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## trébol

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## editorial

This issue of **trébol** represents a significant landmark in our long history.

The internet and other communication technologies have made it possible to deliver this magazine to our readers faster and at shorter intervals. For this reason, this will be the last issue to include a paper edition. From now on, all our articles will be available on [www.mapfrere.com](http://www.mapfrere.com), where they will be filed and classified for easy reference. **trébol** will also notify our readers when a new issue becomes available.

We have specially selected four fascinating topics for our last paper edition: pensions, IFRS, reinsurance and technology - a combination that will set the contents pattern for coming articles.

Changes in the classification and measurement of financial investments (IFRS 9) and the new draft of the IFRS 4 insurance contracts standard are clearly explained and discussed in a detailed article by Pedro López, Deputy General Manager for Management Control - Controller at MAPFRE.

For the first time, **trébol** features commentary from Fitch, one of the four leading rating agencies in the world, concerning the reinsurance market and its immediate outlook. Fitch's views on credit risk are relevant, well structured and substantiated, although they do not always match the views expressed by other industry players. Such diversity of opinion will no doubt help our readers gain additional insight into the reinsurance market.

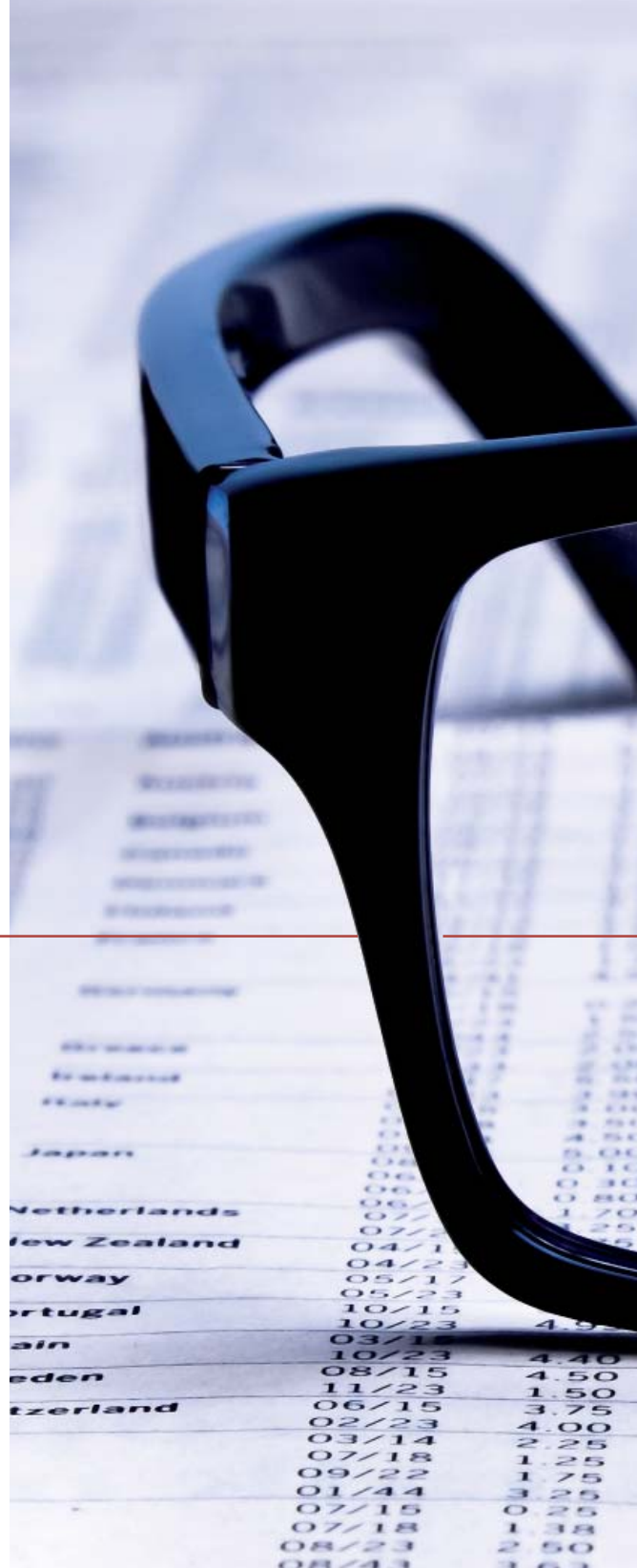
Supplementary social security has become the focus of much attention as a way to mitigate the detrimental effects of the economic crisis on the state pension system. Mindful of this pressing issue, some companies have introduced pension schemes of their own, which need to be accompanied by wider public information and social awareness. This article focuses on a major electricity company and how it is engaging with the need for supplementary provision.

Lastly, Barcelona's National Supercomputing Centre is a world-class facility for performing complex calculations that require speed and specialist skills in areas including medicine, natural resources mapping and disaster modelling. The centre's director, Mateo Valero, gives a passionate account of how it was established, its achievements and its future outlook.

Front cover picture:  
The interior of the Girona tower (Barcelona Supercomputing Center)

# The new IFRS 9 Financial Instruments and IFRS 4 Insurance Contracts Standards

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The International Financial Reporting Standards issued by the International Accounting Standard Board (IASB) were adopted by the EU following a ratification process in which the European Commission was advised by the European Financial Reporting Advisory Group (EFRAG) and the Accounting Regulatory Committee (ARC). First implemented in the financial year 2005, IFRSs are now mandatory for all companies listed on EU stock exchanges.



Though not mandatory for other companies, a large number of countries have amended their accounting systems to bring them into line with the IFRSs and spare companies the burden of applying several different schemes. For instance, a holding company listed on the stock exchange is required to receive its subsidiaries' financial statements under IFRS specifications. But if those subsidiaries are not listed, then they are subject to a

different accounting system, which doubles the effort and adds complexity. This is what a large majority of countries, including Spain, can now avoid after adapting their accounting systems.

IFRSs have also undergone a process of convergence with US accounting standards issued by the Financial Accounting Standards Board. As a result, the US Securities and



**The EU's original goal was to make company accounts comparable and equivalent within the EU by applying the same accounting criteria for recognition, measurement and reporting**

Exchange Commission (SEC) no longer requires companies that use IFRSs to provide a reconciliation to US accounting standards (GAAP).

The EU's original goal, which stems from the property and financial crash that affected countries in South-East Asia and dot-coms in the late 1990s, was to make company accounts comparable and equivalent within the EU by applying -theoretically- the same accounting criteria for recognition, measurement and reporting.

Yet IFRSs were -and still are- based on principles, not detailed rules. This means there is a certain degree of leeway in their application. Salient items including real estate valuation and classification, goodwill impairment and -one of the subjects covered by this article - financial investment classification and impairment criteria are applied flexibly, with no rule determining whether a share should be deemed impaired or not.

Flexible interpretation has led to numerous problems in comparing the accounts of listed companies, which the financial crisis that began in August 2007 has significantly compounded.

For instance, equities that suffered severe downward adjustments in the stock markets were impaired in some cases but not in others, making it impossible to compare the performances of similar companies.

This was no doubt one of the IFRSs' major weaknesses, which the IASB sought to overcome by introducing IFRS 9 to replace the current IAS 39. Preparation of this new standard began in 2008.

As regards the insurance contracts standard (IFRS 4), due to the numerous problems of practical application it involves, its implementation was postponed until a more thorough version is completed, a new version which is currently being drafted. Still, the entry into force of the IFRSs was attended



**The IASB has completed a new financial instruments accounting standard that will become effective on 1 January 2018, although it is yet to be adopted by the EU**

by the following decisions in the area of insurance contracts:

- ▶ To eliminate equalisation provisions.
- ▶ To test the sufficiency of technical provisions.

This article aims to provide a very brief overview of the significant changes that will affect the classification and measurement of financial investments and their impairment criteria, as well as the now quite advanced draft of the new insurance contracts standard, IFRS 4.

### **IFRS 9, the new financial instruments standard**

The IASB has completed a new financial instruments accounting standard that will become effective on 1 January 2018,

although it is yet to be adopted by the EU. The new standard will replace IAS 39 currently in force, and may be applied in advance on a voluntary basis.

The IFRS is structured into the following three phases:

- ▶ Phase 1: Classification and measurement of financial assets and liabilities.
- ▶ Phase 2: Impairment of financial assets.
- ▶ Phase 3: Hedge accounting.

This article focuses on phases 1 and 2 only, as they contain the largest number of new features with respect to IAS 39.

The current standard lays down four categories for financial asset classification.

- ▶ Financial assets at fair value (equivalent to market value) through profit or loss.

**IFRS 9 establishes an expected credit losses model to replace the current incurred loss model. The current impairment regulations included in IAS 39 have revealed that impairment was recognised once the loss had already been sustained**

- ▶ Held-to-maturity investments. Financial assets with a fixed maturity date and fixed or determinable payments, which an entity intends and is able to hold to maturity. Held-to-maturity investments are measured at amortised cost and are unaffected by changes in fair value.
- ▶ Loans and receivables. Non-derivative financial assets with fixed or determinable payments that are not quoted in an active market. They are measured at amortised cost.
- ▶ Available-for-sale financial assets. These are assets that cannot be classified in either of the previous two categories. They are measured at fair value with fair value changes being recognised directly in equity rather than in profit or loss, except where such changes are due to significant and prolonged impairment (decline in the price of the asset). This is the category that gave rise to serious problems in relation to measurement and impairment during the recent financial crisis, as mentioned above.

The above categories established by IAS 39 will disappear under IFRS 9, which is expected to provide a new classification based on:

- ▶ The entity's business model for financial asset management, and
- ▶ The contractual cash flow characteristics of the financial assets.

According to these criteria, financial assets are classified into the following categories:

- ▶ **Financial assets at amortised cost.** These are equivalent to the previous category of held-to-maturity and loans and receivables. The following conditions must be met:
  - a. The asset is managed under a business model whereby financial assets are held in order to collect contractual cash flows (principal and interest); and
  - b. The asset's contractual cash flow solely

generates payments of principal and interest on specified dates.

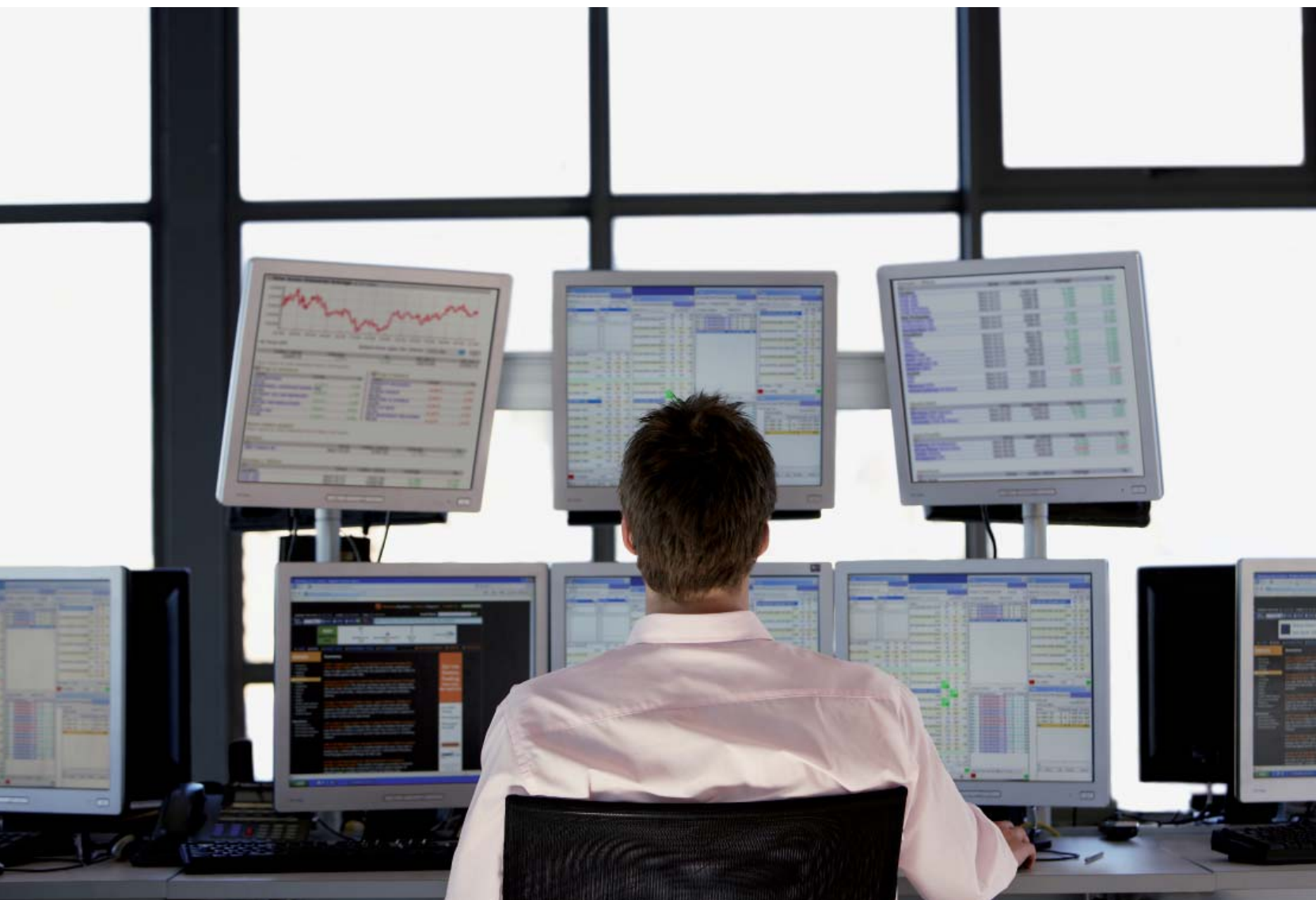
This would initially be the appropriate category for fixed income securities. However, an investment bank holding a bonds portfolio for trading would not be able to classify those bonds in this category. The business model needs to be tested to establish whether it involves maintaining the assets throughout most of their life to maturity, in which case they should be measured at amortised cost, or selling them significantly ahead of maturity, in which case the most appropriate measurement method would be fair value through profit or loss, as explained below.

- ▶ **Financial assets at fair value through Equity.** These are measured at fair value with changes being recognised directly in Equity. This category includes assets that meet both of the following conditions:

- a. The asset is managed under a business model the objective of which is to collect contractual cash flows (principal and interest) or cash through asset sale; and
- b. The asset's contractual cash flow solely generates payments of principal and interest on specified dates.

- ▶ **Financial assets at fair value through Profit or Loss.** This category includes all other assets, chiefly equity instruments. It is equivalent to the previous «trading portfolio» category. Assets are measured at fair value, with changes being recognised in profit or loss in all cases. Nonetheless, the entity has the option to decide at initial recognition which equity instruments are not to be included in this category, in which case all value changes are recognised in equity accounts and do not affect profit and loss. In the last two cases, recognition of losses due to impairment is eliminated, as all changes in fair value are recognised in profit or loss or in equity. Thus, there will no longer be any subjectivity in establishing whether an instrument is to be deemed impaired, as was previously the case.





In the area of financial liabilities, IFRS 9 maintains the classification and measurement requirements of IAS 39.

Turning to impairment, IFRS 9 establishes an expected credit losses model to replace the current incurred loss model. The new system has been introduced because the current impairment regulations included in IAS 39 have revealed that impairment was recognised once the loss had already been sustained, whereas the new approach seeks to anticipate potential losses. This impairment model must be applied to all financial assets not measured at fair value through profit or loss (i.e. assets measured at amortised cost, assets measured at fair value through equity, bills of exchange, lending commitments). Equity instruments are excluded.

The new impairment model comprises the following stages:

- ▶ Expected credit losses for the next 12 months must be calculated on every reporting date. The asset's financial revenue is calculated by applying the effective interest rate to its gross carrying amount. This is an expected-loss scenario.
- ▶ If credit risk has significantly increased since initial recognition of the financial asset, the lifetime expected loss for the transaction must be calculated. The asset's financial revenue is calculated by applying the effective interest rate to its gross carrying amount. This is also an expected-loss scenario.



Implementation of the new model may lead to anticipated recognition of credit losses, increased provisions, greater volatility as estimates are lengthened from 12 months to transaction lifetime, and a change in management systems.

### **The new IFRS 4 insurance contracts standard**

The insurance contracts standard is almost certainly the most challenging in terms of practical applicability.

Owing to this great complexity, its implementation was postponed in 2005, when IFRSs became effective in the EU. Indeed, it remains pending approval to this day and, according to the latest reports, it is not envisaged to come into effect before 2018.

Work is currently under way on Exposure Draft 2013, and a final version of the standard is expected to be issued in early 2015.

The scope of IFRS 4 extends to all insurance contracts, whether or not they have been issued by an insurance company, and to Life and Non-Life lines (discussions are ongoing as to whether it will apply to roadside assistance). It applies to direct insurance, accepted reinsurance, and ceded and retroceded reinsurance.

Measurement of insurance contracts according to the standard is based on three key criteria (building block approach):

- ▶ Current value of the cash flows expected for the insurance contract.
- ▶ Risk adjustment; and
- ▶ Contractual service margin.

- ▶ If a loss has already been incurred, the lifetime expected loss of the transaction must be calculated as in the previous stage, but the asset's financial revenue must be calculated by applying the effective interest rate to its amortised cost (the gross carrying amount minus the allocated provision).

#### **1. Current value of cash flows**

This is defined as the best estimate of the present value of an insurance contract in its potential scenarios. Thus, it must be unbiased (i.e. determined as the average of a range of possible outcomes) and consistent with current market prices.

It must reflect the perspective of the entity and incorporate, in an unbiased way, all of the available information. For Life insurance contracts, options and guarantees must also be included.

Although the notion of discounted cash flow is common in Life insurance, its application to Non-Life insurance is much more questionable and problematic. There may not be a market for many kinds of insurance, there may be no experience to set a number of scenarios large enough to enable unbiased selection (e.g. disaster classes), and in many markets it may not be possible to establish long-term discount rates (e.g. countries with high inflation).

Applying discounted cash flow is even more problematic where ceded and retroceded reinsurance are concerned, as it will not always be possible to calculate a contract's cash flows based on the direct insurance contracts or the accepted reinsurance contracts they protect. An example of this is a non-proportional ceded reinsurance cover protecting an insurer's net retention money for earthquake insurance.

Lastly, the Exposure Draft provides that the discount rates used in cash flow measurement may change over the term of the contract, as such rates are based on the discount rates prevailing at each accounting time. In this case, changes in the current value of cash flows resulting from changes in the discount rate should be reflected in equity, not in profit or loss.

2. **Risk adjustment** is defined as the amount required by an insurer to offset the uncertainty about the amount and timing of cash flows. Obviously, it is a downward adjustment of cash flow current value, and it is recognised in loss in all cases.

Risk adjustment may be associated with the notion of confidence interval in statistics, i.e. a margin deducted from cash flows in order to secure a reasonable confidence range. For instance, if the current value of expected cash flows is reduced by 5 per cent, it will have a 95 per cent likelihood of being realised.

The risk adjustment must be recalculated at every accounting period, and any differences generated in the current value of cash flows as a result of changes in risk adjustment must be recognised in profit or loss.

### 3. **Contractual service margin**

Application of the approach described in the preceding points would make it possible to recognise at time 0 the profitability generated by an insurance contract. This could lead to a situation in which a contract's profit would have to be recognised in full on the first day of its term. The contractual service margin averts this clearly unreal situation by reflecting the future profit of effective contracts and deferring recognition over the coverage period. This notion is analogous to an unearned premiums provision.

Future profit, which is recognised as expected gains are realised over time, is recognised as an insurance liability (provision) that diminishes after expected gains are accrued.

## Conclusions

It may be gathered from the above description of the new IFRS 4 that insurance contract accounting is set to become much more complicated, as it will take in -particularly in Non-Life classes- items that had so far never been included, such as cash flows, interest rates, margins, confidence intervals, etc. Still, IFRS 4 also simplifies the general model for certain Life products (unit linked) and short-term contracts.

The new standard will require heavy investment in the technology needed to perform these complicated calculations. But the largest investment to transform accounting into a measurement of assets and liabilities will have to be made in training, so that company staff become highly qualified and skilled in actuarial science rather than accounting.

**The new standard will require heavy investment in the technology needed to perform these complicated calculations. But the largest investment will have to be made in training, so that company staff become highly qualified and skilled in actuarial science rather than accounting**

# Global reinsurance market



Felgueira lighthouse at Porto (Portugal), hit by the storm in January 2013



Martyn Street  
Senior Director – Insurance  
Fitch Ratings

### 2015 will be a tough year for reinsurers

The absence of large losses, intense market competition and sluggish demand from reinsurance buyers has resulted in a softening market for reinsurers, characterised by falling prices and, less visibly, weakening terms and conditions. The high level of surplus capital held by reinsurers within the sector increases the likelihood of soft market conditions continuing into 2015, although the rate and extent of further price deterioration is unclear.

Ironically, the favourable underwriting results posted by the industry since the record catastrophe loss year in 2011 has fostered the current challenging reinsurance environment. Reinsurers' profitable results are attracting more capital to the sector, some from alternative non-traditional sources, which has created excess reinsurance underwriting capacity, leading to price competition and falling reinsurance rates. However, recent performance reveals that pricing and competition need to deteriorate significantly more before profit

**Reinsurers' profitable results are attracting more capital to the sector, some from alternative non-traditional sources, which has created excess reinsurance underwriting capacity, leading to price competition and falling reinsurance rates**

erosion becomes untenable, as reinsurers in aggregate posted combined ratios below 90% and returns on equity (ROE) of around 12% in the last few years.

companies' reinsurance purchasing habits are permanent or cyclical.

### Soft market or structural change?

When making longer-term analytical assessments, it is important to distinguish between short-term cyclical fluctuations and longer-term structural trends. Price reductions that are the result of lower loss experience or temporary, opportunistic swings in capacity are reflective of the underwriting cycle that companies would manage through as part of the normal course of business.

In contrast, the growth of alternative capital and changes in reinsurance purchasing habits are expected to have long-term implications for the sector. The emergence of alternative capital within the reinsurance sector is an enduring credit negative to traditional reinsurers' ratings. It remains unclear whether changes in primary

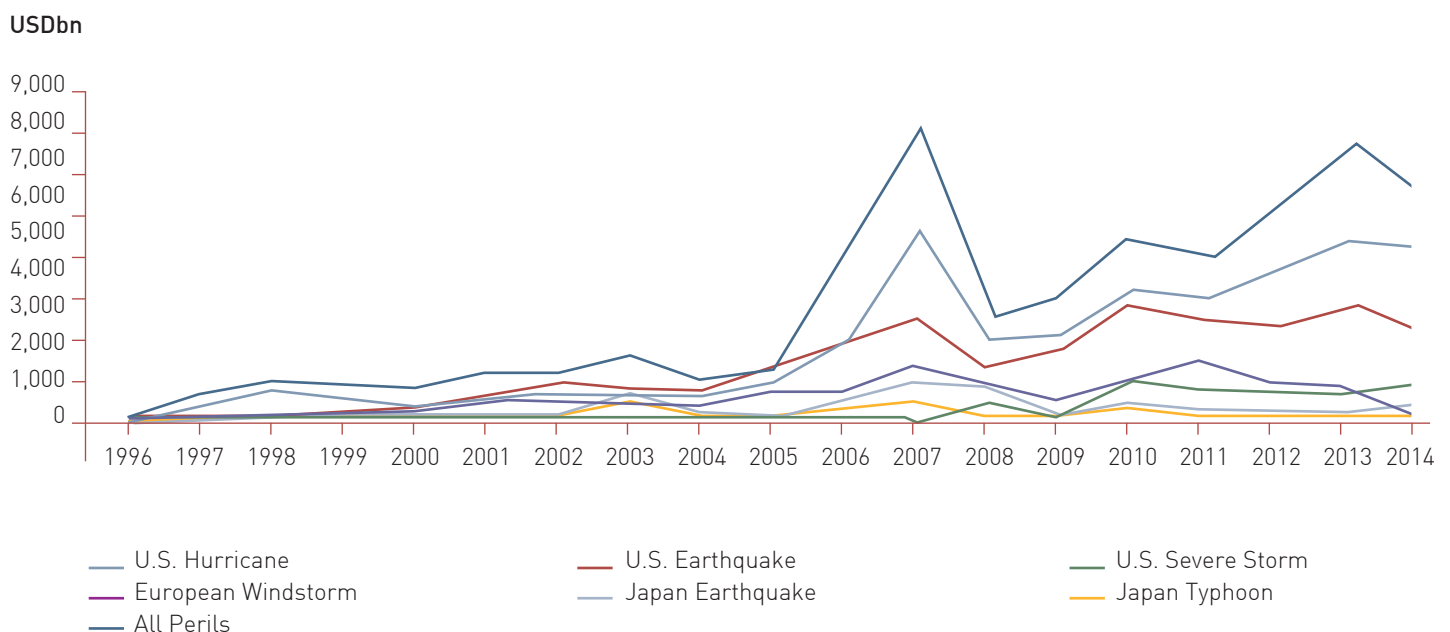
### US property catastrophe prices hit by perfect storm

The US property catastrophe reinsurance market has been the focus for market commentators for some time, most recently due to double-digit percentage point price cuts across some lines. The current pricing deterioration that has occurred is viewed as a combination of a cyclical soft market and structural change, created by the perfect storm of low loss activity and intense supply-side competition. The cyclical soft market was preceded by a build-up of underwriting capacity in recent years, primarily due to a reduction in windstorm activity and associated insured losses across the peak-zones of the Gulf of Mexico and southern US states.

Structurally, the availability of underwriting capacity has been exacerbated by the continued ingress of alternative capital,

**Figure 1: Cat Bond Issuance by Peril and Year.**

Source: Fitch.



which has grown especially rapidly in this part of the reinsurance market. This has intensified competition, both between new alternative entrants and established traditional players, and more recently amongst traditional reinsurers as they look to preserve market share. Figure 1 highlights the marked growth in catastrophe bond issuance since 2008.

While the growth of alternative capital is likely to lead to a natural evolution of the market rather than sweeping reform, it does represent a structural change for traditional reinsurers, prompting some market observers to question the long-term viability of traditional reinsurers that have a high exposure to these conditions.

### **Changes affecting the wider market - casualty next?**

To a lesser extent, a reduced claims burden and intense competition has seen softening market conditions extend more broadly throughout the reinsurance sector during 2014. Some of the

main pricing falls observed at the April 2014 renewals, which is an important renewal date for Asia-Pacific business, saw marked declines for Japanese business, with prices for loss free earthquake and wind/flood programmes decreasing by up to 20pp. The negative movement follows more than two years of significant rate increases after the 2011 losses that affected this region. With losses «earned back» by reinsurers, there is naturally going to be some price readjustment.

Looking to 2015, one of the key market sectors to watch is casualty lines. As property catastrophe continues to soften, traditional capital is likely to be redirected to lines seen as providing greater pricing adequacy, such as casualty. In addition, 2014 saw the emergence of alternate capital in the casualty business with the formation of a specific sidecar company.

It is too soon to judge if a specific vehicle like this, which will employ an alternate investment strategy (heavily hedge fund-managed non-investment grade secured loans) designed to give it a pricing advantage, will gain any real traction. However, some

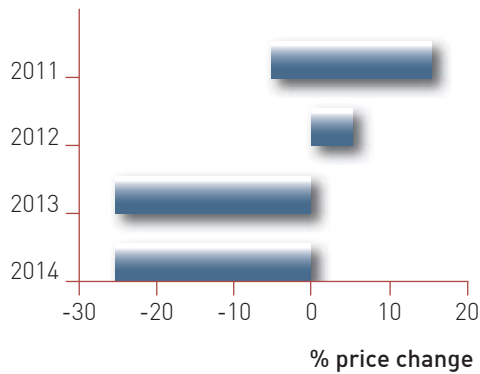


traditional reinsurers may decide to be proactive in defending their market share from a potential new wave of hedge-fund backed casualty reinsurers by cutting back on pricing. This would provide yet another source of pricing pressure in the near term. If vehicles like the one mentioned gained real traction, such pricing pressures would endure.

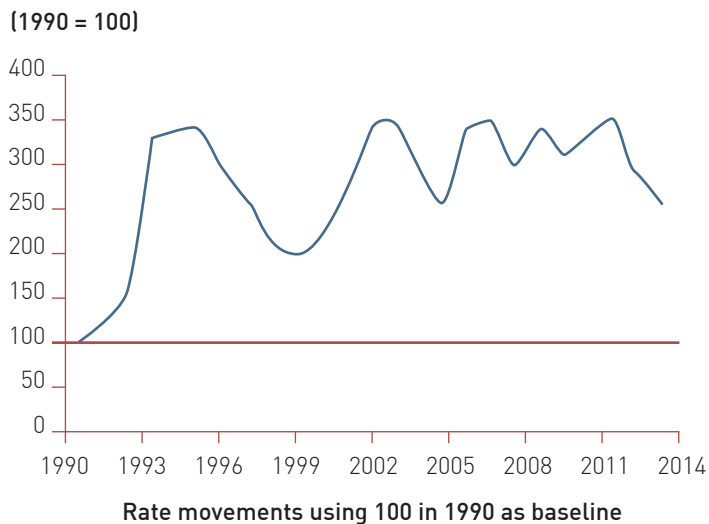
## Falling prices and price adequacy

While the observation of pricing movements is important, it is also necessary to consider pricing adequacy. Figure 2 highlights the rate change for loss free US property catastrophe business renewed at the June-July renewals. A reduction in insured loss activity saw prices change from increases up to 15% in 2011 to decreases of up to 25% in 2014. As a result, rates are at their lowest level since 2005, prior to Hurricanes Katrina, Rita and Wilma (KRW) hitting the US that year (see Figure 3).

**Figure 2: Renewal Pricing Trends.**  
US Property Catastrophe - Loss Free.  
Source: Company and broker reports.



**Figure 3: US Property Catastrophe Trends.**  
Source: Willis Re.



Eyjafjallajökull volcanic eruption in 2010. Iceland © J. Helgason / Shutterstock.com





Many reinsurers publish data on how they view the adequacy of pricing across major classes. Indicators usually assess adequacy on an economic basis, looking to achieve a rate of return above a benchmark level that is often the company's cost of capital. For example, recent commentary from reinsurers following the mid-year 2014 renewals have indicated that market pricing for property catastrophe risk has dropped into the high-single digit expected returns, a level which many market players consider inadequate given the risk and volatility of catastrophes.

The differing hurdle rates and variations in how individual reinsurers classify business classes dilutes comparison with peers, although a review of the data that has been published during 2014 by certain European reinsurers indicates that they continue to view US property catastrophe, at the highest class level, as being profitable. This view is independently supported by long-term pricing indexes that suggest that on a historical basis, prices remain high despite the sharp falls reported in the last two years.



**As property catastrophe continues to soften, traditional capital is likely to be redirected to lines seen as providing greater pricing adequacy, such as casualty**

**Market pricing for property catastrophe risk has dropped in 2014 into a level which many market players consider inadequate given the risk and volatility of catastrophes**



### **Three major risks to be faced by reinsurers during 2015**

#### **1. Deterioration of pricing adequacy and terms and conditions**

In the absence of a major loss event, pricing and terms and conditions for the majority of business lines are expected to deteriorate during 2015, increasing earnings pressure across the sector. However, the price adequacy of written business, which usually considers a rate of return above a company's cost of capital, is expected to remain positive for most classes. The ultimate outcome of renewals will be partly influenced by

the volume of underwriting capacity that is redeployed by reinsurers as they reduce exposure to certain North American classes. Many loss-free casualty reinsurance rates have softened through 2014 and this could extend into 2015. This pressure is being driven in part by increased competitiveness in the casualty market as more reinsurers look to non-catastrophe lines for profit. The profit margins of casualty classes are viewed as increasingly attractive by many reinsurers, in contrast to property lines. The fundamental difference between property and casualty risks, including longer-tail liabilities for the latter, are viewed as a hurdle for reinsurers that would otherwise be new entrants into the



casualty market. The growth of alternative capital within the casualty sector is also expected to be slower than the property market, reflecting reduced investor appetite for longer duration risks that are less easily modelled.

## **2. Search for higher yields increases risk as low returns persist**

The persistence of low investment yields increases the risk of the reinsurance sector being exposed to adverse investor behaviour, driven by a search for higher yields. Increasing the risk weighting of assets held within an investment portfolio, in a search of

higher yield, is an option available to all (re) insurers. Unique to the reinsurance sector are the adverse consequences of capital flowing in as external investors, including pension and hedge funds, search for yield by investing in alternative reinsurance products such as catastrophe bonds.

The ingress of alternative capital poses a greater long-term threat to the reinsurance sector because of the potentially permanent erosion of profit margins on historically profitable products. There is a growing acceptance within the industry that a significant proportion of these funds will have a permanent presence within the reinsurance

**Unique to the reinsurance sector are the adverse consequences of capital flowing in as external investors, including pension and hedge funds, search for yield by investing in alternative reinsurance products such as catastrophe bonds**

sector, due to the portfolio diversification that catastrophe risk provides for investors.

Low interest rates will exert earnings pressure for all reinsurers during 2015. While long-term interest rates for several developed countries, including the US and UK, are forecast to rise next year, their absolute level is forecast to remain below the historical long-term average. Subsequently, reinvestment rates for reinsurers with longer duration fixed income portfolios are likely to be lower than for maturing instruments.

The possibility of protracted low investment yields is unlikely to result in reinsurers deviating from their core investment strategies. These include maintaining sufficient liquidity to meet and settle liabilities in a timely manner, and avoidance of excessive balance sheet volatility. The investment risk profile of a majority of reinsurance companies remains conservative, with fixed-income bonds representing the main asset class. Within this category, there has been a gradual shift away from government to corporate instruments, partly driven by a more stable and improving economy but also in search of higher returns.

While currently limited in scope, the (re) emergence of hedge-fund sponsored reinsurers employing an alternative investment strategy is another sign of some capital providers addressing the limited yield on traditional investments. The use of targeted excess investment returns to provide a pricing advantage can also be a source of soft market pressure if such vehicles gain traction.

### **3. Structural change threatens to weaken competitive position**

It remains unclear exactly how the growth of alternative capital and changes in reinsurance purchasing habits will affect the sector, although the impact is likely to be both negative and enduring. These two trends represent a major challenge for traditional reinsurers, as each is expected to reduce demand for traditional reinsurance products. Of the two, the growth in alternative capital is expected to exert the greatest influence on



the future competitive position of traditional reinsurers.

The emergence of the alternative reinsurance market is on balance a negative for reinsurers' credit ratings and financial strength in the current competitive market. While there are some positives for individual companies (ie, added fee income), the added competition and increased supply of capacity from the capital markets has served to meaningfully dampen reinsurance pricing and resulted in a deteriorating profitability profile for the reinsurance sector.

The erosion of traditional reinsurers' profit margins reduces their ability to absorb underwriting volatility, should it occur. Reinsurers that are especially vulnerable to



**Changes in reinsurance buying habits will likely reduce the overall amount of reinsurance protection purchased, particularly by larger primary cedents**

the current market conditions are those with a greater exposure to property catastrophe risks, as third-party capital continues to focus on model-driven property risks, and, in particular, US peak zone risk, which historically has the highest margins.

Changes in reinsurance buying habits will likely reduce the overall amount of reinsurance protection purchased, particularly by larger primary cedents. Primary insurers are retaining more risk with favourable capital levels to boost returns in the face of low investment yields. It is unclear to what extent this will prove to be a structural or cyclical change.

Historically, primary companies have increased reinsurance purchasing as

prices fall. But large cedents increasingly transact business in a centralised way and on a global scale. Using increased data and more readily available sophisticated modelling, these companies bundle risks into multiple territory programmes, with peak risks then being placed on an excess of loss basis. Subsequently, programmes are better diversified, which, together with an increased scale, allow the cedent to retain a greater proportion of their risk than smaller cedents can.

Decreased demand for reinsurance is also driven by recent benign underlying loss-costs trends that have allowed insurers to be more comfortable accepting risk and volatility. These trends could easily reverse, as an unexpected shift in inflation or interest rates

would specifically influence insurance claims' costs, such as medical costs, litigation settlements or social inflation. Under such a more cyclical change, demand for risk protection by primary insurers could increase and shift business back to reinsurers.

### **Picking winners is not straightforward**

Identifying winners and losers is not straightforward as the effects of falling premium prices and weakening terms and conditions can take years rather than months to depress an individual company's financial strength and be reflected in reported financial results. This point is emphasised by current results that present a solid financial picture, underscored by strong capitalisation and near record profitability. Small mono-line property catastrophe reinsurers, without other distinguishing attributes, are viewed as the most vulnerable to a protracted period of market price softening. This is because of a more limited ability to set and control contract terms and achieve controlled diversification into less exposed lines.

Predictive surveillance can be enhanced with the use of a qualitative assessment that seeks to determine an individual company's vulnerability to continued price softening and the structural changes being observed. A good understanding of a company's position within the wider market, as well as an assessment of its strategy, can provide a useful insight into how the fortunes of one may pan out versus a competitor.

Typical qualitative early warning indicators include: significant diversification or shifts into new business or geographic markets, where the company may lack strong knowledge; and above market growth, which may increase a reinsurer's exposure to under-priced business or indicate a lack of underwriting discipline. Another signal is that of a reinsurer writing business that falls significantly below the reinsurer's technical price floor, to maintain market share, but this last factor is very difficult to detect.

**It is possible to identify two separate and distinct reinsurance groups: mono-line reinsurers whose strategy is to write business that is technical but analysable, usually through the use of models, and traditional portfolio reinsurers that write a more diversified book of business with a longer-term profitability horizon**



### **Reinsurer strategy: mono-line and portfolio reinsurers**

The universe of global reinsurers is diverse, with companies varying in size, geographic scale, product diversity and risk appetite. Corporate strategy is key in determining each of these variables. From the biggest picture perspective, it is possible to identify two separate and distinct groups.

The first is mono-line reinsurers whose strategy is to write business that is technical but analysable, usually through the use of



Hurricane Arthur seen from the International Space Station. July 2014 © NASA / Jeff Schmaltz

**Identifying winners and losers is not straightforward as the effects of falling premium prices and weakening terms and conditions can take years rather than months to depress an individual company's financial strength and be reflected in reported financial results**

models. The profitability of each individual transaction is a key determinant to writing the business, meaning that hard market conditions favour this group. US catastrophe programmes represent one such area where companies of this type would focus and operate. During soft market conditions, sustaining profits can be challenging, with a company's viability requiring a disciplined approach to cycle management, and an ability to vary the amount of capital within the company in tune with the cycle. The second group comprises traditional portfolio reinsurers that write a more

diversified book of business with a longer-term profitability horizon. Profitability is assessed across a portfolio, where a lower return for one transaction may be offset by higher profitability from another. Companies typically have the scale and scope to write globally placed premium, seeking to optimise capital allocation through diversity. In contrast with the first group, these reinsurers seek to prioritise portfolio management and can move in and out of lines of business. They also can accept some degree of under-pricing in certain lines if offset by profits in others, as long

as not taken to an extreme. Nonetheless, these companies can still face an erosion of earnings, if the soft cycle is prolonged and broadens into numerous lines.

### Scale and diversity suggest greater financial resilience

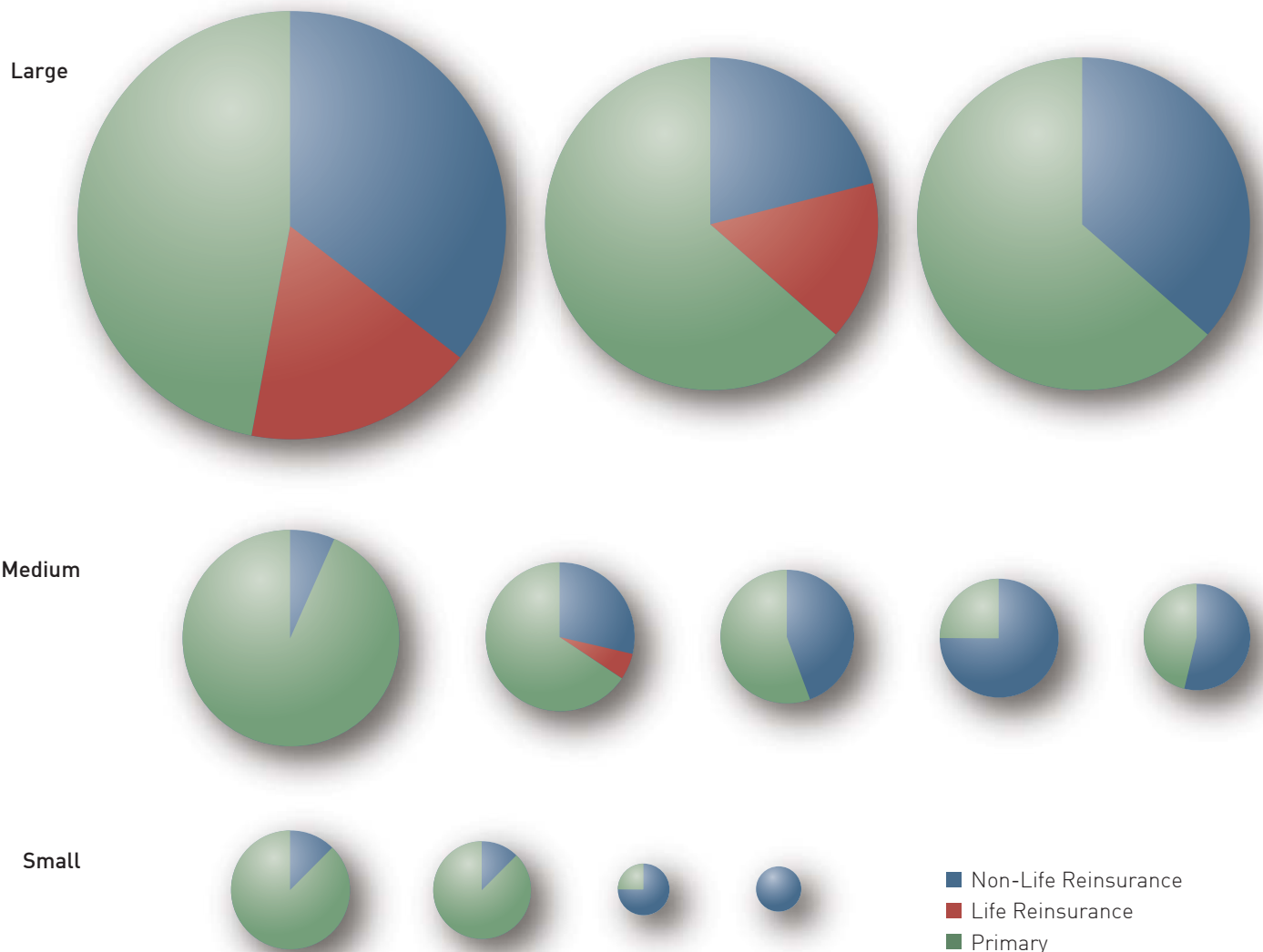
The concept of tiering, which places individual reinsurers in a specific tier based on one or several metrics, has been used by some market commentators to support views on how the sector may evolve. Usually, those companies that appear in the top tier are the largest and arguably

most diversified players, who are viewed as being the best placed to withstand and potentially profit from current market forces.

Figure 4 provides an illustrative example of the tiering concept, in this case with reinsurers being placed into their respective Market Position and Size/Scale category, as assigned by Fitch. They are size-ranked based on total net written premiums (including primary premiums where applicable), given the current focus on declining premium prices. Comparing geographic and portfolio diversity is made more challenging given the lack of comparability between individual companies reporting.

**Figure 4: Reinsurers' market Position and Size/Scale\***

Source: Fitch.



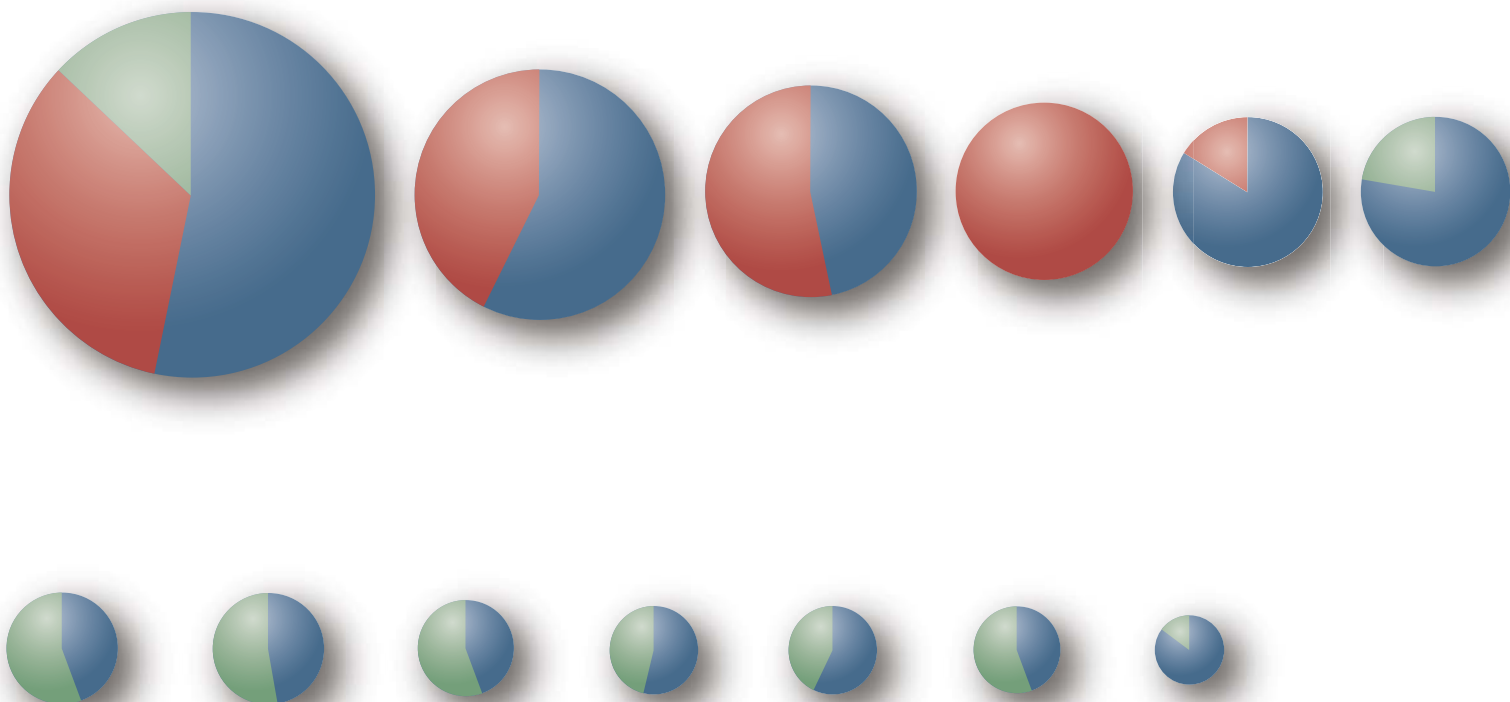


## Value provision and realisation are less size-dependent

Scale and diversity are viewed as two factors that can allow a reinsurer to be resilient when market conditions grow more adverse. But the provision and realisation of value within the reinsurance purchasing chain is also considered as an important key determinant of an individual reinsurer's continued success. Value can be derived from factors including specialist product knowledge and technical expertise, offerings that are less size-dependent but often are sought-after commodities for some reinsurance buyers, whether their requirements are for traditional or alternative reinsurance products.

## Fitch's 2015 rating outlook

Fitch maintains a stable outlook for the ratings of the reinsurance sector. We believe most reinsurers will maintain both profitability and balance sheet strength over the next 12-18 months commensurate with current ratings. There is an increasing risk, however, that a select group of smaller reinsurers, especially those with more heavily exposed property books, could experience downgrades and/or movements to Negative Outlooks. In aggregate, such negative actions could be offset by upgrades of a select group of larger, more diverse players seen as most resilient to market conditions.



\*Described within Reinsurance (Global) Sector Credit Factors special report.

Note: Bubble size denotes total NWP (Net Written Premium) including Non-Life reinsurance, Life reinsurance and Primary business, where applicable. Primary includes all business not designated as reinsurance segment.

# interview with

## Montserrat Arnau

Deputy Technical and Pensions Head  
Endesa  
Madrid - Spain



Madrid-born Montserrat Arnau studied Business and Economics Complutense University and in 1992, she graduated with a specialty in actuarial sciences. Her entire career has been in insurance. She started out her professional life in 1992 when she joined the technical department of personal insurance at Centro Asegurador in an actuarial capacity. In the year 2000 she became head of the department, gaining membership of the insurer's management committee. Two years later, she signed up with Enel Group as a deputy general manager, a position she held for three years.

In late 2005 she started working as an external social security advisor for Endesa and it was in 2007 that she was appointed deputy technical and pensions head at the company. She went on to become secretary of the Endesa Group pension scheme in 2012. In the international sphere, she is currently global head of Endesa's Insurance & Health programme.

In parallel to her main occupation, she also works with the insurance broker G. Baylín Correduría de Seguros on numerous pension commitment externalisation programmes, which involves assessing and negotiating offers with the leading insurance companies operating in the field of social benefits provision.

She has thus played a key role in the externalisation programmes implemented at Endesa, Nissan and Aceralia, to name but a few of her largest and most salient projects in this area. All these endeavours required her to work closely with the management of the respective groups to establish terms of insurance, value existing commitments, select insurers and negotiate the policies issued.

*«Insurers and pension scheme managers will have to face the challenge of developing products that are attractive to their customers and deliver added value compared with other savings instruments»*

The actuarial profession is more eventful than ever. Longer life expectancy may lead to severe imbalances in the Spanish state pension system in the long term. This state of affairs calls for maximum stimulation of creativity, innovation and competitiveness in the profession to develop products with the power to captivate consumers. Stressing the crucial importance of corporate benefit schemes, the actuarial expert Montserrat Arnau discusses these and other matters in this interview, including the future, savings, taxation and retirement.

**How would you describe the current state of supplementary social benefits in Spain?**

The development of supplementary schemes in Spain has been significantly constrained by highly protective state benefits. Nonetheless, the ongoing reforms of the state pension system will most likely change the way the public view this issue, and this will help both corporate and individual supplementary schemes to get off the ground in the medium term.

**Is this a growing segment? What are the boons of supplementary social security?**

Again, it appears certain that Spanish families will eventually need more instruments to channel their long-term savings efficiently. Insurers and pension scheme managers will have to face the challenge of developing products that are attractive to their customers and deliver added value compared with non specific savings and accumulation products.

**Supplementary benefit schemes enable companies to take on pension commitments towards their employees in similar conditions to a pension plan or Life insurance**



Endesa Headquarters in Madrid, Spain

Another key aspect is whether we will see tax incentives introduced in the next few years to encourage long-term saving, and to what extent those incentives will specifically apply to supplementary benefit schemes.

**Focusing on company benefit schemes, what advantages do they bring employees apart from favourable tax treatment in some cases?**

Many of these products enable employees to defer reception of a portion of their salary, often with the option to receive their benefits

as a regular income when they become entitled to it. They adapt to the recipient's needs at the time of reception. So whether or not they provide tax relief, company benefit schemes enable employees to plan the time at which they receive a part of their income in the way that is most financially and fiscally advantageous to them.

Moreover, from a strictly financial perspective, businesses are in a position to secure significantly better financial and technical conditions than individual employees, simply as a result of scale economies.



## Endesa, leader of the Spanish electricity industry

Endesa came into being on 18 November 1944 when construction of the Compostilla power station began in Ponferrada, in the northwestern Spanish province of Leon. Seventy years on, Endesa is the leading player in the Spanish power industry and the largest private electricity multinational in Latin America. Its almost 23,000 employees provide service to more than 25 million customers.

The Enel group, which owns a 92.06% of Endesa, is the largest electricity company in Italy. Enel also owns most of Italy's electricity distribution network and it is an active operator in the production, distribution and sale of electric power and gas.



**The Spanish Insurers' Association (UNESPA) claims that retirement savings do not enjoy a particularly favourable tax treatment, and is calling on the government to encourage supplementary benefit schemes as part of its tax reform. What is your take on this matter?**

The most predictable consequence of Spain's demographics and growing life expectancy is overall ageing of the population. In the long term, this may lead to major imbalances in the state pension system. Encouraging long-term saving

should be a priority for all governments, now and in years to come. Tax incentives are an efficient way to solve this problem, but they are not the only way.

**This year seems to have bucked the trend of previous years, where retirement was not a main concern for Spanish people according to the CIS<sup>1</sup>. Polls carried out in 2014 show that 50% of the population are concerned about their future. What do you think has caused this shift?**

There is probably no single explanation, but it is reasonable to believe that the pension system reform of the last few years may have played a large role in this change. In addition to that, the economic crisis compounds feelings of uncertainty within society and consequently, concerns about the future.

**Encouraging long-term saving should be a priority for all governments, now and in years to come. Tax incentives are an efficient way to solve this problem, but they are not the only way**

<sup>1</sup> CIS: Centro de Investigaciones Sociológicas.



**Showing employees on a regular basis how their income will be reduced when they retire is a powerful way to heighten awareness in society**

Starting in October 2004, the Spanish Social Security will be sending a pension estimate at age 65 to all working people over 50 years old. Private companies will also eventually be required to provide this information to their employees. What is your view on this initiative? Will it help to drive benefit schemes?

As I said earlier, tax incentives are not the only way to encourage long-term saving. Showing individual employees on a regular basis how their income will actually be reduced when they retire is also a powerful way to heighten awareness in society. This will increase the need to build sufficient



savings to supplement state benefits receivable in the future.

**What is your view on the Spanish saving culture?**

The development of saving in Spain has been heavily influenced by two circumstances: a state pension system that provides a high degree of cover, and families' traditional use of their main residence as their principal instrument for asset accumulation.

It may be that Mediterranean societies are less given to save and this has contributed to the smaller weight of long-term savings in the GDPs of those countries. But where



Spain is concerned, I think it would be difficult to establish whether that explains or is actually a consequence of the two facts I mentioned.

**What role are employee benefit schemes currently playing in businesses, including Endesa in particular?**

In my opinion, at a time of severe economic challenges where all reports point to a bleak future for state pensions and families losing saving capacity, company benefit schemes have become extremely valuable to employees in firms with a strong history of providing them.

**What is supplementary social benefit provision?**

The latest initiatives launched by the Spanish government to reform the state pension system have reopened the debate on the sustainability of state pensions and whether retirement savings in the Spanish private sector (i.e. families and businesses) have sufficient bulk to compensate a potential future shortfall in state benefits.

Supplementary benefit provision is channelled through a number of specific instruments (essentially, pension schemes and Life insurance) which supplement state-provided retirement, surviving spouse, orphan, disability and dependant benefits.

These schemes are available to individuals and companies, which enrol their employees either as part of a collective bargaining process or as a welfare perk which businesses voluntarily provide as a way to increase staff motivation and retention.

Supplementary schemes still display a limited degree of development in Spanish companies compared with other western countries, but some of the largest firms have traditionally operated strong social protection systems to supplement their employees' state benefits. Thus, Endesa has a dedicated social benefits department within its directorate-general for human resources.

However, companies where supplementary benefit schemes are weak or non-existent are finding it harder to implement new systems or to improve the ones in place, because they have had to prioritise maintaining their employees' immediate purchasing power or even their level of employment over other incentives.

**What do Endesa employees across the world think about these solutions, which are offered by Human Resources? Indeed, have any studies been performed to gauge their degree of satisfaction?**

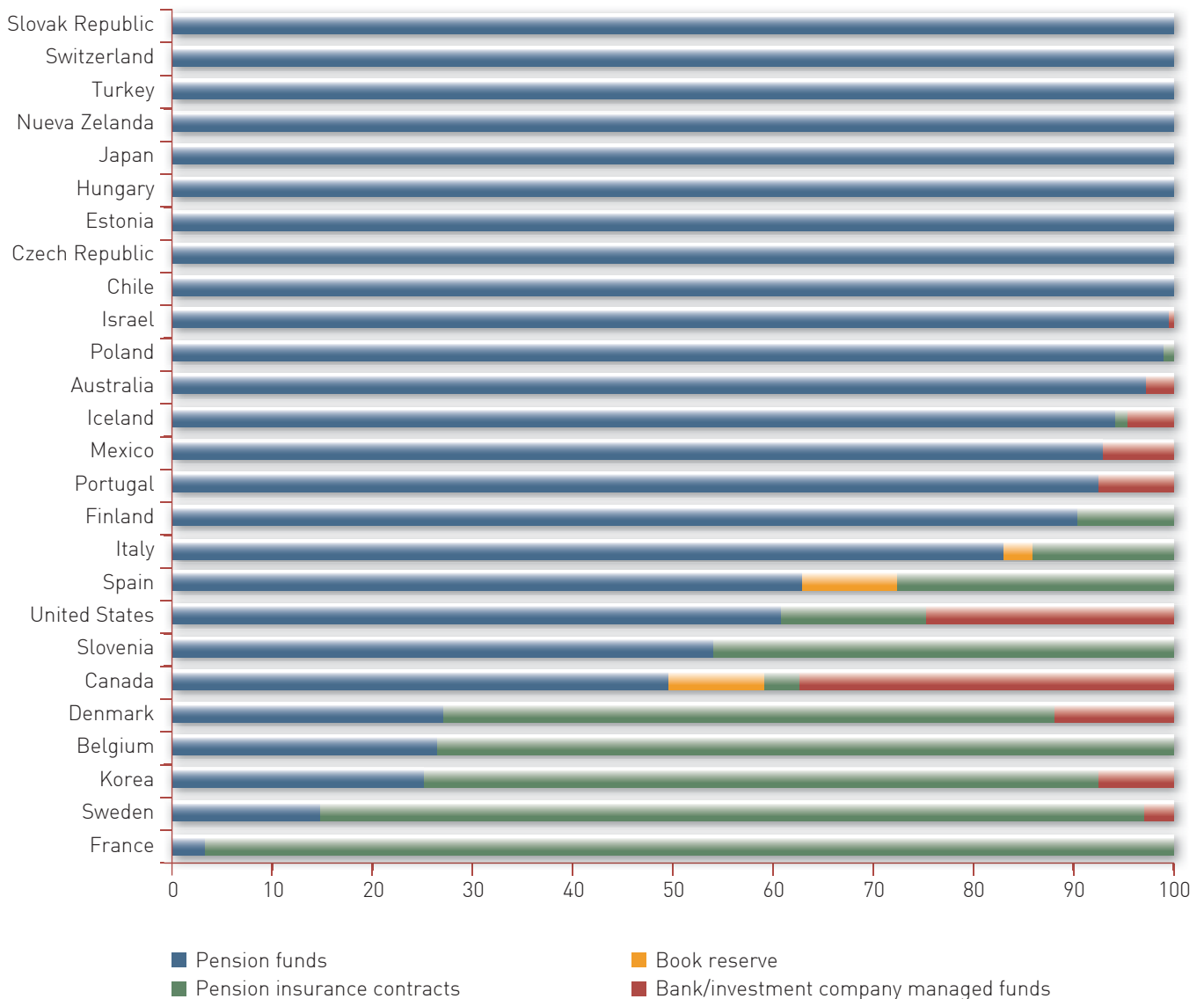
Endesa is in fact the result of takeovers, acquisitions and mergers with companies operating a range of widely differing benefit schemes. In all these processes, Endesa has consistently followed a policy of preserving employees' vested benefit rights under the

same terms as in their companies of origin. In Spain, which is the most complex example in this regard, respecting those rights meant accommodating more than a hundred separate groups, each with its own benefits and cover, among a host of other differences. For a good number of years, all we were able to do was examine, organise, implement and optimise all those rights. Only once that was completed did it become possible to undertake other initiatives, such

**Private pension assets by type of financing vehicle in selected OECD countries, 2011.**

As a percentage of total assets.

Source: OECD, Global Pension Statistics (<http://www.oecd.org/pensions/public-pensions/OECDPensionsAtAGlance2013.pdf>).





as developing what we call a social benefit register. The first social benefit register was circulated to all our employees in 2010. It provides a personalised, quantitative overview of each beneficiary's rights with explanatory notes on aspects including the types of instruments where they are incorporated.

We have also had a number of meetings with the different groups to provide detailed explanations on their benefits rights, how they are implemented, when they are entitled to claim them and other important aspects. All these initiatives have been very well received and appreciated by our employees. Nonetheless, there is still important communication work to be done to highlight the value of the benefit schemes we are fortunate enough to have in companies like Endesa.

**What aspects do you think Endesa takes into consideration when purchasing these products from an insurance company?**

The key priorities are, in this order: solvency, confidence and service.

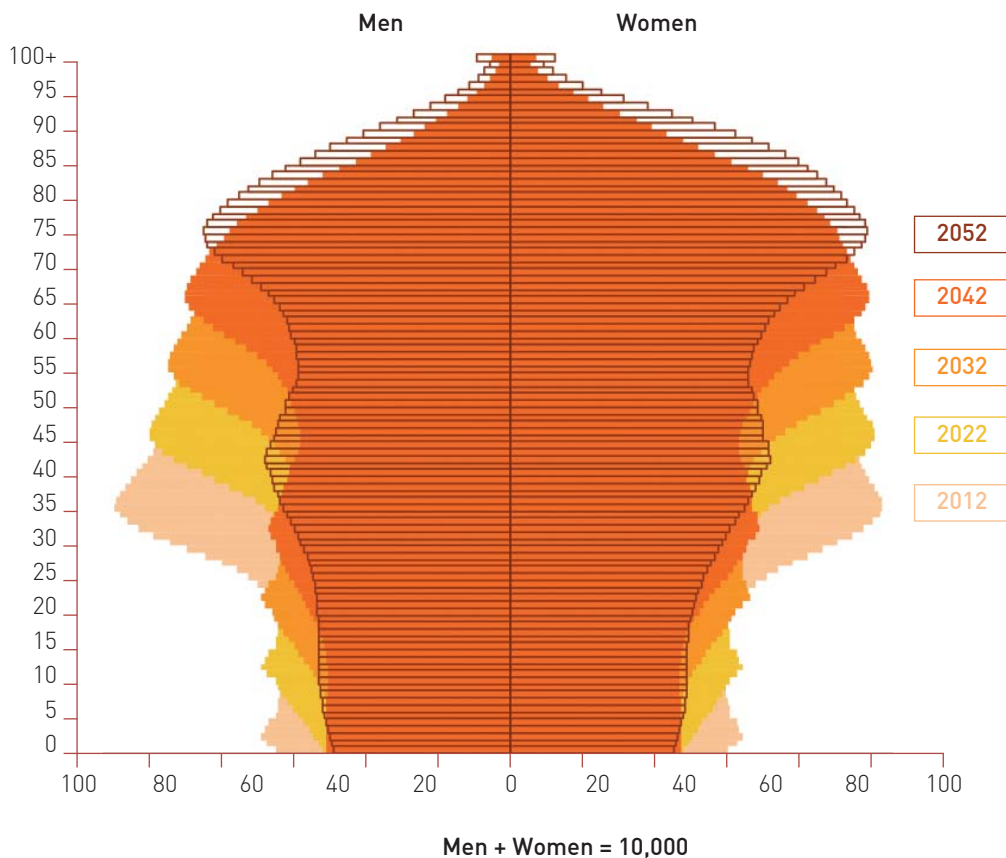
**In what ways does pension reform affect supplementary benefit provision? How is Endesa adapting its future plans to coming changes in state pensions? How might those changes affect the private savings sector?**

Pension reform can only have one effect, which is to strengthen the role of supplementary social security, including company benefit schemes and schemes based on family savings. Initiatives need to be taken to heighten awareness of the importance of supplementary schemes among the working population - particularly

**Insurers and pension scheme managers will have to face the challenge of developing products that are attractive to their customers and deliver added value compared with non specific savings and accumulation products**

**Population pyramids of Spain.**

Source: INE (<http://www.ine.es/prensa/np744.pdf>)



**The development of saving in Spain has been heavily influenced by two circumstances: a state pension system that provides a high degree of cover, and families' traditional use of their main residence as their principal instrument for asset accumulation**

among young people, who view death, disability, dependency, retirement and the needs these events entail as something quite far off.

As I mentioned before, I believe people are generally unaware of what supplementary benefit schemes involve, what purpose they serve, what types of schemes are available and how to become a member. At Endesa we intend to keep working to change this so that employees are able to plan their own needs. This involves ensuring they are fully acquainted with the benefits they will receive in the event of any contingency and what personal savings will provide.

**It has recently been published that it will become possible to surrender pension funds after ten years. Does this also apply to employees in companies like your own?**

This is a new regulation about which we already have some information, but which will probably be further debated before it is finally approved. Still, I think not enough time has passed to be able to tell how the different industries will react to this initiative.

Be that as it may, Endesa has always asserted the belief -both for business and

for social reasons- that company benefit schemes must fulfil the purpose for which they were created, i.e. to protect employees in the events of death and disability, as well as after retirement. Accordingly, we are not inclined to introduce instruments enabling early release outside of those contingencies.

**Is employee mobility giving rise to new benefit schemes? Do expatriates take their vested rights and commitments with them or are they compensated in a different way?**

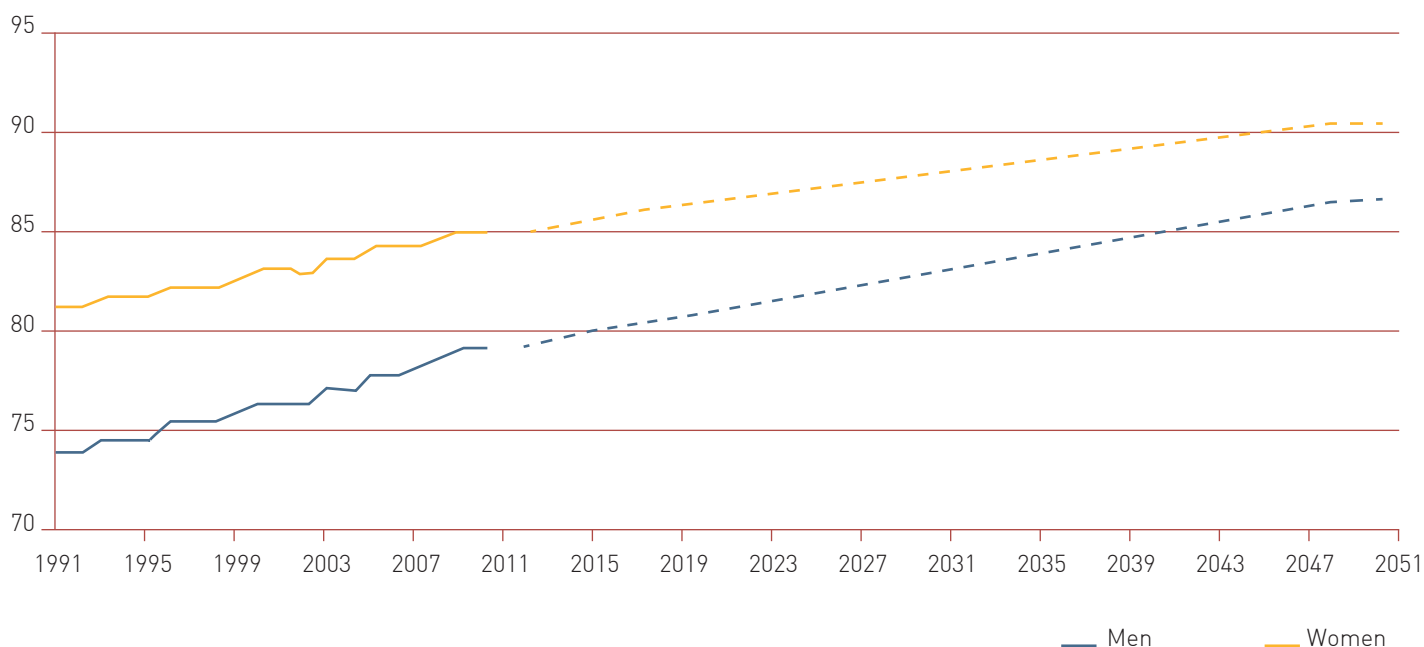
Endesa expatriates take their vested benefits and commitments with them when they travel, with the following special rules:

- ▶ All employees have the same health care cover regardless of their original rights, via a refund policy with global cover.
- ▶ Death and disability covers are subject to certain minimum risk benefits for all expatriates, regardless of the cover they are entitled to according to their original rights.

**Within Endesa, which are the most attractive company scheme models internationally? Which are the leading countries and why?**

## Life expectancy at birth.

Source: INE



I think the supplementary benefit schemes available in each individual country are closely tied up with their culture and tradition in the area of social security and also with local market practices.

That being so, Spain has the most developed company benefit system because our origin lies in a large state-owned company, the INI<sup>2</sup>, which created the companies that have traditionally enjoyed the strongest benefit schemes.

**Some countries require employers to enter their employees into a pension scheme and then allow them to decide whether they want to pay into it or not. Would that model be workable in Spain?**

It could be a starting point in my opinion. But there is a lot of work to be done to stimulate saving and make people aware that they need supplementary social security before such initiatives can have a real impact on the amount employees pay into supplementary schemes.

<sup>2</sup> INI: Instituto Nacional de Industria.



# interview with

## Mateo Valero

Director  
Barcelona Supercomputing Center – Centro Nacional  
de Supercomputación (BSC-CNS)  
Barcelona - Spain



Born in Alfamen (Zaragoza, Spain), Mateo Valero already excelled at maths at a very young age. He completed a degree in telecommunications engineering in Madrid in 1974 and went on to study a PhD at the Polytechnic University of Catalonia (UPC), where he has been professor of Computer Architecture since 1983.

Mateo's «school» of hardware design has pioneered multi-processor system development in Spain, and he has received numerous national and international accolades, including the Eckert-Mauchly Award in 2007 -which is regarded as the Nobel Prize of computers- and the Association of Computing Machinery's Distinguished Service Award in 2012.

The year 1984 marked a turning point for the UPC, as it was then that the Computer Science department acquired a 64-processor transputer. This device can be used to develop software for parallel machines working with multiple processors, such as supercomputers.

This research has been carried out not only at the UPC but also at other facilities that Mateo has helped to create, including the European Parallelism Centre in Barcelona (CEPBA) and the Barcelona Supercomputing Centre (BSC), establishing respectively in 1995 and 2005. The BSC, which coordinates the Spanish Supercomputing Network, has led the development of supercomputing in Spain. It combines supercomputing services to scientists across the country and Europe with research in the fields of computer science and the application of parallel computing to other disciplines, such as bioinformatics, engineering and earth sciences.

Mateo has been ranked among the 25 most influential Spanish researchers every year from 2007 to 2014, as listed by El Mundo newspaper.

[www.bsc.es/cv-mateo](http://www.bsc.es/cv-mateo)

# «Nobody expected Spain to build such a powerful machine»

Mateo Varela is the director of the BSC, Spain's leading institution in the area of supercomputing, which specializes in high performance computing (HPC). His job involves coordinating 300 experts and R&D professionals organized into four main research fields: Computer Science, Life Science, Earth Science and Computer Applications in Science and Engineering. The BSC was established with the declared purpose to develop and manage technology that facilitates scientific progress. Since its inception, it has also engaged in partnerships with industry and the private sector.

## **How did the Barcelona Supercomputing Center project come into being? Who is behind it? What similar initiatives have been undertaken in other countries?**

It was started by a group of passionate computer architects from the Catalonia Polytechnic University School of Computer Science, including myself, who began researching parallel computing in the early 1980s. By 1990 we had set up the first parallel architecture research centre, the CEPBA (Barcelona Parallelism Centre), together with the central government department and the Catalan regional government. This was joined by another centre in 1995, the CIRI (CEPBA-IBM Research Institute), where IBM became a partner.

After almost 15 years of research and experiments with different architectures and programming models, in 2004 we had a very ambitious project, a dream actually: to build and

operate one of the fastest supercomputers in the world, something that required government help and support. That was how the Barcelona Supercomputing Center was created. The whole world was staggered because our supercomputer became number one in Europe and number four globally. Nobody expected Spain to build such a powerful machine. When we did, that propelled us straight into the world's first division of supercomputing. And the quality of our research projects has made sure we stayed there.

## **What is the BSC's basic infrastructure?**

In terms of infrastructure -meaning machinery- the MareNostrum supercomputer remains our central pillar. Its third version was installed last year. Our data repositories are also currently a key element of machinery. But the BSC would not be the BSC if, in addition to infrastructure, it did not have a

**Nobody expected Spain to build such a powerful machine. When we did, that propelled us straight into the world's first division of supercomputing**

staff of more than 300 researchers from a range of disciplines, who use supercomputing to do science and generate wealth.

**What are the main features of MareNostrum that enable it to remain one of the world's top-ranking supercomputers?**

MareNostrum has nearly 50,000 processors, 96 terabytes of primary storage and 2 petabytes of hard disk storage space. The key to its operation lies in making all these elements work together and communicate quickly between them. To do that, we have an optic fibre network almost 80 km in length that links all motherboards and components together.

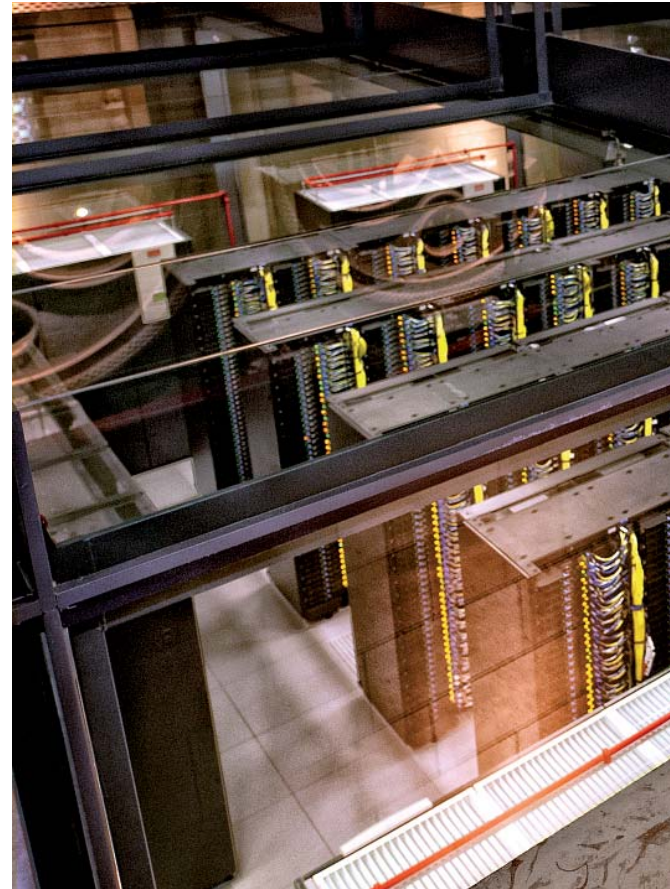
**If we had the fastest supercomputer in the world but it was unable to meet the needs of our users, we would not be doing our job properly, which is to serve science**

**In 2004, MareNostrum reached number four among the world's 500 top supercomputers, and currently it is one of the leading 20 or 30. What does it take to rank with the top few?**

Basically, it has to do with money. But, as with other things in life, money is not everything there is to supercomputing. MareNostrum3 ranked 29<sup>th</sup> in the world when it was installed. With the same investment, we could have built a higher-ranking supercomputer, possibly among the top 10. Supercomputers are ranked by running a very specific software called Linpack on them. The machine that runs it in less time is the fastest and given an accordingly higher ranking. But Linpack is very different from the programs researchers use. MareNostrum performs assignments for scientists across Europe, who work in widely different disciplines and organisations. This means we need to have what we call a «general architecture», in other words a supercomputer that can cater for users with a wide variety of software to run. If we had the fastest supercomputer in the world but it was unable to meet the needs of our users, we would not be doing our job properly, which is to serve science.

**All the experts who control and manage MareNostrum are part of the Barcelona Supercomputing Center. This means you have a vast infrastructure at your disposal. Are you also using outsourced cloud storage or cloud computing systems?**

No. The Barcelona Supercomputing Center has its own data storage system. In fact, we provide data services to other research centres and international projects.



**Talking about cloud computing, how secure is this technology?**

The cloud has some obvious benefits. For instance, it enables making continuous backups of your files, which you can then access from any computer or mobile device. It also makes it very easy to share content with other users and to expand your computing power. Some aspects are really good. But it is also the case that privacy is never one hundred per cent assured in the cloud. So you need to look at your individual needs and decide whether you want to have a cloud backup of certain files or whether you prefer to have a one hundred per cent guarantee of their privacy.

**In what way is the BSC dependent on its optic fibre infrastructure?**

Internally, optic fibre is what enables fast communications between a supercomputer's components so that they can all work together. Externally, it makes it possible to share data remotely, and allows an infrastructure's users to have access to it. Universities and research institutions are interconnected by optic fibre networks.



**Given the importance of this supercomputer, maximum security measures are needed to protect it from any acts of sabotage, attacks and natural disasters. In addition to these, are there any specific contingency plans in place against potential threats?**

We have security systems to prevent vandalism and attacks against the infrastructure, surveillance to prevent intrusions and misuse, and agreements with other institutions to continue providing certain services in disaster scenarios.

**IBM was MareNostrum's manufacturer of choice from the start, and the BSC continues to use IBM's technology. What is the nature of BSC's relation with IBM in today's innovative, highly sophisticated environment?**

IBM built the supercomputer and Intel provided the microchips. We have worked on joint research projects with both these companies since the early days of the BSC (and also with Microsoft, Nvidia, Repsol, Iberdrola, and others). Developing new wealth-creating technologies in partnership with business entities is a defining trait of the BSC. Our

partnership with IBM goes back to 1998. We always have joint research projects ongoing. At some points we have had up to 40 researchers working together.

**Where the operating system is concerned, you seem to favour Linux, which is free software. What is the reason for this choice? Could you mention a few of its benefits?**

MareNostrum was the first supercomputer to use Linux. For us, the chief benefit of using it is that we can provide service to the largest number of users.

**If we were to connect thousands of computers over the internet, we would have the same number of processors and the same storage capacity as MareNostrum. Therefore, by making them all work together, we would be able to process the same number of operations as MareNostrum. To what extent is this an accurate depiction of reality?**

Fairly accurate, except for the fact that the run time of the operations would be much longer. Supercomputers have fast connections linking all their components together, and that is a crucial aspect. The internet and home connections have a much lower latency, so they simply cannot provide that speed of execution.

It is important to bear in mind that processors are constantly sending and receiving data from one another when they work together. Slowing down those transmissions significantly lengthens run time because processors have to remain idle until they receive the input for the next calculation.

**Do you think it will become possible to tap into the power of the thousands of processors inside mobile phones?**

Mobile telephone technology is certainly appealing. It is more energy-efficient and less costly. We are currently working on projects to gauge the extent to which it can be of value to build supercomputers in the future. Project Mont-Blanc, which is led by the BSC, is a good example. It has garnered a good deal of international interest.

**The MareNostrum is currently made up of several thousand processors, with a processing speed in excess of 1 petaflop/s,**

**So you need to look at your individual needs and decide whether you want to have a cloud backup of certain files or whether you prefer to have a one hundred per cent guarantee of their privacy**

**Making personalised medicine a reality is definitely the most exciting project. Doctors will no longer treat patients based on the names of the illnesses they suffer, but on the specific changes taking place in their bodies**

**i.e. more than a trillion operations per second. What kind of projects and domains are best suited to use its full potential?**

We aim to have a machine that caters efficiently to the needs of most users. That is why we chose SandyBridge chips to build our computer over others which may perform faster in certain tasks but are less efficient for other users. MareNostrum performs tasks from all fields of science, from biology to astrophysics and meteorology, as well as a broad range of engineering-related assignments.

**Which are the most innovative projects now ongoing in the medical area? When do you think they will be in actual use in public and private hospitals?**

Making personalised medicine a reality is definitely the most exciting project. Doctors will no longer treat patients based on the names of the illnesses they suffer, but on the specific changes taking place in their bodies. Cancer is the paradigm of this. Today we know there are as many different types of cancer as there are cancer patients. This realisation paves the way for the end of blanket treatments -which are highly aggressive and not always satisfactory-and the beginning of personalised treatments. This kind of medicine is largely based on genomic analysis and therefore heavily dependent on technology, including hardware and data processing. We are putting a lot of effort into this area and, as far as technology is concerned, I believe much of the road towards personalised medicine has already been covered.

**The genomic revolution has brought on an uncontrollable avalanche of biological data which is putting storage capacity to the test, despite recent advances. How has the ELIXIR programme structured European cooperation in this area? How does the BSC contribute to the project as a member of the consortium?**

We have the largest genotype and phenotype database in Europe (EL European Genome Archive, EGA) hosted at the BSC. That currently includes data from one hundred thousand patients, and it is expected to grow extremely rapidly over the coming years. Our role involves providing host services, some secure protocols and making sure scientists can access the databases quickly and securely.

**Turning to the issue of seafloor scanning for hydrocarbon exploration (the Repsol project), have any new reservoirs been identified in areas not previously considered likely to contain oil or gas?**

The aim of Project Kaleidoscope, which was carried out in partnership with Repsol, was to facilitate hydrocarbon exploration in particularly challenging areas, such as the Gulf of Mexico, where the earth's crust is separated from the sea water by salt layers up to two kilometres thick, posing a great hindrance to exploration operations. The technology we developed proved a success. It significantly improved the company's accuracy ratio, gave them a competitive edge, increased their operating profit and opened up new markets in countries that were previously closed to them. It was also a success for us. We are already working on a new, even more finely honed version, and we have already signed up other contacts. All this is proof of the BSC's interest in being a technology partner for the industry.

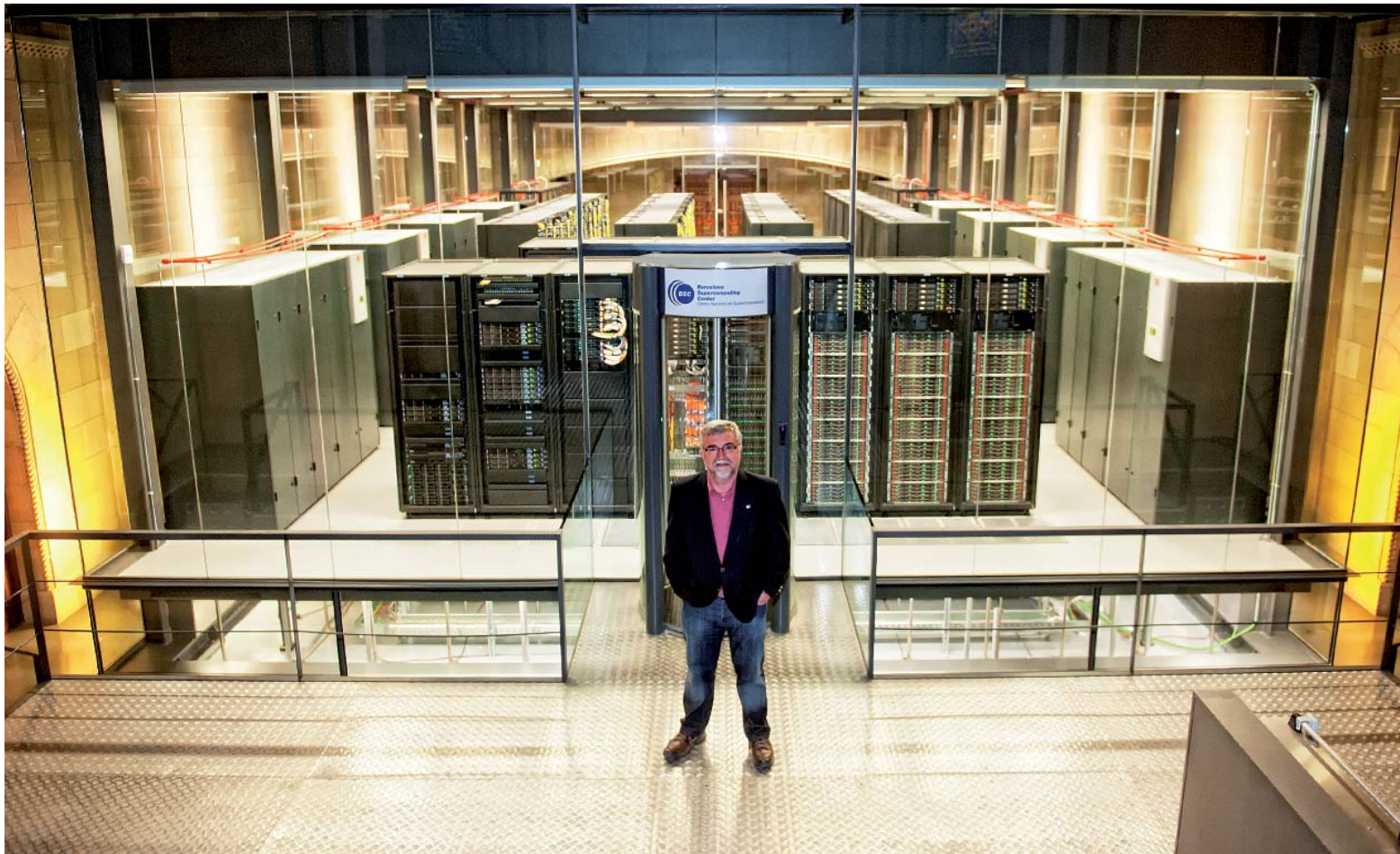
**Studying climate change involves using climate models and processing large volumes of data. What role has the BSC played in this major scientific challenge of the 21<sup>st</sup> century?**

We work with climate models of great complexity and we are world leaders in several fields of research - the study of desert sand movements, for instance. We have conducted studies of future climatic scenarios for government agencies. Unfortunately, the key to preventing climate change will not lie in scientific research, but in how resolved societies -and particularly governments- are to address the issue.

**Actuarial science, which is a vital part of the insurance industry, involves using observed and projected statistics to price a range of insurance products, including Life, Motor, Home and Health, to name but the most common categories. Have you ever considered working with the insurance and reinsurance industry?**

So far we have not had the opportunity to work with any companies in this area, though it is certainly something we would like to do. Insurance companies are obviously potential or actual users of supercomputing, to the extent





that large calculations help them foresee individual and collective risks, as well as the impact of disasters.

**Natural disaster models bring together actuaries, earth science specialists, mathematicians and finance experts in handling the stochastic models used to estimate the likelihood of earthquakes and tropical cyclones -to name the costliest- and their impact in terms of insurance and reinsurance. Do you work with any commercial modelling companies or international researchers in this area?**

We do work with businesses specialising in risk prediction. Specifically, we had a successful partnership with a consultancy firm called Amphos21. The project involved modelling what would become the first nuclear waste dump to be built in Europe -in Sweden, actually- to predict leaks over a time horizon of one hundred thousand million years. This is no doubt an interesting field of study, and one that requires supercomputing to ensure maximum

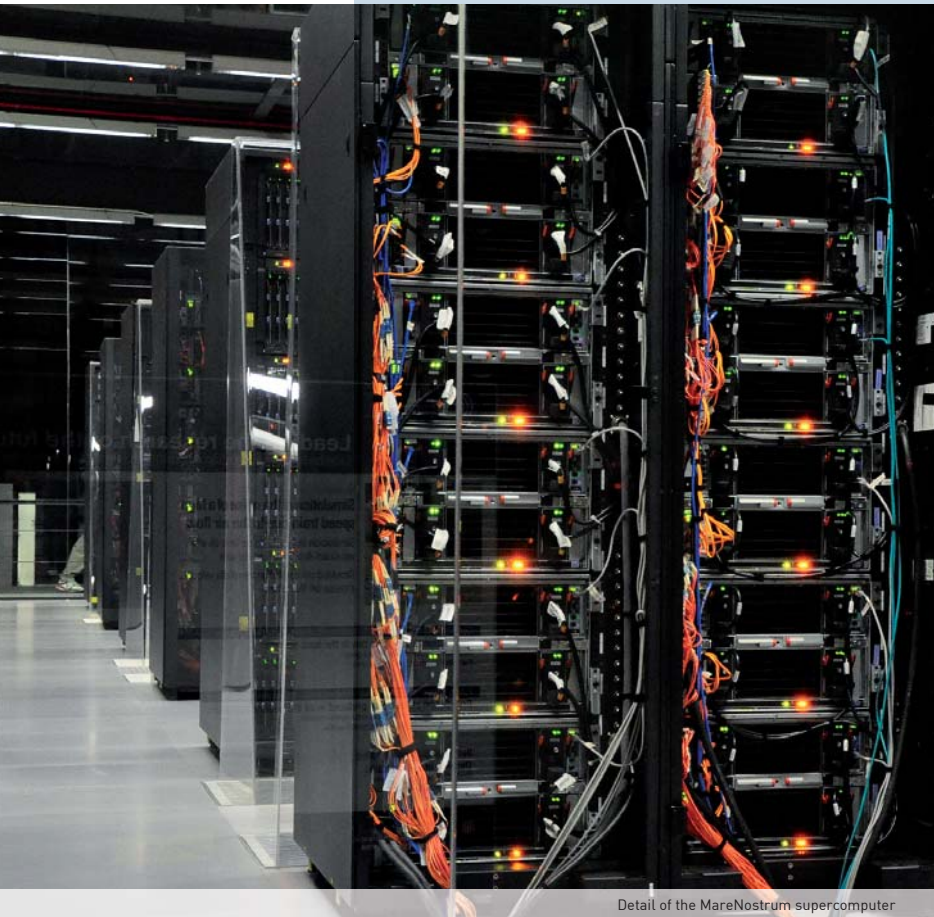
simulation accuracy, because large quantities of data are needed.

At the moment, we are looking for clients to start using a seismic wave propagation simulator, accurate to within metres, which has a number of potential applications. For instance, we could have a clear map of the areas and buildings most and least affected by an earthquake within two or three hours of its detection by a seismological observatory. That map would be extremely valuable to insurance companies, because it would allow them to quickly plan how best to deploy their appraisers on the ground.

In terms of preventive action, it could also be used to examine several seismic scenarios and assign individual risk levels to different areas. If there is a known likelihood that a geological fault will break in a given area, we would be able to foresee the consequences of the break happening at different spots. This is a valuable input for urban planning in towns at risk of having earthquakes, as well as for insurance companies.

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## Facts & Figures



Detail of the MareNostrum supercomputer

### **What is special about the BSC headquarters?**

It is under construction! We have grown a lot faster than expected and we are currently scattered across several buildings in the north campus, but the new building is now under way. I have to thank Repsol for their generous donation, which will allow the works to be completed.

### **How many people are currently employed there?**

Almost 400 people from a wide range of disciplines, all of them seriously committed to innovation.

### **What professional backgrounds prevail among the researchers and engineers?**

They come from extremely varied back-

grounds. From PhD students to senior professionals with impressive qualifications and experience. From biologists to nuclear physicists. The common denominator is computing.

### **What is the BSC's annual budget?**

In 2013, we had 24 million euros.

### **How is BSC funded?**

Our recurrent budget is about six million euros, which is government provided. The rest comes from competitive revenue from our involvement in research projects and business partnerships.

### **How can the BSC be contacted to appraise a project's feasibility?**

If it is an ongoing scientific project, the researchers should contact one of the access committees of the Spanish Supercomputing Network or PRACE, which are the institutions that control access to public supercomputer services. If it is a company or an organisation interested in undertaking research in partnership with the BSC, they can contact us through any of our research departments: Computer Science, Life Science, Earth Science and Science and Engineering Applications. All contact details can be found on [www.bsc.es](http://www.bsc.es).

### **How much does an hour of MareNostrum calculation cost?**

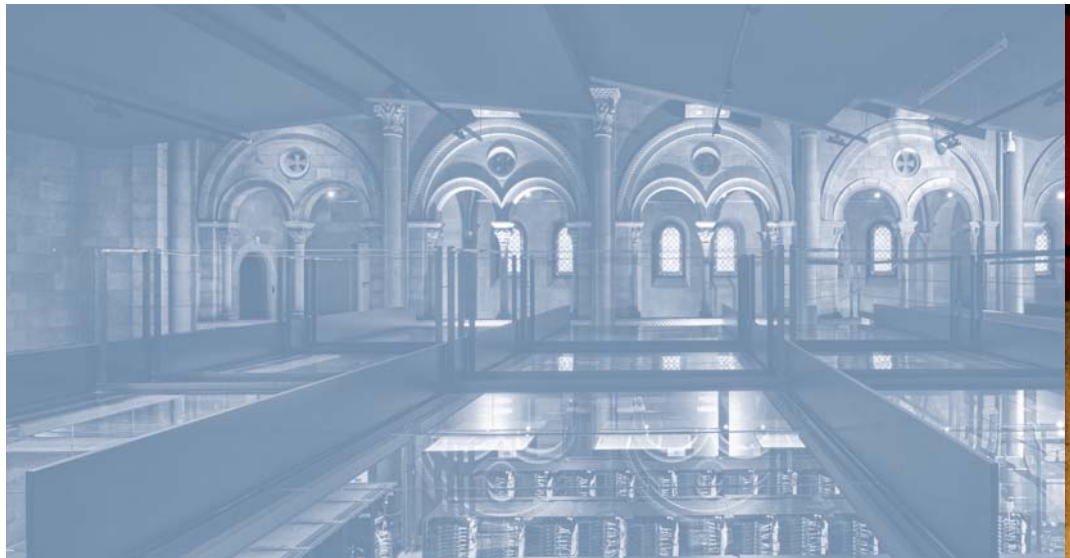
MareNostrum is a computer devoted to science and research. Anyone wishing to use it has to submit a scientific project, which is assessed by an expert committee, or else have a joint research agreement with the BSC.

### **How do you see the BSC in 10 years' time?**

Strongly focused on research on hardware and software, personalised medicine and energy, and working with business to create wealth.



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