during its 10 years of existence.

For instance, there has been a significant increase in the number of accounts being administered.



The pension funds' portfolios have grown on average 22.4% annually and as of December 2007 they have $830 billion pesos which is equivalent to 8.4% of the GDP.



* Se utiliza el promedio de los últimos 4 trimestres del Producto Interno Bruto a precios corrientes publicado por el INEGI.

This growth trend is expected to continue or even to accelerate due to the demographic bonus and the incorporation of PENSIONISSSTE to the system. This imposes a pressure on fund managers to diversify the portfolios.

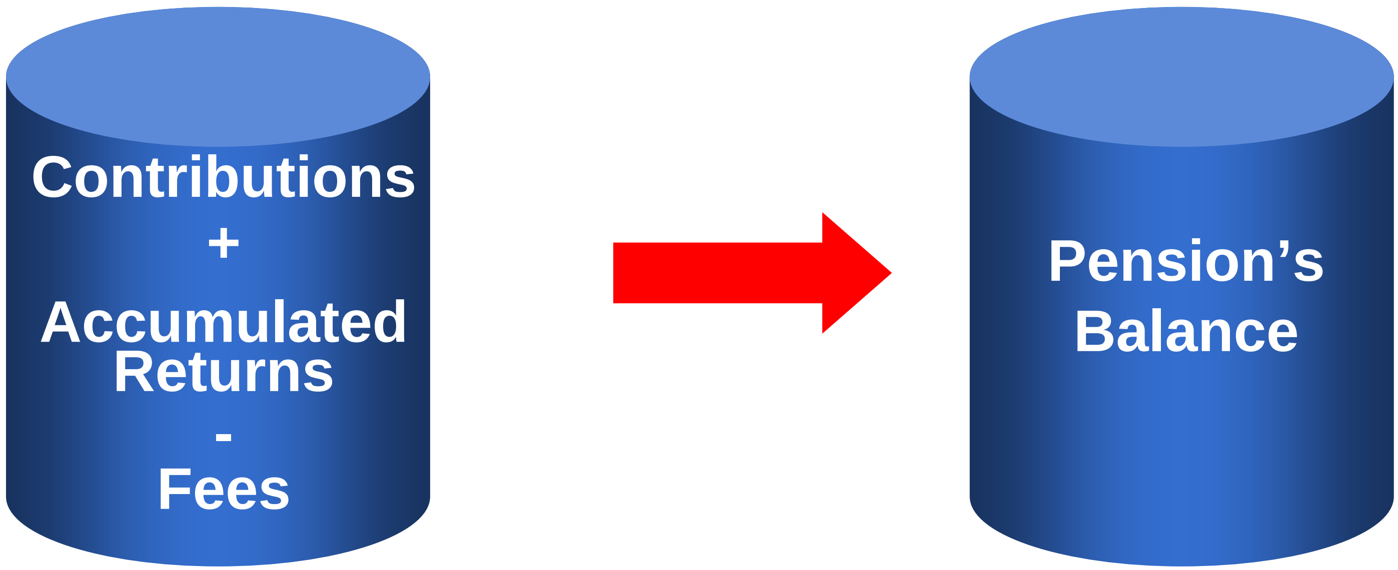
The Retirement Savings System (SAR) in Mexico has peculiar characteristics in the way it works.

Pension System Characteristics:

- It is a compulsory savings system
- The object of the resources is socially sensitive
- There exists Government warranty (minimum pension)
- For lots of workers this is their only financial asset

The pension funds do not face liabilities with predetermined face value, but they deliver to the workers the accumulated balances in the individual account.

Under this scheme workers' pensions are a result of three inputs mainly.

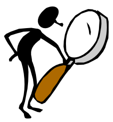


For this reason it is important to have an effective risk control system for the investment portfolios, along with a flexible investment regime.

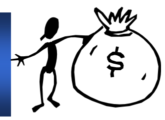
CONSAR
Comisión Nacional del Sistema de Ahorro para el Retiro

The pension system definition in Mexico responds to certain contextual variables.

PRUDENT MAN RULE



REGULATORY AND MARKET FRAMEWORK

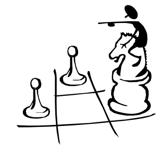


- ✓ **Voluntary investment** (workers' savings)
- ✓ **High financial culture** from the investors (Well performing markets and informed investors)
- ✓ Investors sensitive to returns

MEXICO

- ✓ **Mandatory investment** (workers' savings)
- ✓ **Low financial culture** from the investors – workers (Low participation in spite of good information available).
- ✓ **Non - sensitive** investors to returns.
- ✓ **Low market discipline.**
- ✓ **Complex system.**

FUND MANAGERS

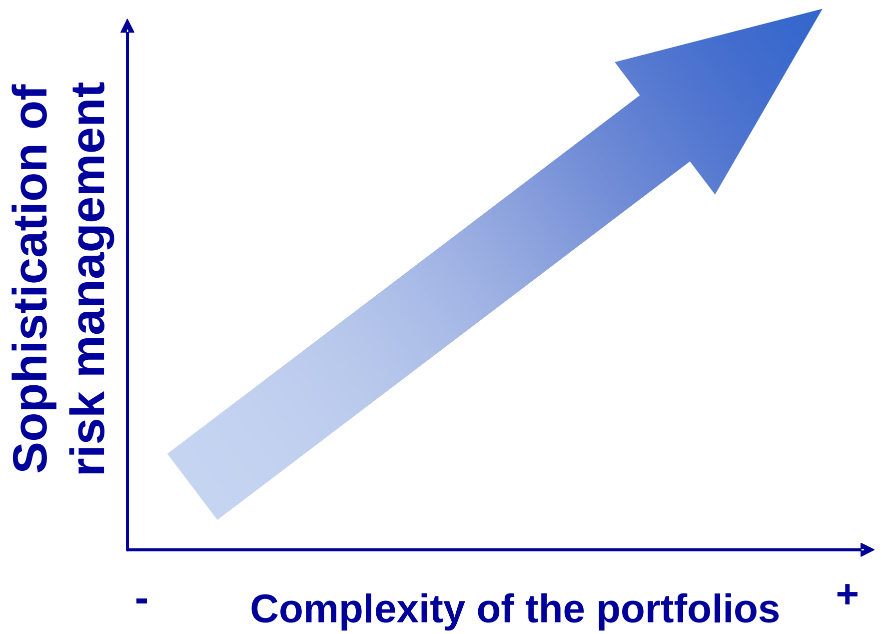


- ✓ **Reduced specific regulation** (great flexibility for the fund manager).
- ✓ **Prudential management.**
- ✓ **Country's legal system** reinforces the regulatory scheme (no need to count on exhaustive set of investment rules).
- ✓ **Specific Investment Regime** permissions and prohibitions by types of risks (credit, market, liquidity and operational risks.)
- ✓ **Prudential Regulation** to reinforce quantitative limits.
- ✓ **Capitalization rules** linked to penalties.
- ✓ **Daily supervision.**
- ✓ **Rules adapted** to country's legal system (Roman Law)

The regulator (its board) defines the investment limits according to its preferences toward risks and considering the ability of pension funds to manage investments and risks.

Index

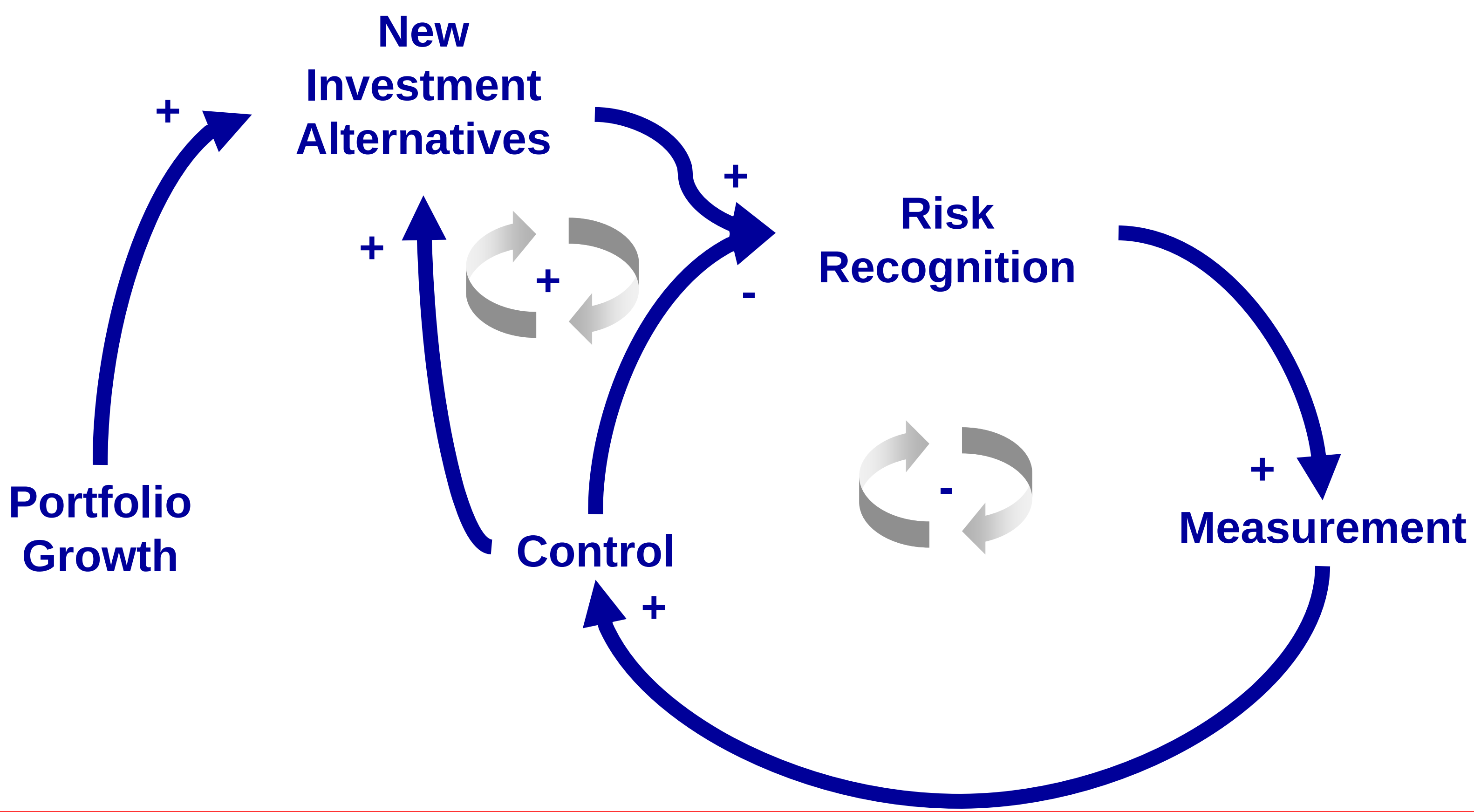
As a pension system grows and gets more sophisticated, the need for solid risk management increases as well.



- The complexity of the portfolios grows as:
  - The funds grow
  - The admitted assets classes expand
  - More counterparties are incorporated
  - Investment in foreign markets is permitted
- The sophistication in risk management must evolve in terms of:
  - Control, quality and timely information
  - Adequate risk models
  - Flexible, effective and efficient regulatory framework
  - Risk management culture

The evolution of risk management is the result of a dynamic process, with a preventive goal and clear direction.

Evolution of Risk management



Authorities and pension fund managers are expected to take turns to lead in the process of sophistication, but specially to complement each other.

To face this challenge, the authority is guided by 4 pillars.

Authority's tools

- **Investment Regime** 1
- **Prudential Regulation** 2
- **Supervision** 3
- **Market Discipline** 4

These pillars constitute the conceptual framework which gives a minimum level of security to pension resources and allows to maximize the returns of the investments

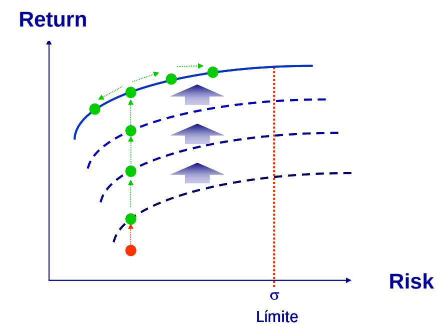
Index

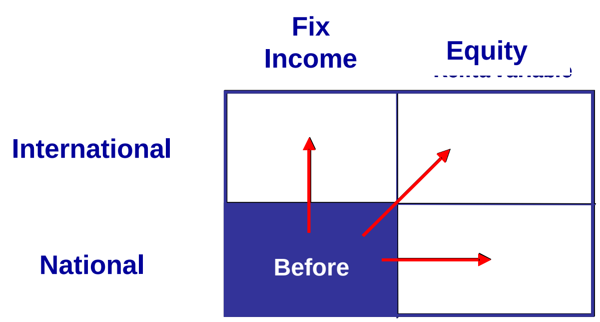
1. Introduction
2. Risk management evolution
   a. Investment regime
   b. Prudential regulation
   c. Supervision
   d. Market discipline
3. VaR and risk management in practice
4. Challenges
5. Conclusions

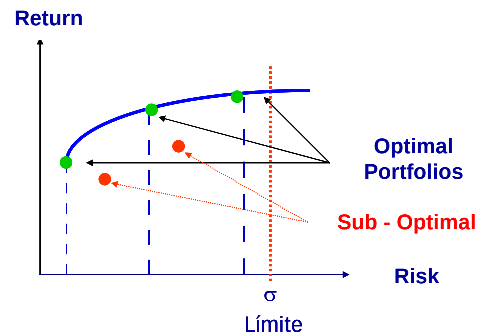
The Investment Regime (IR) is a tool which promotes greater returns and better pensions, since the restrictions it imposes in the portfolio management help to limit returns and risks that can be assumed.

At first the IR was very restrictive. Actions were taken in two stages in order to adapt it:

Stage	Objectives
Stage I – Risk oriented IR *(2001-2004)*	
• **Redefine the IR focusing on better portfolio risk limits (market, liquidity, credit and operational) defined by the allowed asset classes in that moment (local debt)**	1. **Move the efficient frontier vertically allowing greater returns without incurring in greater risks.**
Stage II – Allowance of new asset classes *(2005-2007)*	
• **Open the IR simultaneously to new asset classes, for instance Foreign Securities and Equity**	2. **Allow the pension funds to locate their portfolios at different points over the efficient frontier in order to satisfy different target markets.**







Stage I – During the first adaptation of investment rules the most inefficient limits were removed.

Removal of the issuer limits

- Issuer limits where removed:
  - 65% minimum in government bonds
  - 10% maximum in bank debt
- Credit quality limits were introduced (Minimum A rate)

New issuances

- New issuers´ securities was allowed:
  - State companies
  - Municipal Governments
  - State Governments

New currencies

- More currencies were allowed:

Government: Pesos, Dólares + Euros, Yenes

Private: Pesos + Dólares, Euros, Yenes

•For equity the currency of any authorized index is allowed

Risk control mechanisms

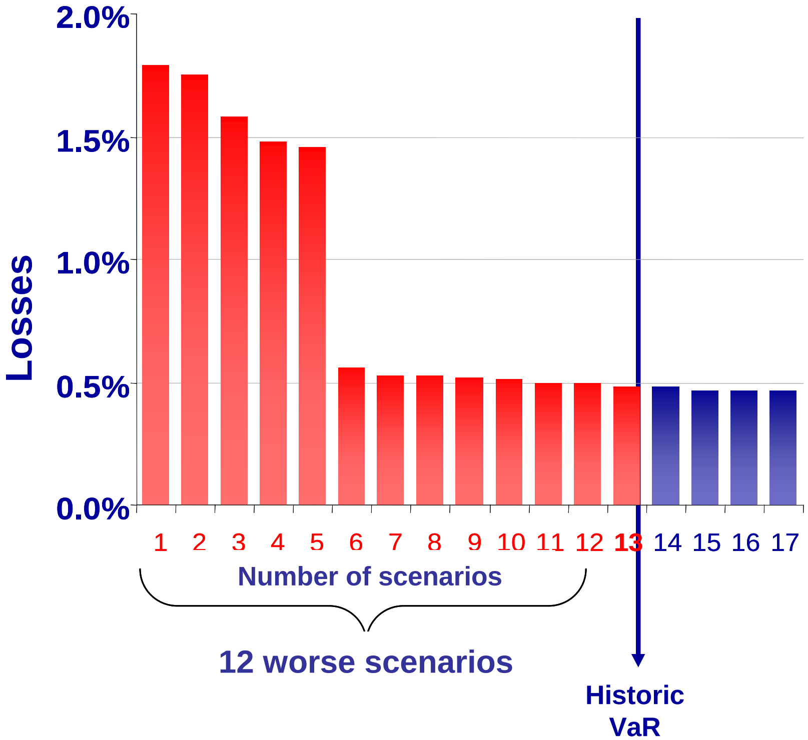
- The Value at Risk (VaR) global risk measure was introduced
- Derivatives were allowed

These changes had various effects, for example:

- Promote a shift in the focus of the IR towards measurement, limit and control of specific and global risks
- Promote the sophistication of the investment areas and the creation of the risk control area
- Avoid concentration of portfolios and pressures on security markets due to a limited supply
- Contribute to a more efficient asset allocation based on risk/return trade-off

Better measures of credit risk were introduced to substitute issuer limits, and the VaR measure replaced WAM measure as a tool of global portfolio management risk limit.

One of the most important limits introduced in the regulation is the Value at Risk (VaR), which constitutes an effective and less distorting global limit on portfolios which helps to limit market risk.



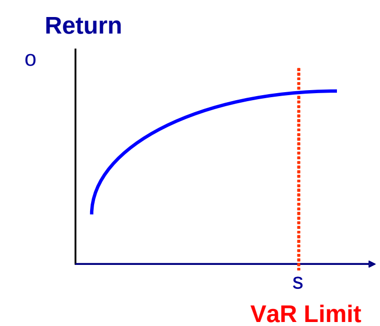
The **VaR** is defined as the **maximum expected loss** within a **confidence interval** in a **determined time** horizon.

The **regulatory VaR** is a historical, non parametric VaR with the **following characteristics**:

- 95% confidence (over losses)
- 1 day horizon
- 500 scenarios used

The introduction of the historical VaR had the following advantages:

- It is an **overall risk measure** since it **captures the market effects** over the whole portfolio, even derivatives, and takes the existing correlations into account.
- It is an **efficient limit** since it does not distort the efficient frontier, but it simply bounds the possibilities space.



- It does not require assumptions over the distribution (parametric assumptions)
- It is **simple to implement**
- It **can be compared among pension funds**

Stage II – At this point the idea was to open the Investment Regime to new asset classes and markets such as equity and foreign securities.

Once stage I was working the IR was opened simultaneously to:

New securities

Equity through equity indices

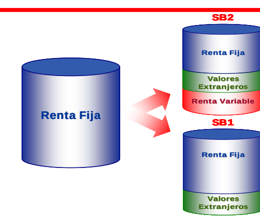
- Equity indices are pre-diversified securities.
- They represent passive investment
- They limit bad practices and conflicts of interests

New markets

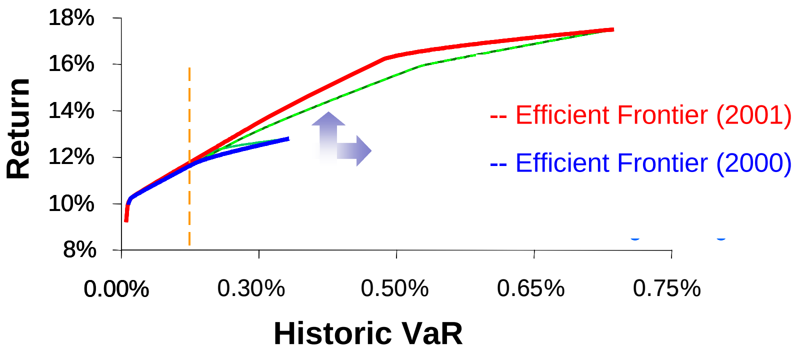
International Markets

- Only those issuers that follow the best practices of disclosure and regulation set by authorities from the European Union and IOSCO's technical committee

At this stage the family of funds (Siefores) was broadened from one to two funds, following a reduced life cycle scheme.



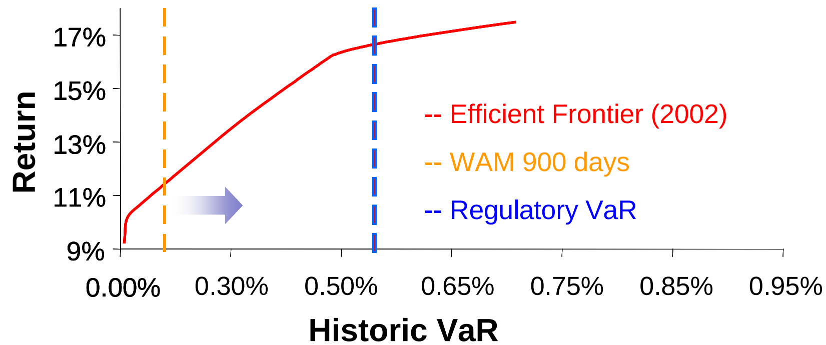
The investment possibilities were broadened thanks to the opening of the IR and the efficient frontier shifted outwards.



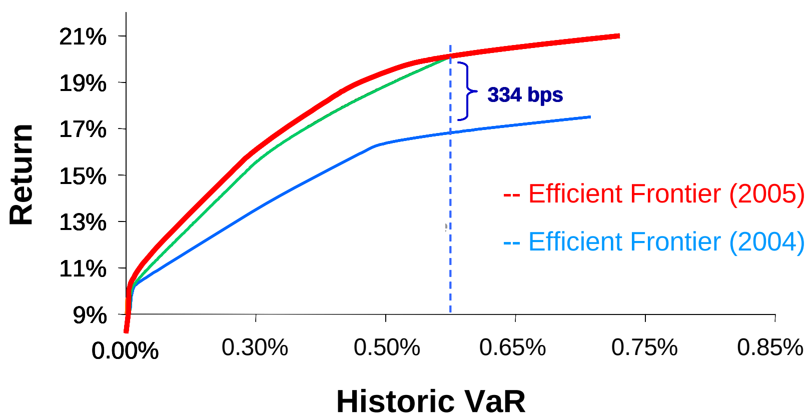
* El límite de PPP equivale a una restricción de 0.04% de VaR Paramétrico aproximadamente

Stage I
2000 - 2001

Stage I
2002



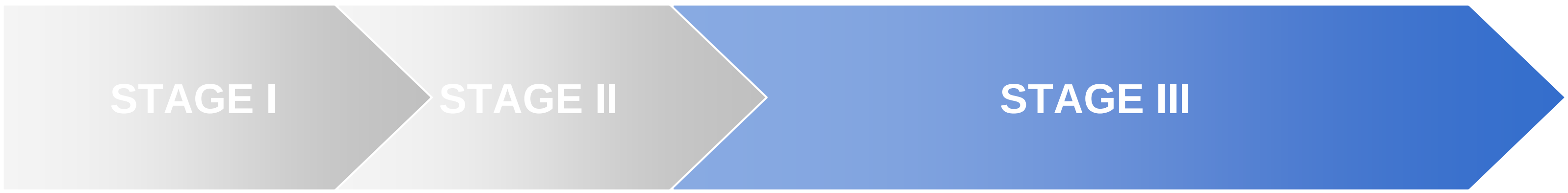
* 0.25% de VaR paramétrico, equivale a 0.6% de VaR histórico



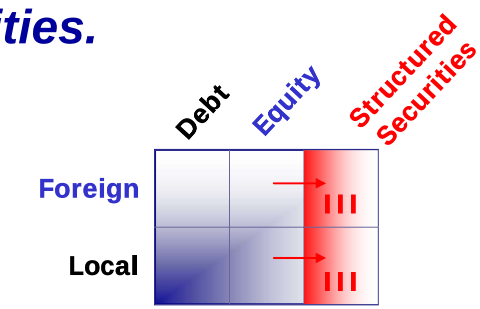
Stage II
2005 - 2007

The accelerated pace of growth of the resources administered in the SAR along with more sophisticated pension funds represented a force to start a third stage of IR flexibilization.

The third stage consists of an integral strategy which includes the following issues:

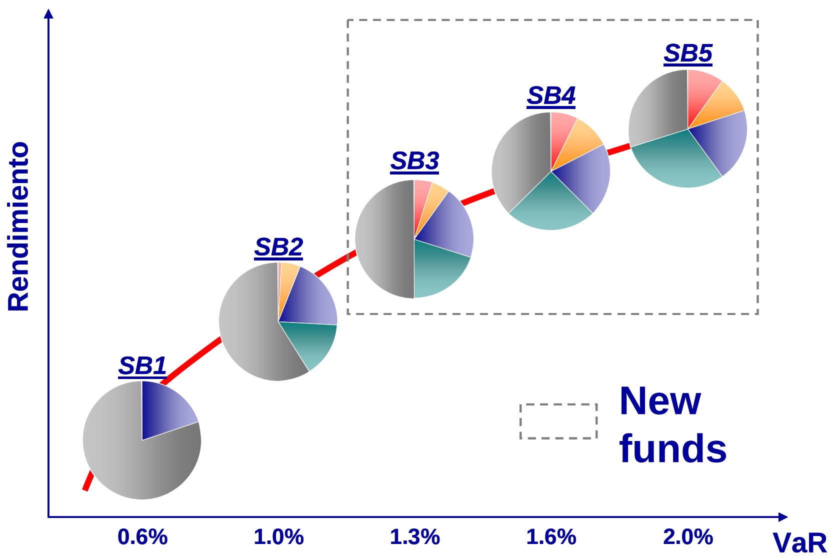


- **Broadening of the family of funds included:**
  - ***a) Optional opening of new funds.***
  - ***b) Addition of new investment securities.***



  - ***c) Relaxing the investment limits of old asset classes for the new funds.***

The family of funds was extended from 2 to 5 (took place in March 31st, 2008). This offer the advantages of greater diversification and differentiation among funds.



The family of funds is a life – cycle type. An specialized IR is defined to each type of fund: more flexible investment rules for funds defined for younger workers.

Advantages

New securities

- The new funds will be able to diversify out of government values and into equity and the new private asset classes.

Grater maturity

- The aggregate risk limits (VaR – one for each type) will allow the funds to invest in securities with maturities which are more compatible with pension funds nature.

Investment Regime Design

- The Investment Regime can be refined further specialized in the future.

CONSAR
Comisión Nacional del Sistema de Ahorro para el Retiro

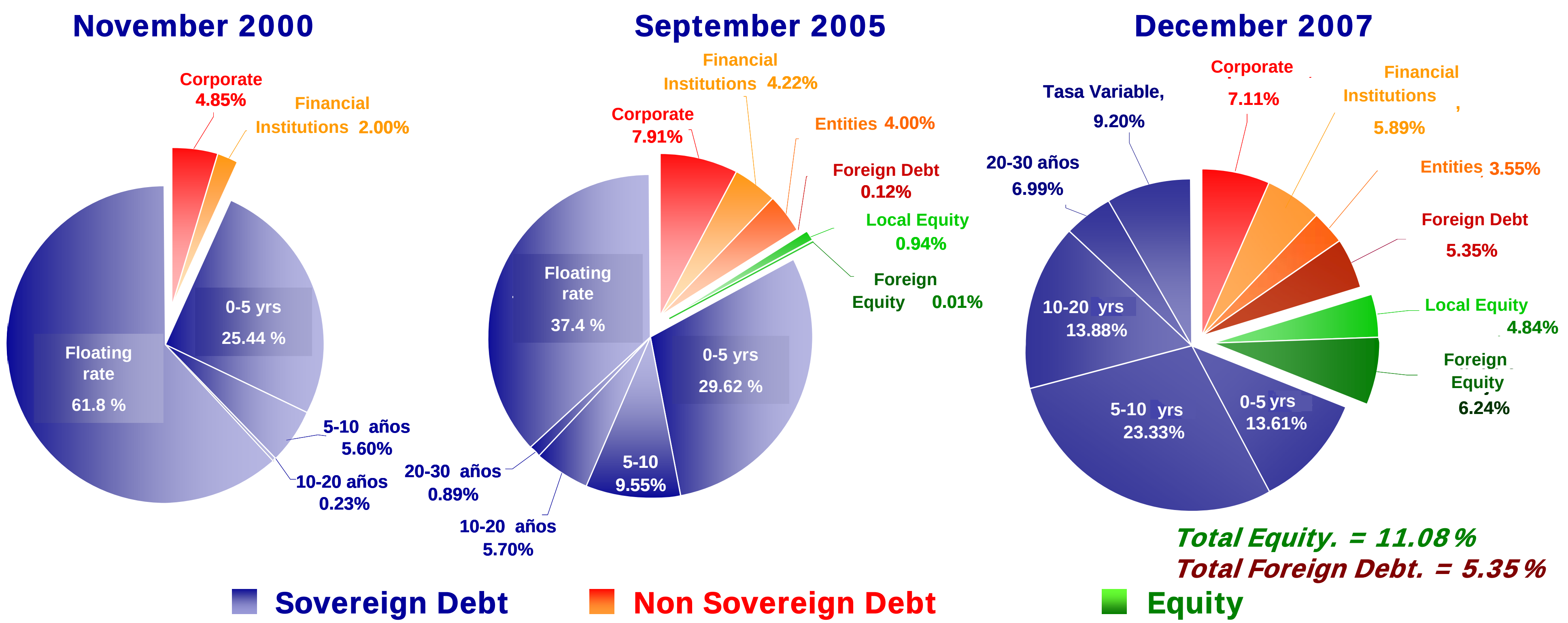
The current Investment Regime is focused on the different types of risk associated to the investment: market risk, credit and counterparty, and concentration.

			Limits by kind of SIEFORE (fund)[1]				
			1	2	3	4	5
Market Risk		Value at Risk [$VaR_{historical}$ (1- α=95%,1day)]	0.6%	1.0%	1.3%	1.6%	2.0%
Market Risk		Equity (only through indices)	0%	15%	20%	25%	30%
Market Risk		Foreign Currency (Dollars, Euros, Yens or currencies to acquire equity)	30%	30%	30%	30%	30%
Market Risk		Derivatives	yes	yes	yes	yes	yes
Credit Risk		mxAAA[2] and Government securities	100%	100%	100%	100%	100%
Credit Risk		mxAA- rated securities	35%	35%	35%	35%	35%
Credit Risk		mxA- rated securities	5%	5%	5%	5%	5%
Concentration / Counterparty Risk	Local Securities	mxAAA rated securities from one issuer[3] or counterpart	5%	5%	5%	5%	5%
Concentration / Counterparty Risk	Local Securities	mxAA rated securities from one issuer or counterpart	3%	3%	3%	3%	3%
Concentration / Counterparty Risk	Local Securities	mxA rated securities from one issuer or counterpart	1%	1%	1%	1%	1%
Concentration / Counterparty Risk	Local Securities	BBB+ rated sec. denominated in foreign currency from one issuer	5%	5%	5%	5%	5%
Concentration / Counterparty Risk	Local Securities	BBB- rated sec. denominated in foreign currency from one issuer	3%	3%	3%	3%	3%
Concentration / Counterparty Risk	For.	A- rated foreign securities from one issuer or counterpart	5%	5%	5%	5%	5%
Concentration / Counterparty Risk		Maximum ownership of one issue[4]	20%	20%	20%	20%	20%
Other Limits		Foreign securities (if fixed income, minimum rate is A-)	20%	20%	20%	20%	20%
Other Limits		Securitizations[5]	10%	15%	20%	30%	40%
Other Limits		Structured securities (issued by Mexican nationals)[5]	0%	1%	5%	7.5%	10%
Other Limits		REITs (Real estate must be in Mexican territory)	0%	5%	5%	10%	10%
Other Limits		Inflation protected securities miminum[6]	yes (51% Min.)	No	No	No	No
Conflict of interests		Securities endorsed by related parties	15%	15%	15%	15%	15%
Conflict of interests		Securities endorsed by parties related to the Afore[7]	5%	5%	5%	5%	5%

1- All limits expressed as percentages of assets under management (Activos Netos) but the maximum ownership of one issue. All limits are maximums, but the inflation protected securities minimum.
2- These are local rates for securities issued by Mexican nationals in Mexico. Global rates apply to foreign securities. All securities must have at least two rates. All securities must be issued through public offers.
3- Issuer or endorser in the percentage it guarantees. Counterparty exposure in repos and derivatives must be added to exposure acquired through securities.
4- Percentage of the total amount stated in the prospectus, adjusted by later amortizations and repurchases.
5- Securitizations must comply with Circular 15-19's appendix K to consider the SPV as an independent issuer; structured securities must comply with appendix L.
6- Minimum limit on securities that guarantee a return equal or in excess of Mexico's inflation rate.
7- This limit is contained in the Law (Art. 48, fracc. X), although Circular 15-19 sets a limit of 0% for related parties that are financial institutions.

Differentiation factors among funds

Due mainly to the flexibilization of the Investment Regime and the sophistication the managers have acquired, the funds continue to have an increasingly diversified portfolio.



Between Dec. 2000 and Dec. 2007, not only concentration in sovereign debt lowered, as new asset classes were included such as equity and foreign debt, but within government securities there is greater diversification in maturities and security types.

Index

1. Introduction
2. Risk management evolution
   a. Investment regime
   b. Prudential regulation
   c. Supervision
   d. Market discipline
3. VaR and risk management in practice
4. Challenges
5. Conclusions

As a important pillar complementary to the investment regime, the authority has put in place and keep on updating a framework of prudential regulation for pension funds.

Principles of Prudential Regulation applied in Mexico

The modern regulation has adopted some principles of prudential regulation, which in the case of pension funds consists of the following:

1) **Creation of an adequate corporate governance for investment and risk management.**
2) **Integral risks management (the usage of forward looking stress and back testing in portfolios as well as early warnings). The establishment of global internal risk limits by risk type.**
3) **Adoption of Best practices (creation of investment, operational and risk manuals).**
4) **Risk based supervision: certification processes for complex operations, daily supervision of Investment Regime compliance, periodic in-situ supervision that aims to detect weakness of risk management and activities that represent greater risks, use or early warnings (forward looking stress tests) and oral communication with top management.**
5) **Certainty and clarity of fund managers fiduciary responsibility (if violation of the financial regulation should happen, by causes attributable to the manager, the loss in the resources of the workers should be compensated), so that the incentives of the manager and the investors go in the same direction.**

The development of the prudential regulation has promoted the professionalization and sophistication of Mexican pension funds, encouraging a long term view.

Main Features of corporate governance

Investments

- Have an Investment Committee.
- Periodic sessions to decide investment polices.
- Have automatic operation, settlement and recording systems for the investments (straight through process.)
- Prepare fund managers and investment team.
- Establish mechanisms of best price execution.
- Reinforce the Code of Ethics for the investment team.

Risks

- Have an Risk Committee.
- Emit an opinion over portfolio risks.
- Create an independent unit for risk measurement.
- Have the models, systems and methodologies suitable to identify, measure and control risks, both current & potential (Forward looking.)
- Fulfill the best practices concerning operational risk.

With a preventive objective this minimum requirements promote an adequate environment of internal control and risk management

The two committees operate independently of each other. The CEO of the Pension Fund is the only person that participates in both committees.

The regulator has to count on prudential regulation as an effective and less distorting tool to manage risks, since market and technology evolution challenge the current regulatory framework.

Factors which promote the adoption prudential regulation in Mexico

- **Need of effective policies which limit maximum losses derived form adverse asset prices movements.**
- **The accentuated search for efficiency (risk/return.)**
- **Increased complexity of the financial markets and securities.**
- **Increased efforts to align capital structure, risk preferences and capacity to manage risk.**
- **Increased efforts to better assign the scarce supervising resources as well as to increase their efficiency end efficacy.**

Index

Supervision has evolved as new technologies have been available, and the objectives have been modernized in parallel with fund managers sophistication.

Principal Supervising Items

- **Requirements for adequate risk management Architecture**: Robust systems (straight through processes.)
- Evidence of **good practices** implementation for investment and registration of operations.
- Periodic **sessions** of investment and risk **committees** and **minutes** of decisions taken.
- **Supplementary** quantitative **indicators** of risks: Forward looking stress tests, back-testing, Parametric VaR simulations, before and after VaR measurements (before buying portfolio assets), marginal VaR.
- **Comprehensive assessment of risks.**

The supervising model count on two instruments: Surveillance and Inspection. Through this, three main aspects are reviewed.

Instruments

A) Surveillance | **B) Inspection**

Law Mandate

Aspects to be Supervised:

1) PENSION RESOURCES ADEQUATELY INVESTED
   - Abide by the Investment Regime

2) PENSION RESOURCES VALUATION & REPORTING
   - Fund Asset valuation using market prices
   - Accounting and registration of the fund following best standards

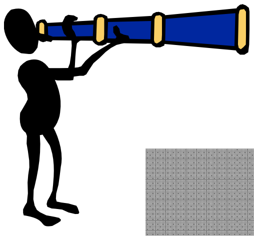
3) PENSION RESOURCES RISK MANAGEMENT
   - Adequate Internal Control
   - Investment and Risk management
   - Robust corporate government – appropriate infrastructure

- The three aspects which are supervised verify that:
  - A safe scheme is used when investing
  - Correct valuation is made
  - A control environment prevails
  - Financial risks are estimated and controlled
- The authority has the power to penalize violations.

The authority plans yearly in-situ inspections and it reserves the right to further test pension funds that may not have appropriate risk management relative to the investment choices they make.

Tools: Automated daily supervision of the investment portfolio.

Surveillance System

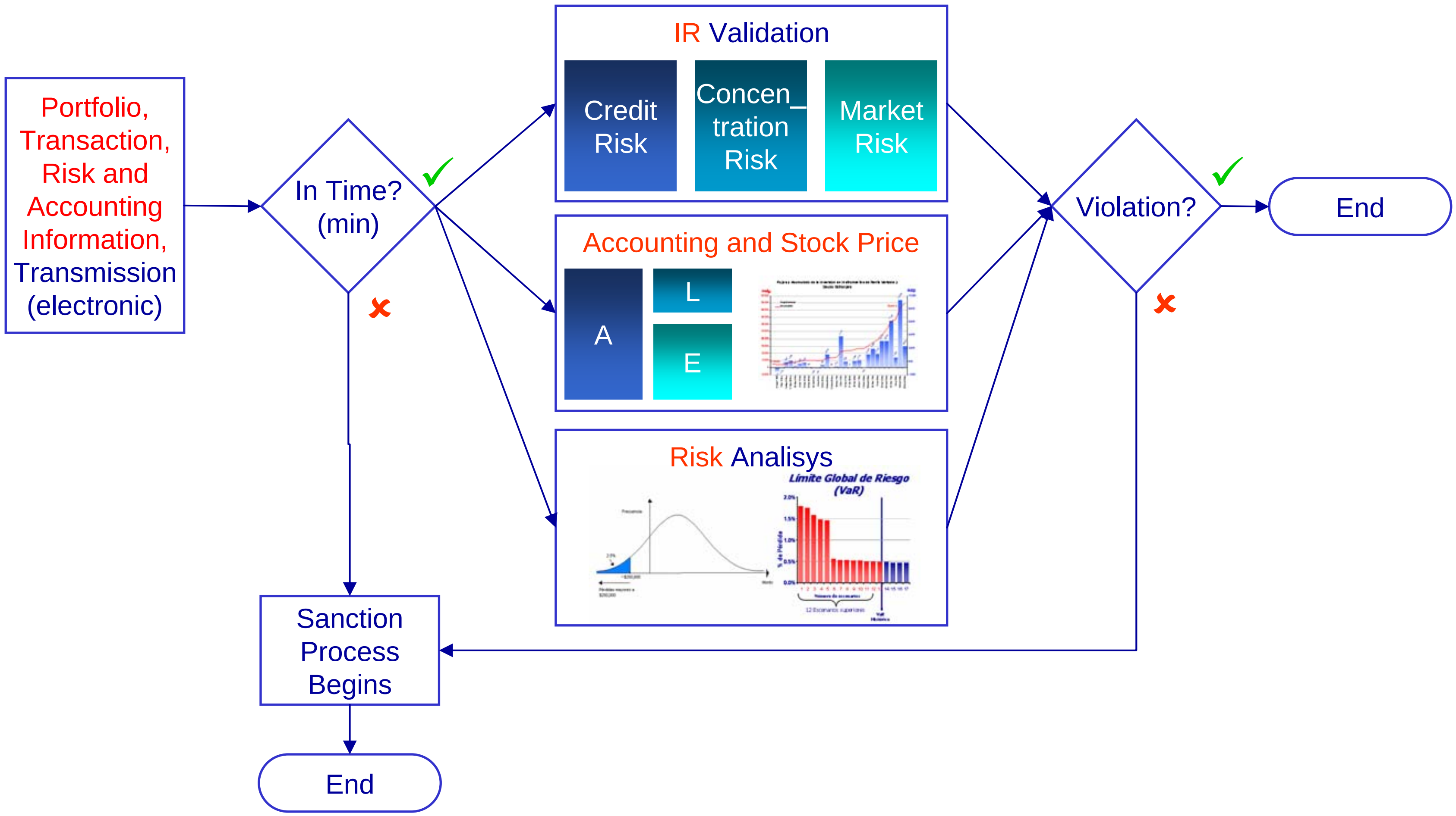


Verifies the accomplishment of all the parameters established in the Investment Regime

It allows the portfolios of the pension funds to be followed daily, as well as to simultaneously do the accounting of each one

Responds to the need to modernize supervising tools which rises form the incorporation of new kinds of securities and/or risks faced by the pension fund

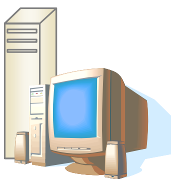
Reception and validation of daily information, in order to have quality inputs for risk supervision is a fundamental part of financial surveillance.

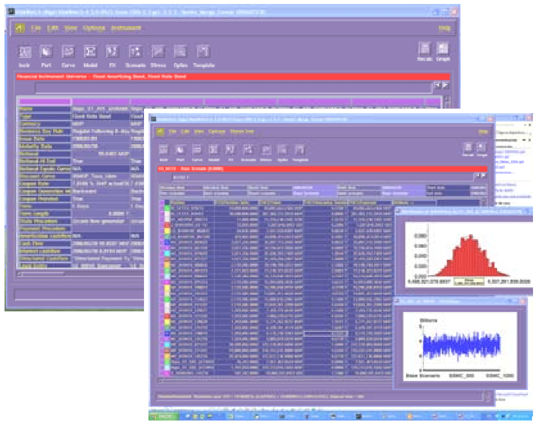


This process is predominantly automatic, which poses a great challenge in the design of the information that is required and in its processing.

Provided that there is good quality information, sophisticated systems for risk analysis can be used.

Database

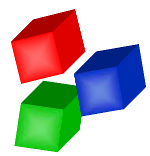


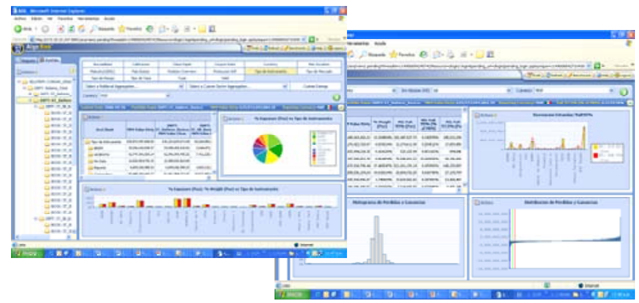


Calculation Engine

- Security modeling
- Theoretical Valuation
- VaR Calculation
- Duration Calculation
- Stress Scenarios

Daily cube generation





Interface

- User profiles
- Limit monitor
- Result consulting (VaR, duration, portfolio composition)
- Benchmark comparison
- Stress testing
- “What If” Module
- Automatic reports

Historical risk indicators data base

This system allows to theoretically value the portfolios, detecting significant deviations, estimating the historical VaR and the parametric VaR for different time horizons as well as to carry on stress testing scenarios that are forward looking.

CONSAR
Comisión Nacional del Sistema de Ahorro para el Retiro

Risk management systems such as the ones used by CONSAR offer to the supervisor several advantages:

Risk Analysis

- As a natural aspect of the system, it allows daily measurements, evaluations and analysis over the risks associated to the portfolios as well as the generation of online reports.
- It allows the modeling and replication of the valuation of derivatives instruments, which are not valuated by the price vendor at the time.
- The systems considers the comparison of portfolios against benchmarks referring to their composition and risk.

Inspections and verifications

- It allows to design and use complex portfolios which can be used as exercises during the certifications of derivatives and new pension funds. (Virtual portfolios, “What If?” scenarios)
- It allows the comparison between the internal risk models of the pension funds, with an independent model, corroborating the congruence between the two of them.

Regulation design and analysis

- The system simulates the possible effects in the different sensibility measures which arises from possible changes in the IR. (Virtual Portfolios, “What if” scenarios)
- It allows analysis of tracking error management strategies

Tools: In-situ supervision.

INSPECTION VISITS

CHECK THE OPERATIONAL SYSTEMS OF THE SIEFORES

- Regulation
- Processes
- Best Practices
- Risks
- Information Systems
- Committees

One of the goals of the inspection and verification visits is to **stress the systems**, the **models** and the working **equipments** of the managers.

General description of a verification visit:

Stage 1 Ongoing Business	Stage 2 Stressed Business	Stage 3 Disaster Recovery Plan

- Business simulation for at least 3 days, with events which forbid the right estimation of the closing prices of the funds.
- This implies simulation and evaluation of the operation, confirmation, settlement, registration and estimation and control of financial risks.

- New securities and crisis simulation are introduced.
- In this stage, the ongoing business for 3 days, validating the correction of whatever caused the events.

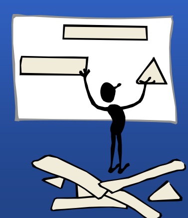
- Simulates the ongoing business for 2 days in which a Disaster Recovery Plan is carried on, operating the Afore from the contingency site.

Penalizations.

WHEN VIOLATION ARISES FROM:

PRUDENTIAL RULES

- Fines
- Violation Correction



INVESTMENT REGIME

- Fines and Portfolio Recomposition
- Compensation of the losses which were Generated

Index

An essential risk limiting variable is the discipline that can be exerted by the market through the analysis of disclosed information.

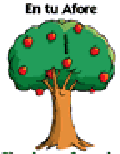
Relevant information disclosure rules

- **Disclosure requirements:** Development of a prospectus which contains the regulation following strategies.
- **Accounting rules:** Market value is used, the inputs come from the authorized price vendors which ensure a consistent and comparable valuation of the portfolio (valuation prices cannot be altered). Compliance with the International Accounting Principles. For special cases, an accounting manual which is established by the authority and the sector is used.
- **Selected Auditing Rules:**
  - ✓ **Auditable scope:** Financial Statements and Risk management Evaluation Systems. External Auditors' Reports.

CONSAR's strategy includes the revelation of the degree of financial sophistication of the pension funds.

On a monthly basis a table is updated and published with information about the certification to operate complex securities by the pension funds. This table constitutes an indicator of the financial sophistication of each pension fund.

En tu Afore



Siembra y Cosecha

Afore con Mayor Cantidad de Servicios de Innovación Financiera

Afore con Menor Cantidad de Servicios de Innovación Financiera

Servicios de Innovación Financiera

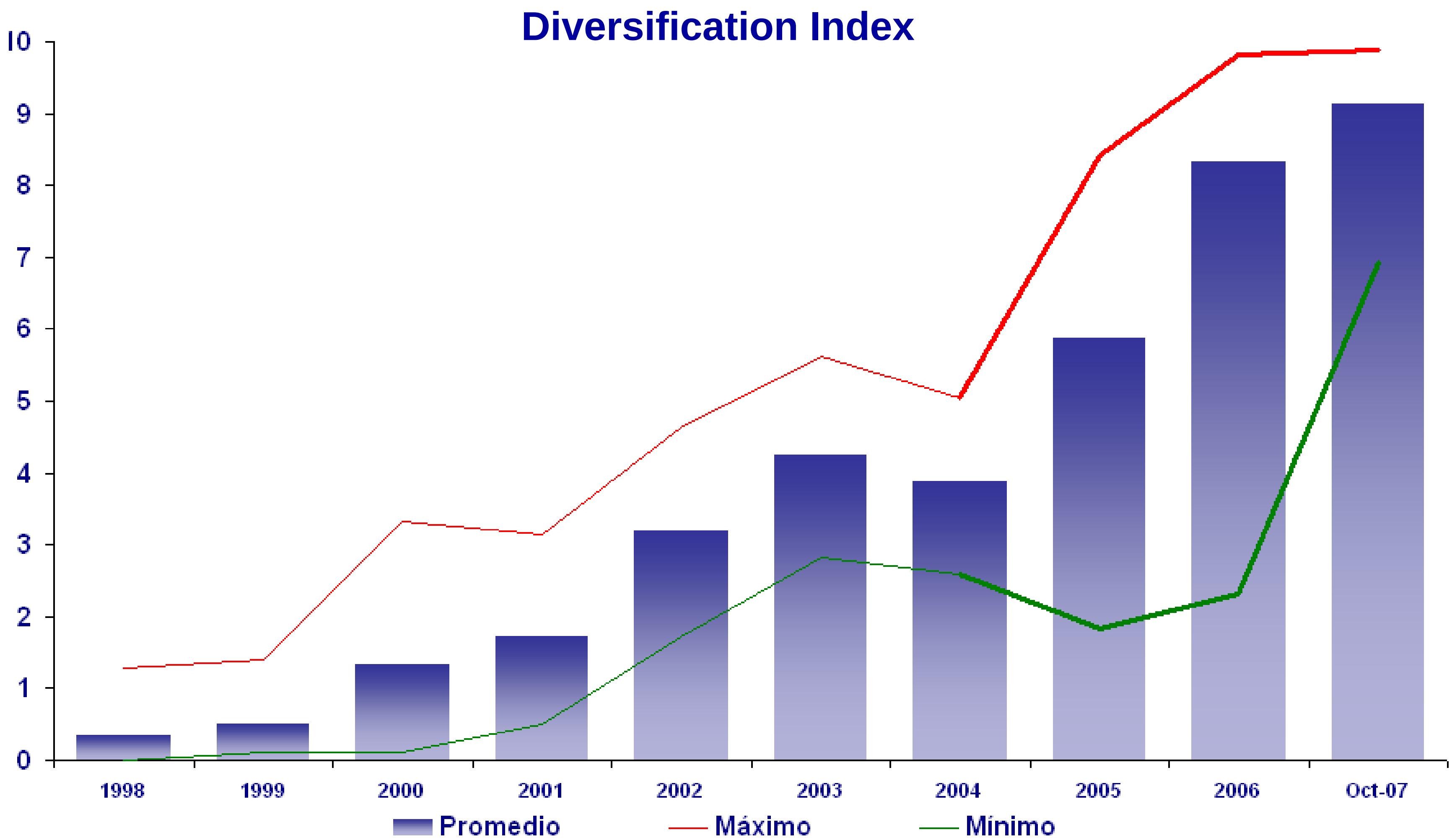
Servicios	Afores certificadas para operar con:							IV. Custodio Internacional	V. Siefores Adicionales
	I. Instrumentos ligados a índices accionarios*	II. Valores internacionales	III. DERIVADOS (Instrumentos para limitar riesgo)						
Afores			1. Futuros	2. Contratos Adelantados	3. Swaps	4. Opciones	5. Con contrapartes Internacionales		
Banamex	Sí	Sí	Sí	Sí	Sí	Sí	Sí	Sí	Sí
Bancomer	Sí	Sí	Sí	No	No	Sí	Sí	Sí	Sí
ING	Sí	Sí	Sí	Sí	No	No	Sí	Sí	Sí
Profuturo	Sí	Sí	Sí	No	No	No	Sí	Sí	Sí
XXI	Sí	Sí	Sí	Sí	No	No	Sí	Sí	No
Santander	Sí	Sí	Sí	Sí	No	No	Sí	No	No
Principal	Sí	Sí	Sí	Sí	No	No	No	Sí	No
Actinver	Sí	Sí	No	No	No	No	No	Sí	Sí
Metlife	Sí	Sí	No	No	No	No	No	Sí	Sí
Inbursa	Sí	Sí	No	No	No	No	No	Sí	No
Afirme-Bajío	Sí	Sí	No	No	No	No	No	No	No
Ahorra Ahora	Sí	Sí	No	No	No	No	No	No	No
Azteca	Sí	Sí	No	No	No	No	No	No	No
Banorte	Sí	Sí	No	No	No	No	No	No	No
Coppel	Sí	Sí	No	No	No	No	No	No	No
HSBC	Sí	Sí	No	No	No	No	No	No	No
Invercap	Sí	Sí	No	No	No	No	No	No	No
IXE	No	No	No	No	No	No	No	No	No

● Sí obtuvo la certificación para operar este instrumento ● No tiene la certificación para operar este instrumento

*Notas con capital protegido a vencimiento.
Cifras al 31 de octubre de 2006.

For the pension funds to be allowed to operate "complex" assets the authority runs a certification process within which the fund has to show proficiency both with its human capital and its infrastructure.

A Diversification Index (relative to investment possibilities) is also published monthly (based on the HHI), which complements the information over the strength of the portfolios.



***The index has a higher value for those portfolios which have a bigger number of asset classes with a lower concentration among these classes**

Source: CONSAR, numbers as of October 2007

Additionally, each fund must define a Benchmark with which the fund informs about their medium and long term view over their investment strategies.

Benchmark requirements

- **Replicable**
- **Transparent**
- **Ex – ante determination**
- **No ambiguity**
- **Measurable**
- **Appropriate**

For their construction

- **Adherence to the current regulation**
- **To take into account operational issues:**
  - **Size and growth rate of the portfolios**
  - **Volume and liquidity of each selected issuance**

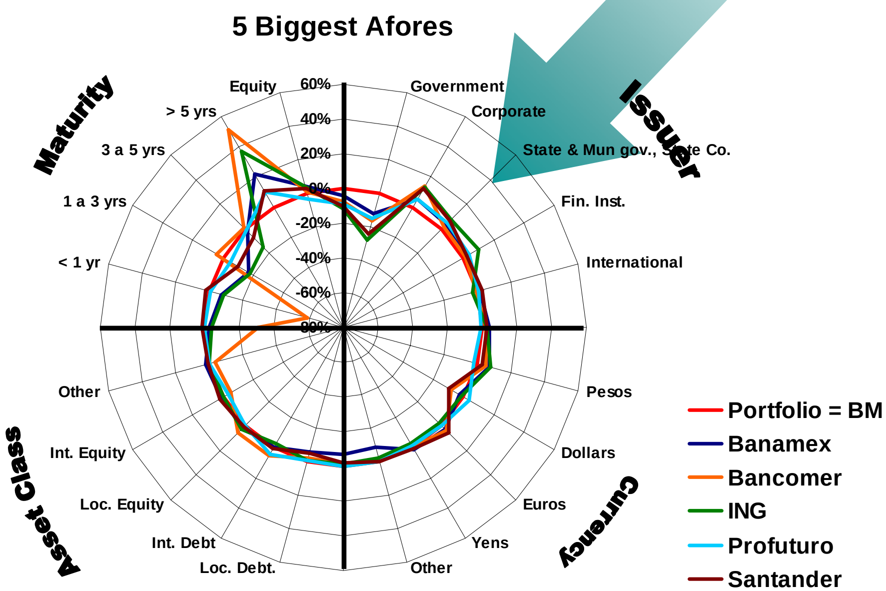
Along with the publication of the Benchmark portfolios, CONSAR builds internal reports on Benchmarks to follow pension funds tactical deviations.

The reports include comparisons of the position of the pension funds with its Benchmark

Security Issuer

SB2	Investment Portfolio						Benchmark					
		Private Securities [1/]						Private Securities [1/]				
Afore	Soverign	Corporate	State & Mun govs. Fed Companies	Financial Institutions	International [2/]	Total	Soverign	Corporate	State & Mun govs. Fed Companies	Financial Institutions	International [2/]	Total
Actinver	74%	13%	7%	0%	6%	100%	67%	8%	5%	5%	15%	100%
Afirme	64%	8%	20%	3%	4%	100%	66%	21%	0%	9%	4%	100%
Azteca	93%	6%	0%	1%	0%	100%	65%	12%	10%	8%	5%	100%
•	•	•	•	•	•	•	•	•	•	•	•	•
•	[illegible]	•	•	•	•	•	•	•	•	•	•	•
•	[illegible]	[illegible]	•	•	•	•	•	•	•	•	•	•
Profuturo	[illegible]	[illegible]	5%	4%	7%	100%	87%	7%	0%	0%	7%	100%
Scotia	[illegible]	[illegible]	8%	3%	14%	100%	40%	25%	5%	10%	20%	100%
XXI	[illegible]	14%	6%	5%	12%	100%	58%	14%	5%	13%	10%	100%

The radars include comparisons of returns and risks.



Index

The purpose of financial regulation is to strike a balance between controlling the risks of the investments and to obtain higher returns.

- The correct definition of this balance is fundamental:
  - A tight control of risks causes returns to be diminished.
  - A preference for efficiency (higher yields) can cause higher risks than the desired level.
- Variables that play an fundamental role in the risk/return balance:
  - Preferences of the regulator (the board of CONSAR) play a predominant role in the determination of investment regime parameters. Proposals have a technical analysis.
  - Ability of pension funds to manage risks: this exerts a bias towards greater liberalization of the investment rules.
  - Financial innovation and market evolution: new diversification strategies, more sophisticated financial products, technologies to transfer risks, liquidity and depth of markets, better price discovery dynamics, more efficient microstructure, etc.

The regulator has to ensure that investment rules will contribute to resilient, well diversified and efficient portfolios, and thus will contribute to higher pensions for millions of workers (for many of them these will be the unique retirement resources.)

In the balance of risk/returns the VaR plays an outstanding role since it is a global risk control parameter. The method for the calculation of the historical VaR has advantages and disadvantages.

Advantages

- ✓ It is an objective, transparent and reliable method to measure portfolios' market risks.
- ✓ Easy and low cost implementation method.
- ✓ No parametric assumptions are needed.
- ✓ It allows comparability among funds (same inputs and methodology for every one).
- ✓ Allows funds to administer the consumption of the VaR limit since 499 scenarios are known beforehand (out of 500) and thus the measure is predictable (but not manipulable) to a great extend.

Disadvantages

- ✓ The main assumption in the VaR scenarios is that risk factors are going to behave as they did in the past (history repeats.)
- ✓ The method is informational demanding; historical risk factors series are necessary, but they may not be available (case of new instruments.)
- ✓ No catastrophic events are considered other than the ones that already may have occurred.
- ✓ The VaR is silent about the severity of the losses above the regulatory limit.

In the balance of risk/returns the VaR plays an outstanding role …(Cont.)

Advantages

- It is computed by independent third parties.
- It takes into account correlations among securities, which means that it takes into account diversification or concentration that may not be apparent (although in theory this can fail –it is non coherent measure.)

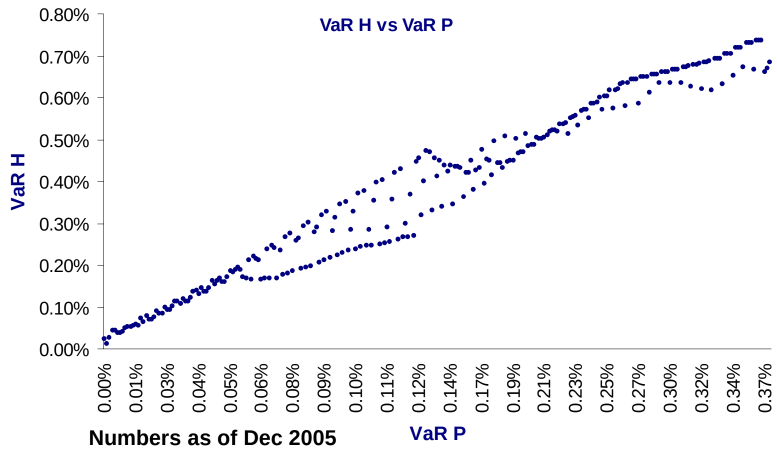
Disadvantages

- It cannot be used in optimization problems to determine efficient portfolios (non convexity problems.)
- It may be a factor that leads to herd behavior of pension funds (no evidence up to now, even under stressing conditions.)

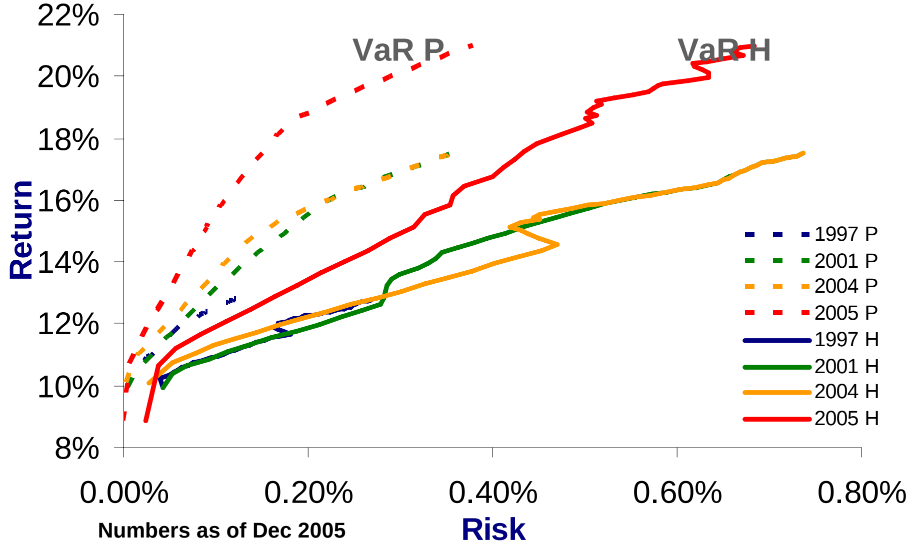
Because the historic VaR cannot be put into an optimization problem, pension funds may have to follow "guess and verify" strategies to determine efficient portfolios.

There is not a 1-1- relation between Parametric VaR and Historic VaR, but good starting points can be obtained from parametric VaR optimization to arrive at a efficient portfolio abiding by the Historic VaR limit.

Historical VaR vs Parametric VaR different portfolios



Efficient Frontiers with Historical VaR and Parametric VaR with the IR from different Years



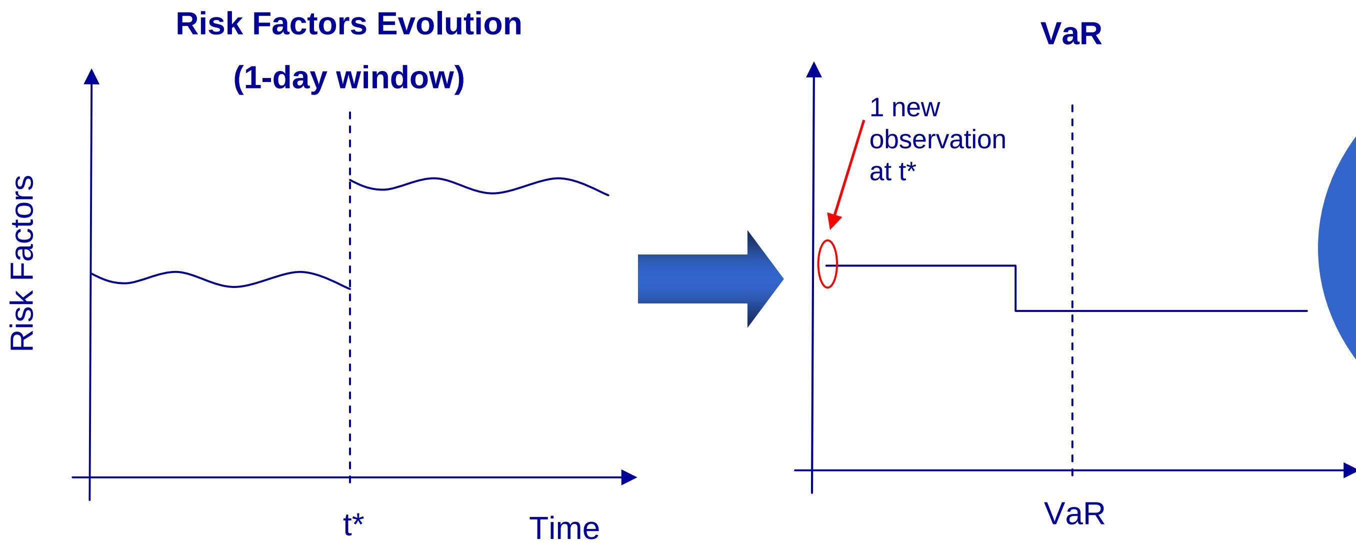
The determination of regulatory parameters of the historic VaR depends on the VaR methodology itself as well as on the investment regime.

Regarding the methodology, there is a set of basic parameters to be determined that in turn define the historic VaR.

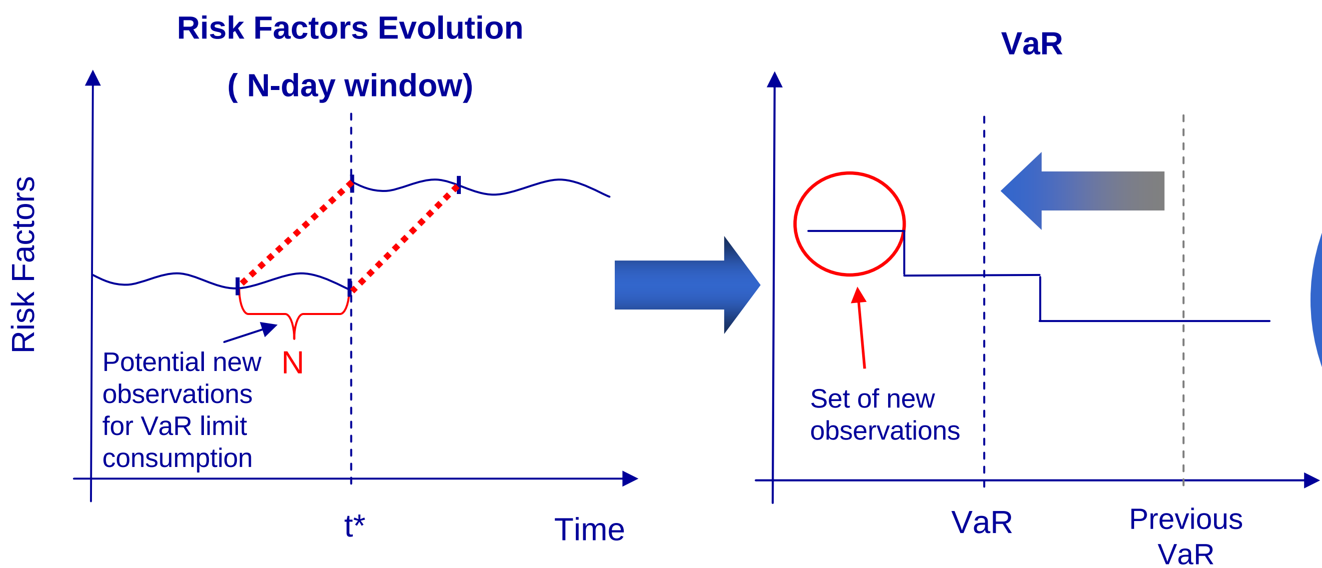
Main historic VaR parameters

- Confidence level (95%): standard levels.
- Number of scenarios considered (500): large enough to capture transitory volatility and structural changes.
- Evaluation frequency (daily.)
- Horizon for computation of portfolio's losses (1 day): estimations of longer horizons for portfolio changes are available through standard methods.

The 1 day horizon for computation of portfolios' losses allows not to overestimate permanent changes in risks.



With a 1-day horizon, a permanent change in risk factors is mapped into a single new VaR observation that may lay on the tails of the distribution.



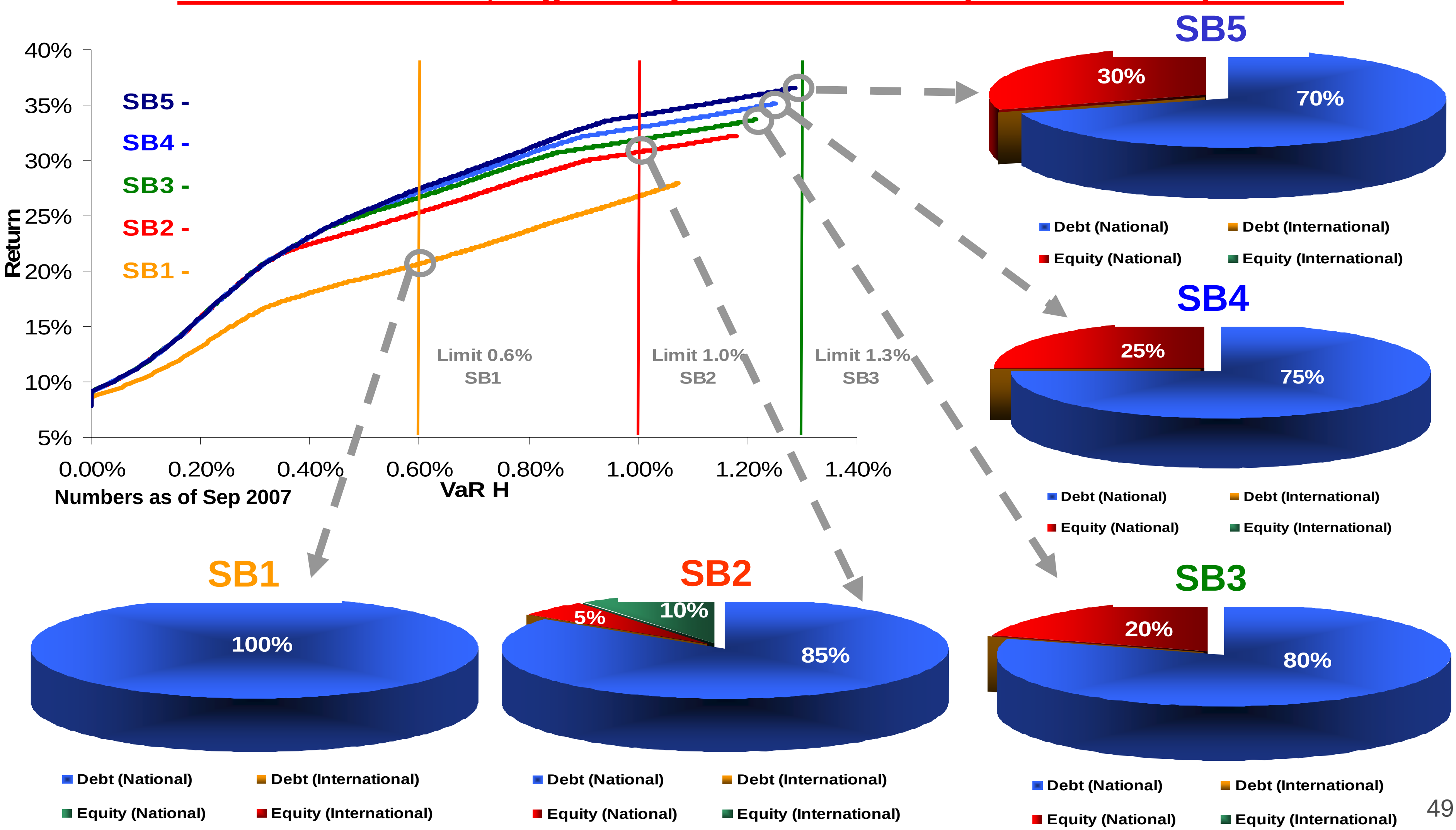
Even though marginal losses of the portfolio haven't increased, a longer horizon exacerbates the risk measure.

And it may cause an abrupt recomposition of portfolios.

On the other hand, the investment regime exploitation can foster portfolio diversification, but this may require congruent regulatory VaR limits.

For each type of fund a VaR limit is defined in a way that full exploitation of regulatory limits is possible.

Efficient frontiers, regulatory VaR limits and portfolio composition



The historic VaR measurement is supplemented with a set of prudential regulation tools that allow pension funds and the regulator to have a better assessment of risks.

Prudential Risk Control Standards

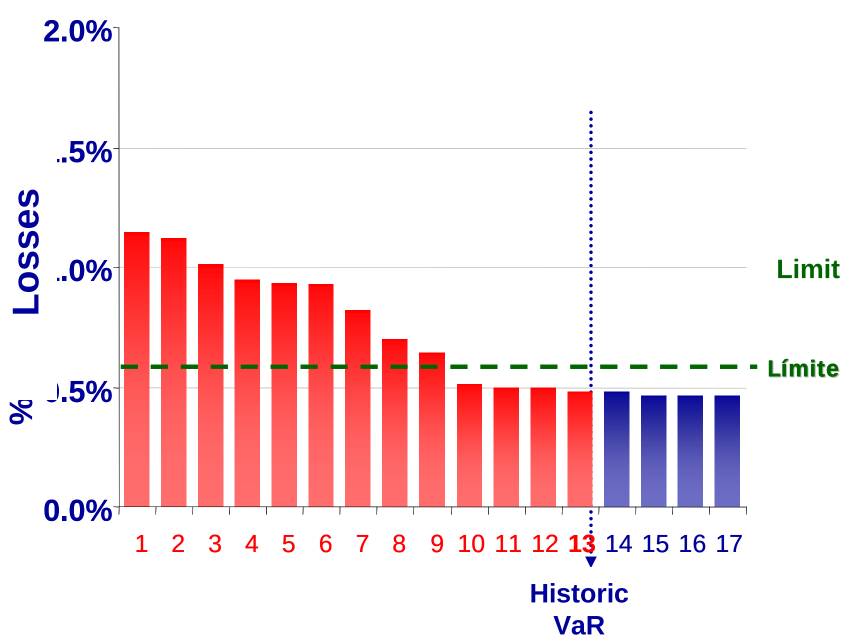
- **Additional tests are performed:**
  - **Regulatory limit of the historic Value at Risk (VaR) before and after taking new positions. The Risk Management Committee must provide, in advance, scenarios of portfolios from any operation.**
  - **Stress test scenarios (forward looking) of the portfolio carried out by the fund and the regulator.**
  - **Marginal VaR (changes in risk due to asset classes - a type of risk attribution.)**
  - **Portfolio Monte Carlo simulations.**
  - **Early warnings.**

The historic VaR measurement is supplemented with a set of prudential regulation tools…(Cont.)

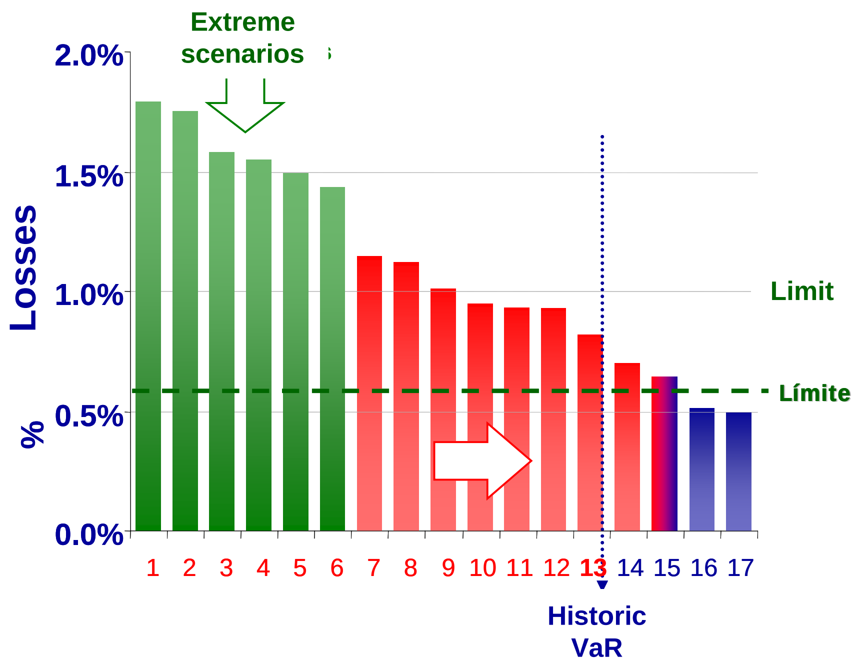
VaR changes

- **Before assuming a new investment position pension funds have to find out what will be the effect on the VaR and thus on the risk measure.**

Before



After a significant change in asset allocation



The historic VaR measurement is supplemented with a set of prudential regulation tools…(Cont.)

Stress tests are generated in order to estimate the magnitude of potential losses if a similar crisis to those observed in the past should present

Results of Stress Tests

Stress Testing – Crisis Scenarios - Estimated Losses*					February 29, 2008	
Siefore Basic 2	Mexican	Russian	Asian	09-11	MtM Theo Val	Δ%
SISTEM SB2	$123,021	$115,505	$29,616	$13,854	$758,726,541,174	0.72%

*Millions of pesos

Stress Testing – Interest Rates - Estimated Losses						
Siefore Basic 2	100 bp decrease		100 bp increase		Concavity chg	
	$	%	$	%	$	%
SISTEM SB2	-$18,676*	-2.54%	$17,236*	2.34%	$324*	0.04%

*Millions of pesos

Stress Testing – FX - Estimated Losses*				
Siefore Basic 2	UDI – 5%	USD – 5%	EUR – 5%	JPY – 5%
	$	$	$	$
SISTEM SB2	$11,124	$1,354	$326	$37

*Millions of pesos

The historic VaR measurement is supplemented with a set of prudential regulation tools…(Cont.)

Characterization of Financial Crisis used as parameters for Stress Testing:

Main Financial Crisis

- **The percentage variations in risk factors for the following World Financial Crisis were taken, using the periods established for each crisis.**

1) México 1994 Crisis (Tequila Crisis)

- End of 94
  - Cetes 28 days from 13.75% to 31%
  - Peso-Dollar currency rate from 3.46 to 4.995
- Begining of 95
  - Peso-Dollar currency rate up to 7.2

2) Asia 1997 Crisis

- Peso-Dollar currency rate from 7.73 to 8.17
- Cetes 91 days from 19.12% to 24.4%
- IPC down from 5341.76 to 4823.68 points

3) USA September 11, 2001

- S&P 500 down 5%
- DAX down 9%
- Nikkey 225 down 7%
- Dolar-Euro currency rate from 0.90 to 0.92
- Yen-Dolar currency rate from 121 to 118

4) Russian 1998 Crisis

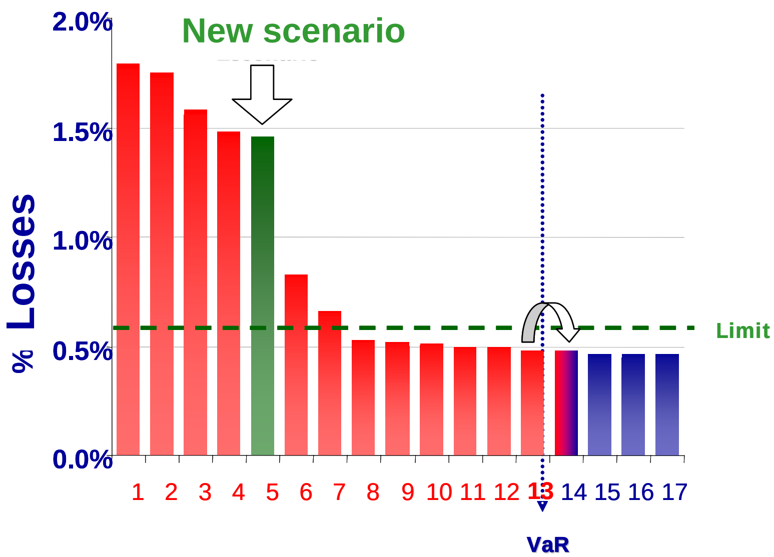
- Peso-Dólar currency rate from 9.30% to 10.32%
- Cetes 28 days from 21.49% to 47.86%
- IPC down from 3533.14 to 3395.98 units

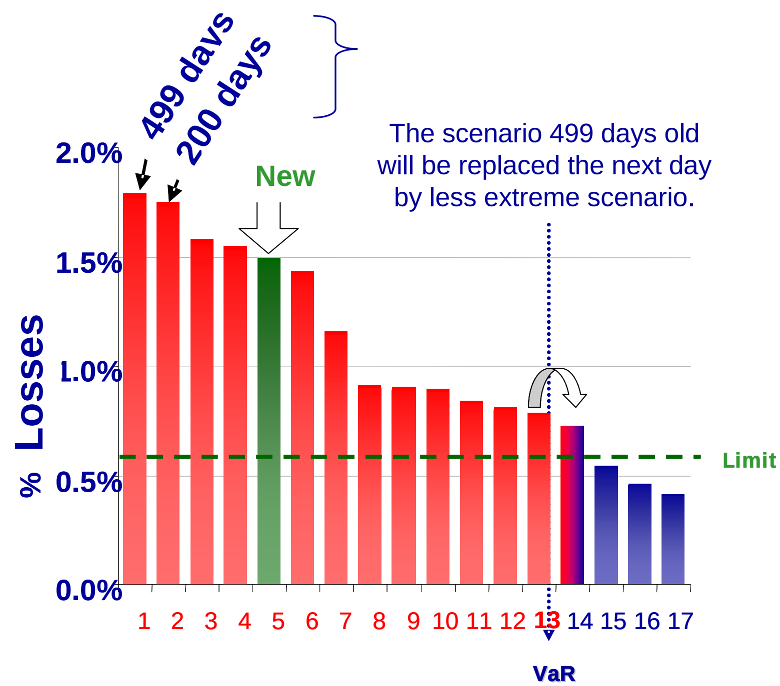
The historic VaR measurement is supplemented with a set of prudential regulation tools…(Cont.)

A series of indicators stemming from the VaR are used as early warnings and are calculated by the funds and the regulator on a daily basis in order to take preventive actions

Early Warnings

- **Their objective is to watch day to day changes in the tendencies of the VaR, allowing to anticipate violations of the maximum limit established in the IR. Two types of alarms will be calculated:**
  - ***Number of scenarios that exceed the regulatory limit.***
  - ***Time that extreme scenarios will remain as potential VaR measure..***





Other quantitative risk measures may be needed to further supplement the historic VaR.

Because of the information it conveys, the conditional VaR could be added as a risk measure (as another prudential tool). It is necessary that it be easily implemented in the industry.

	VaR			VaR Conditional		
Risk Measure	VaR of current portfolios	VaR of portfolios 100% Concentrated in Government securities	VaR of current portfolios excluding domestic private issuers and domestic equity	Conditional VaR of current portfolios	Condicional VaR of portfolios 100% Concentrated in Government securities	Condicional VaR of current portfolios excluding domestic private issuers and domestic equity
System Simple Average	0.64%	0.59%	0.61%	0.89%	0.82%	0.83%
System Weighted Average	**0.65%**	**0.67%**	**0.64%**	**0.92%**	**0.94%**	**0.91%**

The computation of regulatory Historical VaR of a investment portfolio is relatively easy.

The inputs and steps necessary to calculate the historical VAR of a portfolio:

1. Inputs:
   a) Theoretical pricing formulas for all assets in the portfolios
   b) Market values of all asset prices
   c) Historical information of risk factors - market determined- like interest rates, exchange rates, and other factors that determine the valuation of each securities in the portfolio is needed.
2. Steps to compute VaR:
   a) The estimation of the historical percentage variations of risk factors is performed (500 days).
   b) With these variations of risk factors a set of price scenarios for individual securities are computed (500 days.)
   c) Price scenarios are used to determine 500 scenarios for the current portfolio valuation.
   d) Gains and losses of the portfolio's value are computed and sorted in descending order.
   e) The regulatory VaR is the 13th worse scenario (corresponding to the 95% confidence level).

The historical information as well as the risks and price scenarios are calculated and provided by professional price vendors (independent third parties.) CONSAR replicates on a daily basis the VaR calculations of every pension fund (using same inputs) and VaR methodology.

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:

$$P_{CETE} = \frac{\overset{\text{NV}}{10}}{(1+\frac{\underset{\text{Market Rate}}{.07}}{360}*\underset{\text{Time to maturity}}{91})} = 9.826 \Rightarrow VPort_{(actual)} = \overset{Num.Titles}{100,000} * \underset{Price}{9.826}$$

$$= 982,613.21$$

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%

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

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

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

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

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.

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%

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

= 7.00%*1.07692

= 7.00%*0.99301

= 7.00%*0.92857

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

NV

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

Rate

TTM

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

$$= \underbrace{9.81301}_{\text{Price}} * \underbrace{100{,}000}_{\#\ of\ Titles}$$

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

$$= \underbrace{982,732.69}_{\textit{Value of the port \#4}} - \underbrace{982,613.21}_{\textit{Value of the port today}}$$

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

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%

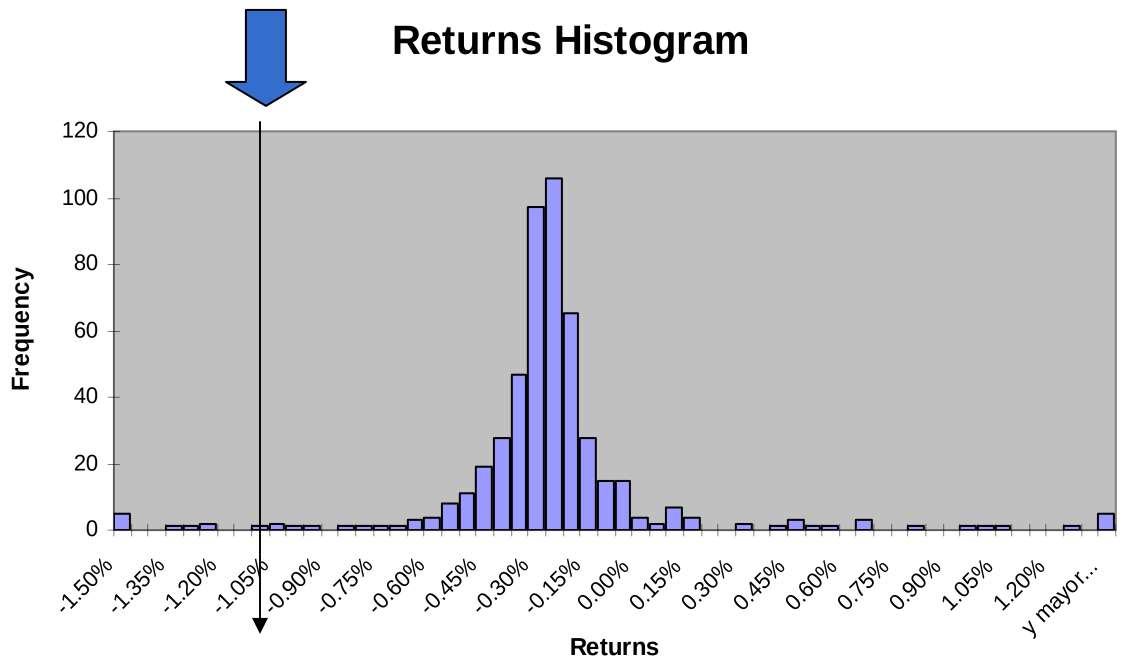
In our example, As we use 500 scenarios and looking for a confidence level of 95%, the VaR Portfolio will be the 13° worst scenario ((0.05/2)*500=13), ie. VaR will be 0.7159%

VaR at 95% confidence level

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



VaR at 95% confidence level = 1.039%

The regulation establishes that a VaR limit should not be exceeded or otherwise pension funds must recompose the investment portfolio.

- **When the VaR limit is violated the pension fund may be liable of any losses incurred.**
- **The VaR of a portfolio can increase for one of three reasons:**
  - **Change in the portfolio composition by asset class (this is under the control of the pension fund.) The changes in the composition of the portfolio can cause either a lower or a greater VaR, depending on correlations.**
  - **Increase in the volatility of the risk factors (which are exogenous to the pension fund.) The volatility of these variables is transmitted directly to the price of the securities in the portfolio.**
  - **A combination of the previous.**

To discriminate between first two situations the VaR of portfolio of day t-1 is evaluated with risk factors of date t (the date of the violation). If it does not exceed the regulatory limit, then the pension fund is liable.

The VaR limit necessarily goes together with mechanisms of portfolio re-composition (exist specific regulation for this purpose.) Repeated violations of the limit may cause suspension of the fund manager or revocation of the pension fund permission to deal with complex securities

Index

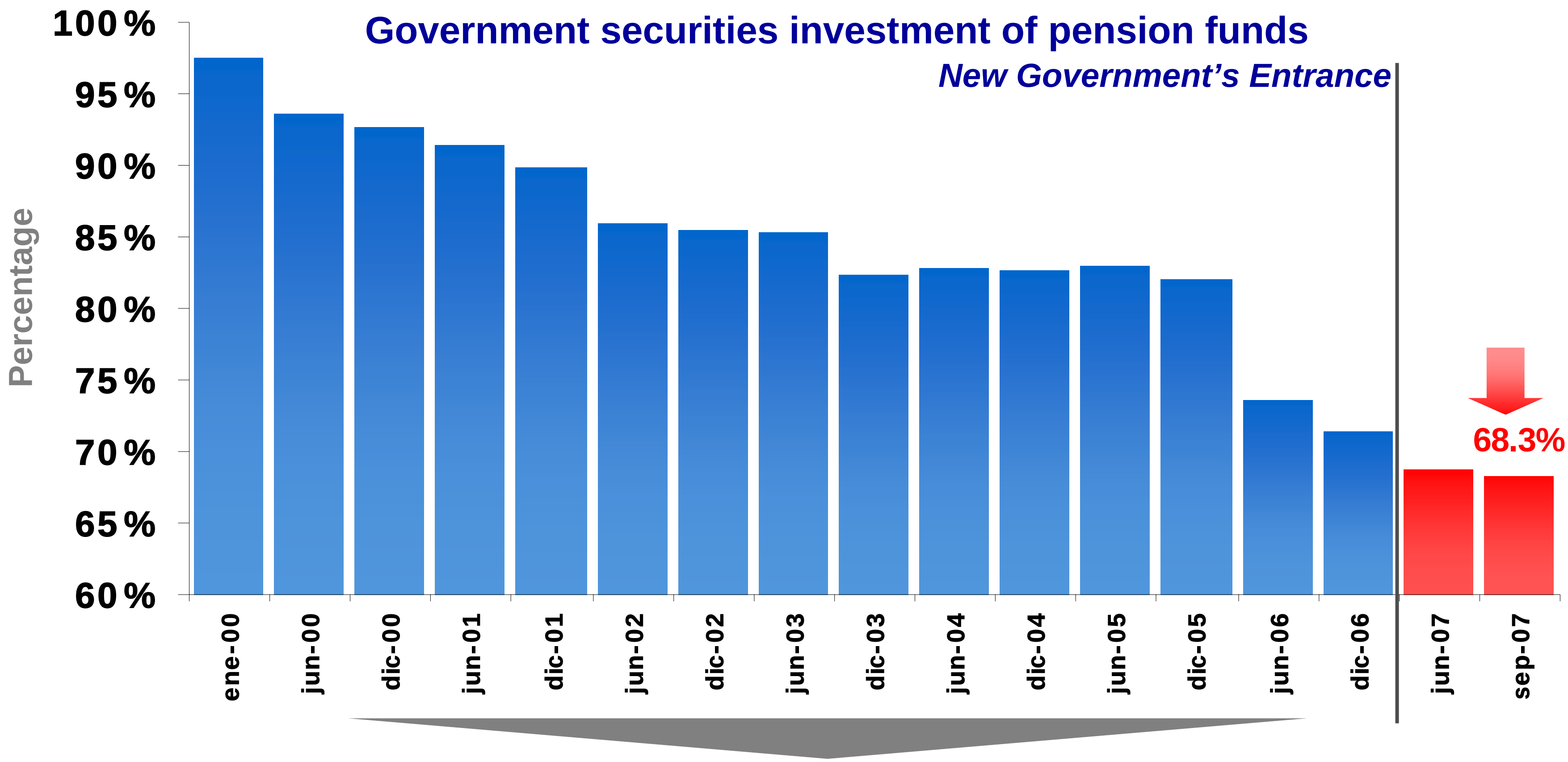
The risk management capabilities of fund managers must evolve in congruence to the evolution of the investment regime

Investment Regime Evolution

Aperture

	1997	2000-2002	2005	2007
Investment Regime	•Government and Bank securities •Security type oriented limits	•Corporative securities •Derivatives •Risk oriented limits	•Foreign securities •Equity	•Structured securities •REITS
Risk Management	•Asset class limits	•Prudential Risk Management rules •Prudential Investment rules	•Assets' Risk type oriented limits •Internal model verification	•Complex securities risk measurement •Long term view •Operational risk

One of the fundamental **risk control** tools of the portfolios will continue to be to **limit their concentration** in certain types of assets

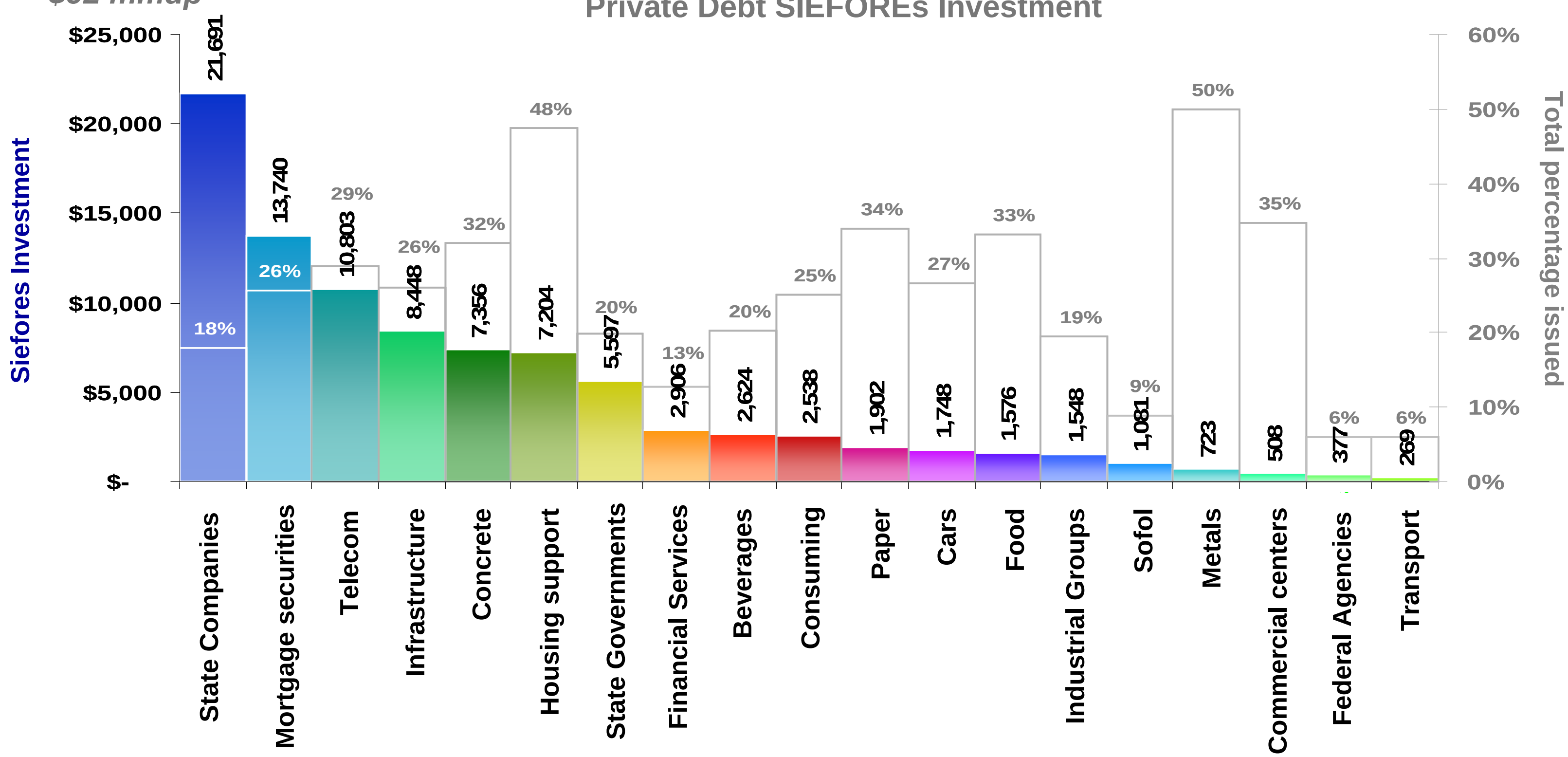


One of the challenges is to maintain the continuous and growing diversification of funds.

The more diversified a pension fund is, the more robust are the returns in the medium and long term.

In order to promote the diversification and to obtain better returns, investment in different issuers must also be promoted.

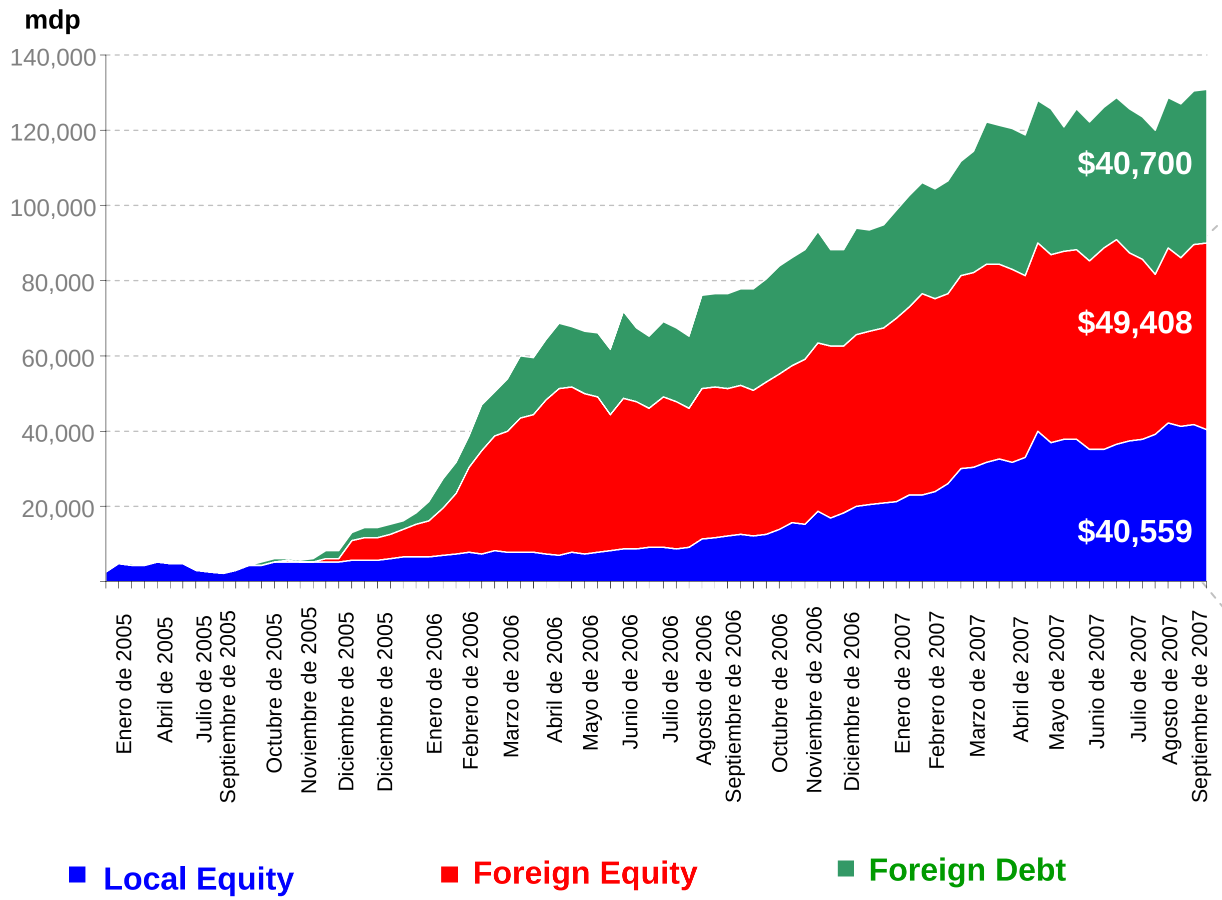
The pension fundss currently have 22.7% (92 billion pesos) from the total outstanding private long term debt, hence diversifying their portfolios and financing productive sectors



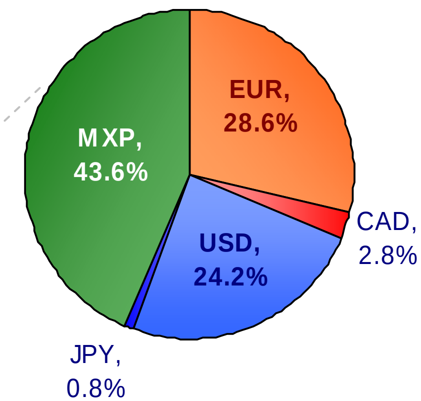
Siefores Básicas al cierre de agosto de 2007 ; Fuente: CONSAR e IXE; Cifras en millones de pesos

Obtain the maximum benefit form the possibility of investing in local and international equity markets which contribute to the diversification into productive sectors, geographic regions and currencies.

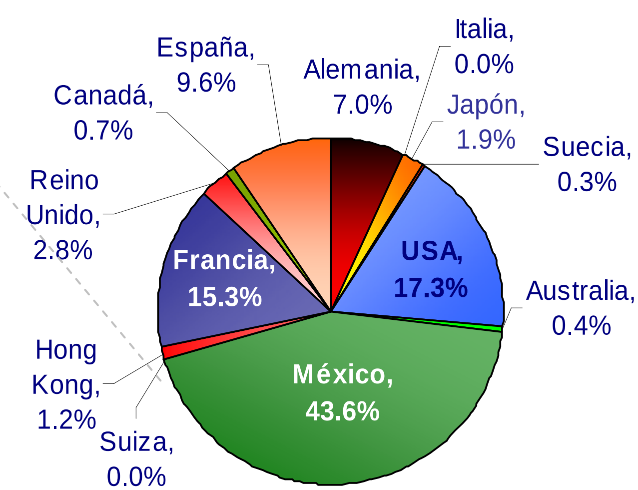
Equity and International Debt Investing



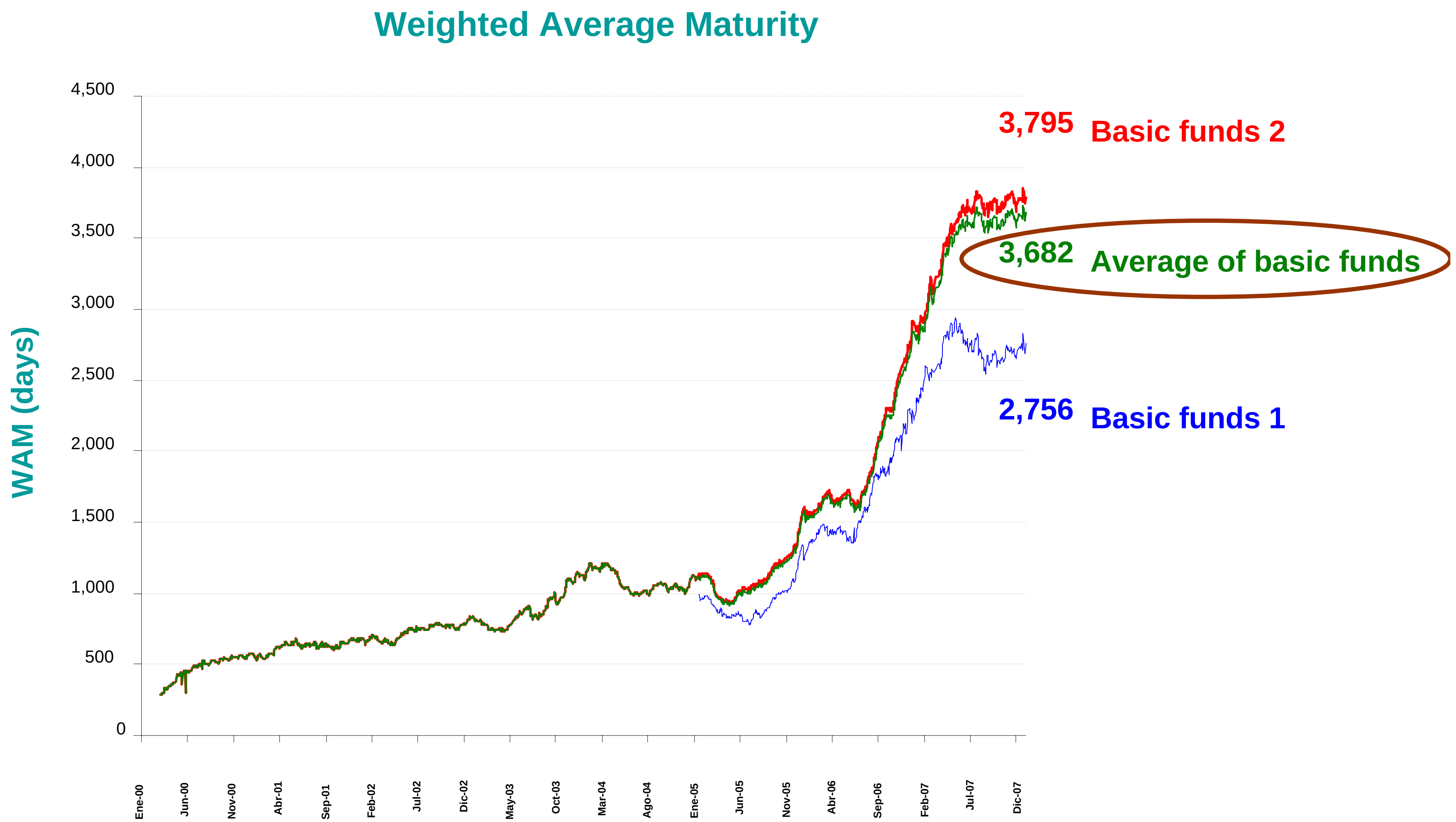
Equity by currency



Equity by country



Pension funds have to focus on long term asset allocations which will demand more sophisticated investment strategies and comprehensive risk management.



The authority has the challenge of introducing and maintaining a regulatory framework which promotes market development and contributes to better pensions

In order to fulfill this challenge the authority has to develop regulation which:

Develops Financial markets

- Give access of new issuers to the markets
- Foster the sophistication of the markets and their participants
- Promote price making through liquid and deep markets
- Continue the process of relaxing the investment regime as pension funds increase their risk management capabilities

Promotes the financing of Productive Activities

- Establish the bases which puts financing sources in contact with long term productive investment and productive projects linked to national development under a security scheme which maximizes workers' returns.

Promotes an adequate regulatory framework

- Increased Risk Management capabilities of pension funds.
- Strengthen investment and risk areas (for instance to broaden analysis, valuation and risk measurement functions).
- Improve operational risk control (for instance rules which avoid conflicts of interest and control outsourcing).
- Keep linked the capital requirement of pension funds to the maximum risk allowed to them

The pension funds main challenges are to strengthen their risk management abilities, to diversify the portfolios and to generate high returns.

Areas or activities which to strengthen simultaneously

Investment Analysis

- To understand and correctly evaluate the opportunities which rise from new asset classes.
- To cover different markets and security classes
- to understand complex securities which optionalities and different risk factors

Risk Assessment

- To measure and get acquainted with complex securities embedded risk
- To constitute an effective counterweight to investment areas

Control

- To effectively reduce growing operational risk in settlement and management due to*:*
  - *More funds*
  - *New markets*
  - *More transactions*
  - *More complex securities*

As long as the managers fulfill this strengthening, they will have an advantage over their competitors which will allow them to capture more clients and increase profits. But the converse is also true: not doing it may doom them to exit.

Index

Some lessons about risk management we had heard of and that we can confirm from the Mexican pension funds' experience are:

- ✓ An efficient administration of risks requires the application different tools in order to keep pace with technology and market evolution as well as with the need for better returns to deliver high pensions.
- ✓ Prudential management tools are the most dynamic pillar of effective risk management, and can be comprehensive. Pension funds must have incentives to foster its adoption and development.
- ✓ Supervision is more effective as new technologies are available.
- ✓ Quantitative regulatory limits are distortionary of efficient asset allocations, but parameters can be set to foster diversification and reduce distortions.
- ✓ It must change the current leadership of regulation as the main driver of comprehensive and efficient risk management adoption. Pension funds must realize of the vale it can add to their firms on a sustainable basis.
- ✓ The historic VaR is currently the unique global risk measure of Mexican pension funds' portfolios, and it has worked properly in limiting aggregate risks. It is set in congruence with the investment regimen, and it must be supplemented by other quantitative parameters (manly concentration and credit) and qualitative measures and strategies of risk control.

CONSAR
Comisión Nacional del Sistema de Ahorro para el Retiro

SECRETARÍA DE HACIENDA
Y CRÉDITO PÚBLICO
SHCP

Mexican Pension Funds: Var and Risk Management

April 2008

En tu Afore
Siembra y Cosecha

Comisión Nacional del Sistema de Ahorro para el Retiro

Camino a Santa Teresa # 1040 8o. piso, Col. Jardines en la Montaña
Delegación Tlalpan, C.P. 14220, México D.F.
Tel. +52 (55) 3000-2608 y 3000-2548 www. consar.gob.mx