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TOWARDS COVERING
OPERATING LOSSES?

BY **ELIOTT PRADAT, HINARII PICHEVIN,
FABRICE TAILLIEU**
AND **JEAN-PHILIPPE BOISSEAU**

The whole world is going through a historic and dramatic period in many ways. We have had serious disruption of our daily lives: the closure of schools and non-essential activities, millions of people on short-time working, etc.

To deal with it, the authorities have implemented unprecedented support measures for businesses, dealing with full or partial unemployment, support from the State and central banks for a rescheduling of bank loans, the mobilization of emergency bank loans which companies may need because of the epidemic.

The impact on our economies is on a historic scale: for example, on April 14, the government estimated that France should experience in 2020 an 8% decline in GDP growth (Gross Domestic Product), a public deficit around 9% of GDP and a debt of around 115%. These will change but the direction of impact is certain. By comparison in France, GDP has only fallen significantly 3 times since 1950 and never by more than 3%.

To the health crisis is added, for an as yet unknown period,

an economic crisis despite the measures taken at French, European and even global levels. While the crisis has been mitigated for some companies by the technological advances of recent years (telework, digitalization, etc.), many companies have seen their activity slow down or even stop overnight. On April 22, the government announced that one employee in two in the private sector was in partial activity and that 820,000 companies and associations had already used the partial unemployment scheme, five weeks after the start of confinement.

WHAT WAS THE IMPACT ON INSURANCE COMPANIES?

First, they were able to adapt to exceptional circumstances and mobilized to ensure business continuity and service to their policyholders by using, for example, video expertise in the event of claims.

With public State support, the main credit insurers in France also undertook to market on April 15 additional offers of credit coverage inter-company for French companies up to € 12 billion.

In a further positive development, insurers announced that they were taking a series of exceptional extra-contractual measures amounting for the most exposed and a global investment program in favor of small and medium sized enterprises at a cost of over € 3 billion.

Looking at claims, some insurers have seen a significant decrease due to confinement, particularly for motor and housing risks. Other portfolios are strongly impacted in terms of volumes (insurance whose premium volume is based on turnover for instance) or in terms of increased claims (cancellation of events for example or liability insurance).

And of course the sharp fall in the financial markets had a strong impact on the returns on financial investments, which weighs on the profitability and on the solvency ratios of many companies and insurance groups.

In this context, reflections on the establishment of an insurance

scheme covering operating losses have started within the profession.

INSURANCE FOR OPERATING LOSSES IN EVENT OF CATASTROPHE

When the company (or professional) is faced with a claim due to material damage, business interruption insurance makes it possible to offset the effects of the reduction in turnover. The compensation paid is thus intended to put the company back in the financial position that would have been if the disaster had not occurred.

On the other hand, operating losses following immaterial damage (breakdown of the energy network, strikes, etc.) are, for the most part, not covered and the current health crisis generally falls within the scope of the contractual exclusions.

In these times of crisis, insurers are often under pressure from public opinion and the political world. In the United States, for example, some States plan to require insurers to pay for part of the operating losses resulting from confinement. In Germany, Bavaria has imposed an agreement to cover 10 to 15% of operating losses for a period of 30 days. In this context, some insurers are worried about being obliged to retroactively cover risks for which they have not collected premiums.

In recent decades, public policies have effectively been implemented in many areas, for influenza vaccination for example, for better management of the risks of natural disasters as well. Risk prevention plans (natural, technological, etc.)

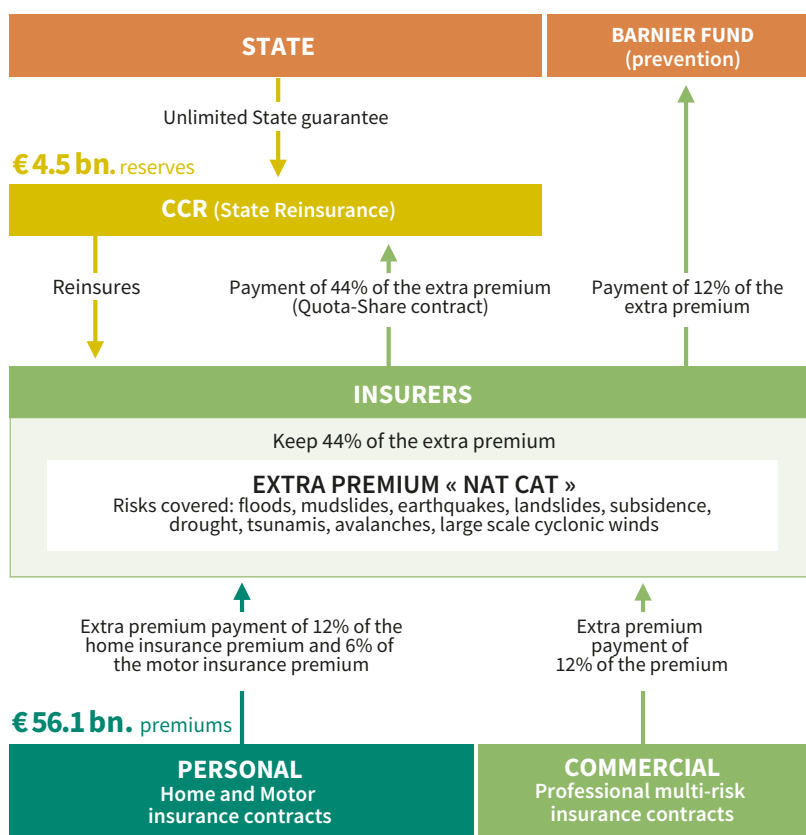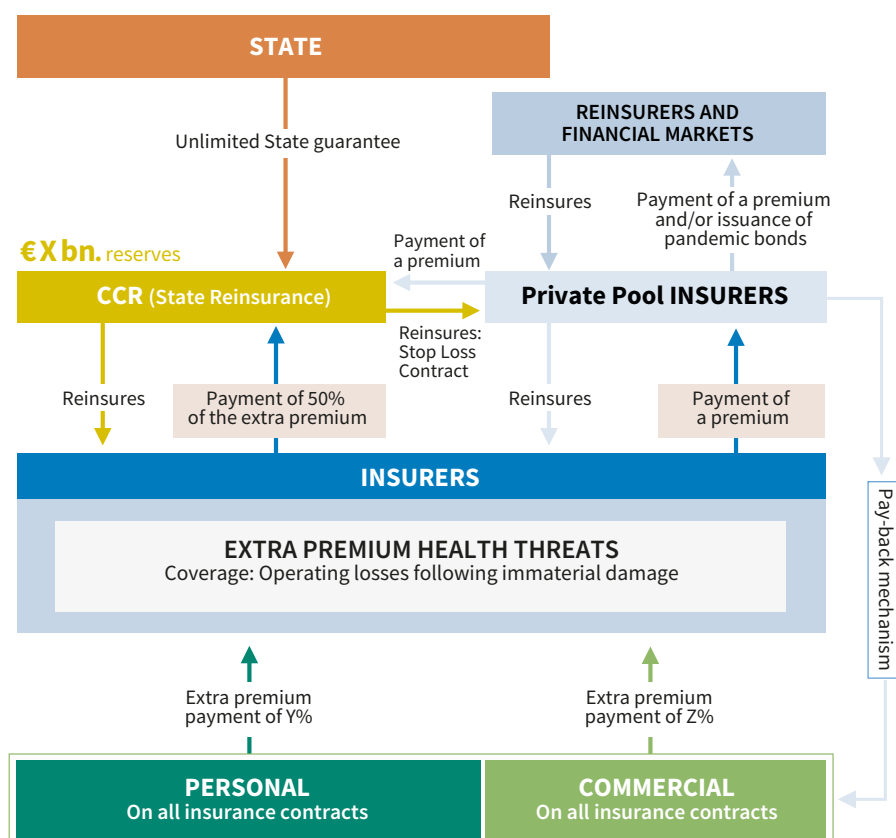**FRENCH INSURANCE MECHANISM FOR NATURAL DISASTERS**

ILLUSTRATION OF A POSSIBLE INSURANCE MECHANISM COVERING OPERATING LOSSES

have been defined to try to prevent the unpredictable.

In the debate that is opening today on a widening of the coverage of operating losses, it will also be necessary to provide the preventative arm.

Regarding the establishment of coverage for operating losses following an epidemic, France, like other countries, has had strong experience in building such mechanisms in recent decades.

In 1982, following catastrophic floods during the winter of 1981, the compensation plan for natural disasters was created in order to respond to a lack of cover for natural risks in France.

Reformed several times since, this mechanism is based on several principles, among which: generalized cover for all natural hazards not covered by conventional insurance contracts, a single premium rate (set by the State), solidarity between territories, rules which define the triggering of the mechanism and an unlimited State guarantee in the event of exceptional claims.

In 2002, following the terrorist attacks of 2001, a system of insurance and reinsurance (Gareat) was created in France in order to address the shortfall in cover of the risks of damage to property related to the terrorism. Above a certain threshold of insured capital (currently set at € 20 million), insurers must join this structure. For this so-called '*Large Risks*' section, beyond a first line of co-insurance up to € 500 million, Gareat places an Annual Aggregate Excess of Loss reinsurance program

up to a certain level (€ 2,600 million in 2018), supplemented by unlimited coverage with a State guarantee. In the UK, a similar system for insuring terrorist risks was introduced in the 1990s following a spate of large losses, some of which were uninsured.

These mechanisms have specificities linked to the nature of the risks covered, but have many common points, in particular: a compulsory nature, the principle of national solidarity, rates of extra premium, the principle of the intervention of CCR ('*Caisse Centrale de Réassurance*'), wholly-owned by the French State, and the unlimited State guarantee.

An emergency bill to create insurance for risks linked to serious health crises was tabled in the Senate on March 27 by Catherine Dumas and 70 other senators. It proposes to build a risk insurance scheme linked to serious health threats, along the lines of natural disaster risk insurance, to insure the economic world against future epidemics.

While there may be similarities in the structuring of the insurance scheme with the other schemes in force, the fact remains that fundamental differences remain. There are still questions about the scope and limits of coverage for health crises.

The bill defines health disasters as follows:
- 'The effects of serious health threats are considered to be operating losses which had as a decisive reason the restrictions or prohibitions on travel and meetings or the closings or restrictions on the opening

of establishments decreed in order to prevent and limit the consequences of these health threats',
- 'The status of serious health threat is noted by ministerial decree which determines the zones and the periods when the serious health threat led to prescribe measures.'

If the consequences of confinement on the loss of operations are direct, post-confinement consequences are also to be expected, differentiated by sector of activity.

## WHAT BASIS FOR FINANCING THE SYSTEM?

Given the potential amounts linked to operating losses, the question of the base to which a premium would be applied arises. The explanatory memorandum to the bill specifies that, as in the case of natural disaster risk insurance, the scheme insurance for risks linked to serious health threats would be financed by an additional contribution.

The scheme of the future regime remains to be drawn: will it be carried by CCR, which would have the ultimate recourse of the State guarantee, by a pool system of (re)insurers, or a combination of the two?

The future mechanism may also provide for the repayment of part of the premiums to the State in order to finance preventive measures (similar to the Barnier Fund for major natural risks) and the establishment of a centralized database.

In France, the claims experience relating to the non-motor Natural

FRENCH GDP EVOLUTION BETWEEN 1950 AND 2018 (GDP EVOLUTION RATE - COMPARISON YEAR TO YEAR IN %)
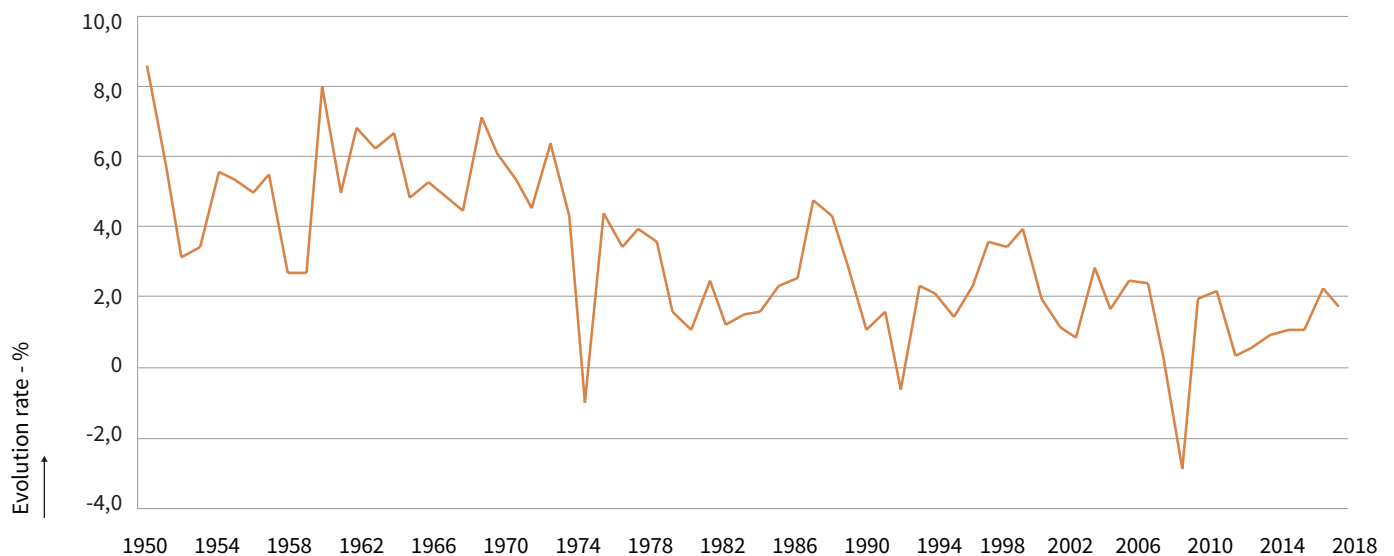
Disasters regime never exceeded € 3.3 billion in one year, and averaged € 977 million over the period 1982-2018, for a premium volume of € 1.67 billion in 2018 (source: CCR). The volumes involved for the health regime will be very significantly higher in the event of an epidemic, for lower frequencies of occurrence.

In the event of an unlimited State guarantee, taking into account potential losses, a stop-loss mechanism could supplement the system.

Other possibilities could be envisaged such as:
• Coverage through 'pandemic bonds'. These instruments came into being a few years after the Ebola virus. Adopted by the World Bank in July 2017, they consist of raising funds from private investors so that they can then have significant financial resources to deploy health aid in the event of an epidemic. However, these instruments have recently come under fire from several critics (trigger criteria, deadline for releasing funds, etc.).

• Coverage through a fund which could be funded by a subsidy from the State budget, a system of premiums and the participation of insurance companies.

WHAT WOULD BE THE COST OF SUCH A MECHANISM?

The definition and the production of a quantitative analysis allowing to illustrate the mechanism and the impacts of the implementation of such a regime consist of delicate exercises taking into account the still very important uncertainties around a part of the epidemic.

One can imagine that a hypothetical COVID-21 would be less expensive than the current COVID-19 due notably to better anticipation. Thus, the future mechanism will probably have to be confronted with reality and therefore be evolving.

OUTLOOK

The experience of COVID-19 will probably trigger a new system for covering operating losses in the event of a health crisis. Faced with political pressure, it is likely to see the light of day in relatively short time.

The organization and parameters of this system remain to be defined, and, even if future health crises would probably require State intervention, given the amounts involved, this new regime would make it possible to better outline the role of the different parties.

Anyway, risk management systems will have to embed these systemic risks and their impacts on the organization of companies, as well as on strategic planning and risk and solvency assessment.

Finally, from our point of view, the thinking should go beyond covering pandemic risk, and also integrate other systemic risks such as Cyber risk for example.

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RISKING BUSINESS VALUE WITH 'SIMPLY' APPLYING THE FAIR VALUE APPROACH

BY **DAVID BRUNSVELD** AND **SERVAAS HOUBEN**

In light of the potential audience of this article, we sometimes deviate from specific IFRS accounting terms.

IFRS 17 PRINCIPLES BEHIND TRANSITION

IFRS 17 is the new accounting standard for insurance contracts, with an objective to provide users with relevant information about the financial performance of insurance contracts. Users can assess the effect of these on an entity's financial position, performance and cash flows, and better than before compare financial reporting between entities globally.

To comply with IFRS 17, a transition is needed from current accounting (e.g. from IFRS 4) to IFRS 17, for all existing contracts. This is to account as if IFRS 17 had always applied and to derecognize balances that would not exist with IFRS 17 (with net differences booked in equity).

One outcome is an opening balance of expected future profits, the '*Contractual Service Margin*' (CSM). This CSM will gradually release into the P&L over time (in potentially many years). To determine the opening CSM one needs to use historical data about insurance policies and assumptions.

To transition, it is required to apply the '*full retrospectively approach*' unless this is '*impracticable*'[1]. When '*impracticable*', there is an option to choose between (some mix of) the '*fair value approach*' and a

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1   '*Impracticable*' depends amongst others on costs and efforts needed to meet the requirement.

'*modified retrospective approach*'. We will call this the transition option. This **option** has potential value, as each insurer can make choices that fit more or less to their business context and value perspectives.

TRANSITION APPROACHES AND OPTIONS

Thus, IFRS 17 distinguishes three transition approaches:

1. (Full) retrospective approach: the standard approach, unless '*impracticable*'. Past contracts are accounted for as if IFRS 17 had always applied. Requiring the use of historical data on policies, assumptions (setting), actual cash flows and at least annual (actuarial) measurements.

2. Fair value approach: a choice if the full retrospective approach is '*impracticable*'. The CSM is the difference between the IFRS 13 fair value and the IFRS 17 estimate of insurance contract(s). IFRS 13 allows a buyer's valuation and can result in different assumptions (e.g. discount curve, expenses), contract boundaries and risk assessments (risk margin, non-performance risk).

3. Modified retrospective approach: another choice if the full retrospective approach is '*impracticable*'. This approach is to mimic the full retrospective approach as much as possible, allowing various modifications[2]. It includes using all available information that would be used in the full retrospective approach, such as data about risk assumption changes since issuance or cash flows such as amounts charged to the policyholder.

Only the fair value and modified retrospective approach allow to combine contracts issued more than a year apart [3]. It is allowed to apply some mix of the fair value and modified retrospective approach.

Table 1 (below) indicates the relative business value contribution, for each combination of value factor and transition approach:

It may not be easy to choose for some mix in the fair value and modified approach. However, the opportunity to optimize the transition option value may in practice be a consideration, where the fair value and the modified retrospective approach are assessed in light of the specific business context and value perspectives. One differentiator in that consideration is the business value from more (detailed, historical) management information.

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2 E.g. on how to combine contracts or how to construct the discount rates.

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3 **https://www.ifrs. org/-/media/feature/ meetings/2019/ february/iasb/ ap2d-amendments- to-ifrs-17-insurance- contracts.pdf**, Appendix A.

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4 These factors are subjective and can be divers. We think our selection covers most of the factors considered by management.

TABLE 1: Assessment of relative value

Value factor [4]	Fully retrospective	Fair value	Modified retrospective
Operational effort	--	+	+/-
Accuracy of estimates	++	+/-	+
Flexibility (tailoring potential)	--	+/-	++
Management information (e.g. trends)	++	-	+
Explainable approach	+	+	-

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PERSPECTIVES ON VALUE OF MANAGEMENT INFORMATION

As the transition option allows for a transition approach per group of contracts, insurers can choose to vary approaches for example by product line. The following characteristics could also be considered:

- **Closed or open books:** for open books business information on trends is more relevant (to future changes in pricing, reinsurance contracts, claims management or acceptance). For closed books, less instruments are available and less historical information might suffice;
- **Level of materiality:** when lines of business or product groups are less material, the value from historical data could be less and a fair value approach might suffice. For material blocks, a detailed analysis might be more valuable;
- **Company specific or industry pricing:** when pricing is based on an own risk assessment, more detailed and historical information could be valuable. And lesser so when pricing (policies) are prescribed by a regulatory body;
- **Type of profit sharing:** profit sharing products are more complicated (e.g. to fulfil the criteria for fair treatment[5]) and more nuanced or granular information might be valuable;
- **Plain vanilla or otherwise:** more complicated products may benefit from more detailed information over time;
- **Product duration:** products like lifelong annuities can't be repriced, and less rich information might suffice. For pricing shorter term products it might be valuable to distill trends in performance.

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- **Portfolio transfers and M&A:** for portfolio transfers or M&A activity, a potential buyer or seller could value a clear (audited) track record of past performance, impacting a deal or transfer price.

CONCLUSION

The fair value approach may seem the most practicable transition option, as it requires the least historical data. Nevertheless, transition options using more historical data could add more business value. We think insurers can benefit from the availability of transition options, taking into account their specific portfolio characteristics and context. We believe that doing so helps management to optimize business value while complying with IFRS 17.

5 **https://www.fca.org.uk/firms/fair-treatment-customers**.

SOLVENCY II
OPEN ISSUES TOWARDS
EUROPEAN CONVERGENCE

BY **GIAMPAOLO CRENCA** AND **DONATO LEONE**

The Solvency II Directive of 1st January 2016 regulates the European Insurance market, in particular in measurement of the solvency of each single Insurer which is one of the most important financial indicators for both policyholders and market players.

The logic for having an EU directive covering specific business activity like insurance is the goal of the European Commission to pursue harmonization and equal conditions within the EU.
This principle is the basis for efforts to avoid disparity and to guarantee homogeneous treatment at each level and need to be confirmed also in the insurance sector.

The complexity of this Directive and the lack of '*coordinated detailed guidelines or standard of practice*', that concerns all the specific aspects that are still subject to '*interpretation*' by the insurer, risks undermining the purpose of harmonization and making policyholders and market players unable to do an appropriate comparison of solvency positions in the insurance market.

We look in this article at just some of matters that would need to be better specified to avoid

the distortions above reported considering that the practice currently used not only can be different between EU Countries but also between insurance companies in the same EU Country !

First of all, we believe that it is necessary to provide specific indications to insurers about the Data Quality context, particularly instruments and criteria to be used in order to check the appropriateness, completeness and accuracy of the data used both for Best Estimates (BE) and Solvency Capital Requirement (SCR) evaluations.

We also observe in the market different approaches to Contract Boundaries and suggest it should be appropriate to specify better the concept related to '*recognition date*' with reference to the treatment of recurring insurance premiums, additional premiums, one-year renewable contracts (in this case where the contract includes an automatic renewal clause if the policyholder and/or the insurance company does not terminate it within a fixed date preceding the expiration date) both for BE and SCR (in particular, in the last case of automatic renewal, about the evaluation of the Volume Measure of the

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Premium component of Non-Life or Health short term non-life (STNL) underwriting calculations.)

SOLVENCY CAPITAL REQUIREMENTS CALCULATION
Looking to the SCR Underwriting of Non-Life or Health STNL, and in particular looking at USPs, we believe that an argument to develop is the set of tests used to verify if the data fit the assumptions set out in Annex XVII of Commission Delegated Regulation - following also only

'*CDR*' - (EU) 2015/35 and the '*Selected Criteria* or *Decision Tree*' to decide on application of USP and, if yes, the time horizon to be selected.

As you know, the evaluation principles of the USPs are strictly connected to the adequacy check of the Standard Formula in order to represent the risk profile of the insurance company. In this context we believe that it is necessary to provide standards to do this analysis, required by the law, also for all the parameters out of USP scope.

We also draw attention, in relation to the single module or sub-module of Solvency Capital Requirements' evaluation, to the SCR Lapse evaluation both in Life (and Health STL) products and in Non-Life (and Health STNL) products. Specifically, for Life products, in particular for products with future discretionary benefits (and, therefore, with benefits connected also to market conditions and management actions within Companies), it would be appropriate to provide guidelines on the whole process allowed to be used by a Life insurance company to select the prevalent option and scenario to stress and therefore to evaluate the Lapse SCR in case of stochastic approach considering also the Dynamic Policyholder Behaviour.

For Non-Life products, the Interpretation of '*discontinuance*' (Article 1, paragraph 14 of CDR (EU) 2015/35) is a very important concept in relation to '*other discontinuity options or not exercising continuity options*' in order to evaluate the SCR Lapse Non-Life or Health STNL. The question is: 'must we consider as an option also the

'*discontinuance*' provided by the primary legislation on all insurance contracts, for example for Motor, the destruction or theft of vehicle (as it seems in Article 1, paragraph 15 and 16 of CDR (EU) 2015/35, also if, often, this '*option or rights*' is not linked to a policyholder choice) or only the specific clauses provided for in the single insurance contract (for example refund of the premium in Collateral Protection Insurance (CPI) insurance)?

We believe necessary to mention also the topic of the evaluation of the adjustment for the loss-absorbing capacity of deferred taxes because, also considering the recent rule (included in the CDR (EU) 2015/35 review), the method used by single insurers is still characterized by non-homogeneous approaches, for example the approach used to verify the business continuity post shock, to identify hypotheses post shock and to put consistently the loss (equal to Basic SCR+SCRoperational+Adjustment for the loss-absorbing capacity of technical provisions) in local balance sheets also in terms of timing.

> **In conclusion, for a European Union that pursues the aim of equal conditions and harmonization it is necessary that the rules are clear, based on accurate definitions and leave very little room for interpretation.**

Despite appreciating very much the great work of the European Parliament and Council (both on Directive Solvency II and the set of Commission Delegated Regulations) and of EIOPA (set of Guidelines and Q&A) in production

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of '*rules*' and documents in such a complex, technical and specific context, we believe that is necessary to integrate these set of documents with further '*coordinated detailed guidelines or standards of practice*' that concern not only the aspects above reported, but all the specific features that are still subject to '*interpretation*' by the single insurer.

In this implementation the Actuarial Associations of Europe may play an important role, also working with Associations of all the other interested players (insurers, Insurance Supervisory Authorities, etc.) in order to receive all the requests and, in cooperation with EIOPA, analyze, collect and transpose them to an integrated document to be submitted to European Union Institutions.

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COVID-19 OUTBREAK:
WHAT CAN ACTUARIES LEARN ABOUT MORTALITY?

BY **ALEXANDRE BOUMEZOUED**
AND **AL KLEIN**

THE CHALLENGE OF MEASURING MORTALITY

It is important to recognize that few published numbers can be directly used to estimate the extra mortality claims a life insurance company may have. For example, the Case Fatality Rate (CFR), i.e., the expected mortality rate among those infected, can potentially vastly overstate or understate the total death rate. It may be:

- Overstated because limited testing did not identify all COVID-19 cases, especially in the denominator
- Understated because some deaths that will occur have not yet been observed, and hence omitted from the numerator

The accuracy of the reporting of the cause of death is questionable, in both directions. A death may be classified as COVID-19 if the individual is a confirmed case, even if the death was from another cause. Actual COVID-19 deaths may not be classified as such if they were not a confirmed case. It is not clear how non-hospitalized COVID-19 deaths are recorded in many countries. The actuarial community has monitored publications of all-cause death counts to try to estimate excess pandemic mortality in comparison to a reference. One place such weekly updates can be found for 15 countries is the Human Mortality Database[1]. The understanding of COVID-19 mortality dynamics based on such data remains challenging because it requires corrections from the reduction in road accidents, increases in deaths from delaying care, etc.; the full extent is not yet known.

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It is now acknowledged that COVID-19 mortality appears to be highest for the older ages and those with impairments, including respiratory, cardiovascular and diabetes.[2] Mortality appears to be higher for lower socio-economic groups as detailed later, males than females, and those with higher Body Mass Indices.

DERIVING MORTALITY ASSUMPTIONS USING FORECASTS FROM EPIDEMIOLOGICAL MODELS

Developing a pandemic risk model is one way to estimate overall excess deaths due to COVID-19. Apps have been provided on multiple websites. Modelling is challenging because many components interact dynamically in the forecast and depend on a large number of assumptions and parameters, which change as the pandemic evolves.[3]

SIR-type models are conventionally used to model epidemics. These are compartmental models in which populations, usually denoted by S-Susceptible, I-Infectious, R-Removed, interact with each other. The Removed state can be further split into recoveries and deaths. Because populations S and I are assumed to be connected, each individual from population I infects individuals of population S with a so-called infection or contamination rate denoted by α. This means that at each time step the number of infected individuals increases by αSI, and decreases due to recoveries or deaths. The model is said to allow for interactions, i.e., is non-linear.

These epidemiological models typically use parameters (contamination, recovery and fatality rates) from the literature. One challenge is the exponentially increasing number of publications, requiring an exhaustive manual analysis, and their tracking has remained out of reach for many actuaries. One solution is Natural Language Processing, as it can assist actuaries in digesting research papers and identifying general trends on parameters and assumptions.[4]

The current experience on COVID-19 reminds us that for pandemic risk modelling, more structural models are needed to appropriately capture the risk of

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propagation and its impact. There are unique features with COVID-19, and there will likely be unique features with future pandemics. Some (re)insurance companies have improved their pandemic risk internal models, and it is possible there may be a greater regulatory push to implement more complex models.

INSURANCE COMPANY MORTALITY EXPERIENCE

The insured population generally corresponds to the high-income segments. Lower general mortality has been observed globally for this socioeconomic class. The basic effect of this pandemic on insured mortality is likely to be similar to its effect on overall population mortality by age, but with a recognition that newly underwritten policies likely have fewer health conditions, reducing the insured mortality at these early durations. Some authors[5] showed that the most deprived socioeconomic groups were associated with higher mortality rates. Reasons could include more underlying health conditions, less access to healthcare, more intergenerational living situations (which have been found to lead to more COVID-19 infections), more individuals working as essential worker (and are then more exposed to COVID-19), and more likely to take public transport (which also puts this group at more risk of exposure).[6]

Regarding comorbidity, the use of statistics from medical underwriting will be useful to calculate the proportion of insured individuals suffering from these diseases. Also, when good health has been established at underwriting, the assumption of absence of comorbidity can be made to last some period of time after underwriting, e.g., 1-5 years.

Will the mortality associated with the COVID-19 impact the life insurance business? The short answer is yes, but by how much depends on the many factors discussed as well as a company's exposure to the more at risk individuals. Underwriting is a strategic component for a company to help protect itself with respect to mortality from future business written during this pandemic, a reoccurrence of COVID-19, or any other pandemic that may follow.

1 Human Mortality Database. University of California, Berkeley (USA), and Max Planck Institute for Demographic Research (Germany). Available at **www.mortality.org** or **www.humanmortality.de**

2 **https://milliman-cdn. azureedge.net/-/media/ milliman/pdfs/articles/ impact-covid-19-on-life- insurance-mortality.ashx**.

3 **https://milliman-cdn. azureedge.net/-/media/ milliman/pdfs/articles/ pandemic-risk-modelling. ashx**.

4 **https://fr.milliman. com/fr-fr/insight/ automatic-extraction-of- covid19-epidemiological- parameters-using-natural- language-processing**.

5 Cairns, A. J., Blake, D., Kessler, A. R., & Kessler, M. (2020). The Impact of Covid-19 on Future Higher- Age Mortality.

6 **https://www.cdc.gov/ coronavirus/2019-ncov/ need-extra-precautions/ racial-ethnic-minorities. html**.

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COVID-19

BY **TONY O'RIORDAN**

COVID-19 will be indelibly etched in collective consciousness as a truly global pandemic of enormous scale. At the time of writing, there were 8.0 million diagnosed cases worldwide with more than 430,000 deaths associated with the illness. The epicentre of the virus has spread beyond China, firstly into Europe via Italy, with most European countries significantly impacted, but particularly Italy, Spain, UK and France, and then more widely. Brazil, Russia and India in particular have seen significant growth in cases in recent weeks, with a number of South American and Middle Eastern countries now heavily affected. The USA currently has most cases and deaths, with almost 2.2 million cases and 118,000 deaths. Deaths from COVID-19 are particularly prevalent in persons showing certain pre-existing medical conditions and at older ages, with the average age of those dying being circa 80.

Responses across the globe have been unprecedented with large proportions of the world's population in lockdown. To various extents, people have been confined to their homes with all other than essential travel banned. People who have been infected are in isolation where possible and contact tracing has been active in identifying and communicating with those with whom infected people have been in contact. There have been positive indications arising from measures taken, with the rate of growth of infections decreasing in many countries, and definite signs of flattening of death and infection curves. China has now substantially reduced lockdowns, and new infections have reduced to low levels. European countries have also moved to reduce restrictions, while there is a range of measures in place in the US.

The challenge now being addressed in many countries is to reopen society at the right time in a way which will enable people to reengage with normal activity while ensuring that the conditions are right to minimise the risk of further outbreaks of infection and to ultimately eradicate the virus. Reopening is likely to be gradual, and the timing of widespread availability of an effective vaccine is likely to be key to resumption of full societal interactions.

There have been dramatic effects on economies worldwide resulting from the enforced changes in behaviour. China's economy fell in Q1 (by 6.8%). The Chinese government only began reporting quarterly economic growth estimates in 1992 but the last time it officially acknowledged a year-on-year fall in output was for 1976. Almost all economies are now in recession. Examples of impacts are a significant drop in oil price, dramatic increases in numbers unemployed globally, and heightened levels of business failure. Governments and central banks have responded by creating enormous fiscal and monetary stimulus to seek to maintain economies pending restoration of more normal levels of activity.

Investment markets have also been very significantly impacted, with European equity markets down 16% (EuroStoxx 50) year to date at 12 June, and global equity markets, having been as much as 30% lower in mid March before the recent recovery, down 8% (MSCI World). Interest rates have reduced in main markets, though both sovereign and corporate bond spreads have increased, the latter to a greater extent.

In summary, the impact of COVID-19 across the world has been enormous and it will have significant long term social and financial implications for economies, governments, corporate entities and individuals.

IMPACTS ON (RE)INSURANCE COMPANIES

COVID-19 puts stress on many key areas of exposure for insurers at once, e.g. lower and more volatile asset prices, lower interest rates, higher bond spreads and defaults, challenges in business retention, efficiency and operational risk. For non-life insurance in Europe, higher claims come from lines of

Portnoo, County Donegal / Ireland
April 10 2020: Sign warning Covid 19

business such as non-damage business interruption, travel, event cancellation and medical malpractice, while claims are reduced from individual lines such as motor and home. For life and health insurance, higher mortality arising from the virus as well as requirements for medical treatment will impact on claims arising from mortality, sickness and perhaps also disability. In the short term, reductions in visits to doctors and elective treatments is likely to lead to lower claims on health insurance. The resulting economic slowdown will also impact on new business for all lines.

It will be important for (re)insurers to have a developed picture of the actual and potential impact across the full range of affected areas and to understand the range of risks to which they are exposed and possible outcomes. The Own Risk and Solvency Assessment (ORSA) carried out by (re)insurers is an ideal tool to give insight to the impact of COVID-19. Where representative scenarios are available from previous ORSA exercises, this is a valuable

reference. Alternatively, an ad hoc ORSA may be required to consider risks not previously addressed. Financial measures impacted will include capital coverage, profitability, liquidity and availability of dividends to shareholders.

'Underwriting and pricing practices will need to adapt to the new environment.'

At this point in time, (re)insurers need to consider the stresses impacting on a number of groups of stakeholders, including employees, customers and distributors such as brokers and tied agents. As well as financial and capital impacts, areas affected include customer and business growth, people and operations, and strategy and performance management. Underwriting and pricing practices will need to adapt to the new environment.

Customers will be affected by the response of insurers to requests for claim payments, particularly where there is doubt as to coverage

provided by their policies. Customers will also in many cases struggle to pay premiums. The reaction of (re)insurers to these situations will act to shape the reputation of the industry. There is evidence of many initiatives across Europe to alleviate the burden on customers at this time.
The main immediate balance sheet impact on the insurance industry as a whole comes from the impact of Covid-19 on capital markets and hence on the asset side of (re)insurers' balance sheets. Risks on the liability side of the balance sheet might also be very large for (re)insurers which are heavily exposed to certain types of insurance most at risk of heightened claim experience during the crisis, e.g. event covers and non-damage business interruption.

Operational risks are heightened with additional stresses from heightened customer activity, employees working from home, concerns re cyber security, and disruption of asset markets all impacting.

The AAE supports the position of EIOPA and European regulators in being responsive to the crisis. Regulators have rescheduled required regulatory submissions, postponed non-urgent work, and have been open to implementation of tools which could mitigate risks and impact, e.g. extension of recovery periods. EIOPA is focused on the information provided to customers and has encouraged fair,

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is CFO of New Ireland Assurance and has written this position paper on COVID-19 as Chair of the Insurance Committee of the Actuarial Association of Europe.

explicit and flexible treatment of customers. In this context, EIOPA has suggested premium refunds for lines of business with significantly reduced exposure due to the crisis. Heightened levels of regulatory scrutiny are in operation, reflecting the pressures operating on companies.

EIOPA has also asked (re)insurers to suspend dividends and share buy backs, and to avoid bonuses for the time being.

Completion of the 2020 Solvency II review by EIOPA will now be delayed until the end of 2020, and the COVID-19 crisis may bring new perspectives to bear as part of that review. Given the wide-ranging impacts of COVID-19, these may include heightened focus on system-wide impacts across the whole financial system.

Actuaries in (re)insurance companies are providing inputs in important ways:

• Supporting firms to think about the needs of their customers, considering the public interest, and mindful of the reputation of the insurance industry and its practitioners
• Providing input and direction, through actuarial and risk management functions, to fulfilment of regulatory capital requirements and use of stress and scenario analysis to understand developments in the risks to which (re)insurers are subject
• Supporting the provision of updated projections of business development and of revised pricing, allowing for the impacts of COVID-19
• Coordinating provision of effective interpretation of information and presentation of statistics.

The AAE also identifies some considerations which regulatory authorities should assess:

• The impact on the Solvency II 2020 review, including
  - appropriateness of stress factors being applied to risk modules
  - whether Solvency II allows properly for a pandemic crisis

  - effectiveness of measures to impact pro-cyclical behaviour such as equity symmetric adjustment
• Impact on consumers, and the need for Insurance Guarantee Schemes
• Macroeconomic impact in the short to medium term, with likely depressing impact on interest rates which are already at very low levels
• To the extent that COVID-19 constitutes an extraordinary adverse situation, alterations which could be made to prescribed Solvency II scenarios to provide capital relief for (re) insurers where necessary.

IMPACT ON PENSION SCHEMES
Pension schemes have been materially impacted by the economic impact of the COVID-19 pandemic following recent moves in equity markets and bond yields.

Investment market impacts have put pressure on solvency of defined benefit schemes. In some cases, that is leading to difficulty in making payments to retirees. Market impacts will also lead to a reassessment of the appropriateness of funding plans.

Defined contribution (DC) funds are reduced by asset falls with implications for the level of retirement benefits.

The economic difficulties associated with the crisis are leading to difficulties for employers in making payments, with implications for the strength of employer covenants. Some pension schemes are enabling employers to reduce contributions for a short period of 3-6 months,

seeking to ensure that risk benefits can continue to be funded. In some countries, state support is being made available to help employers fund contributions on a temporary basis. Some DC schemes are allowing delayed take-up of capital at retirement in order to enable conversion of capital into an annuity at potentially more favourable rates in the future (this is consistent with a recommendation of EIOPA). Most schemes have taken operational measures in order to ensure uninterrupted payment of pensions to beneficiaries.

Actuaries working on pension matters are providing inputs in important ways:

- Providing input and direction to efforts to understand current and forecast impacts of the crisis, allowing for various different possible scenarios
- Supporting schemes in addressing the needs of their members
- Providing analysis and information to understand developments in the risks to which schemes are subject, e.g. calibrating new longevity scenarios

WIDER IMPACTS OF COVID-19 AND ACTUARIAL INSIGHTS
Use of data related to COVID-19
There is currently limited statistical comparability between countries due to different methods used to measure rates of infection and death, as well as different approaches to testing, testing capacity and criteria applied for test eligibility. As a consequence, it is not yet possible to effectively assess the future development of COVID-19.

The AAE will continue to monitor publicly available material from sources such as the European Centre for Disease Prevention and Control and the World Health Organisation as well as from actuarial or other professional bodies, and will draw the attention of its members to available models and insights in order to support them in fully understanding the implications of COVID-19 and in defining risk scenarios for financial institutions. The AAE will also be available to provide support to interested parties in interpretation of statistics in order to enable correct conclusions to be made. This could include comparison of incidence in European countries according to relevant criteria, e.g. population density, age, gender, socio economic segment, etc.

Modelling
Research-based actuaries have joined in the push to model more effectively the epidemiological dynamics of COVID-19 and the factors which might influence its ongoing development, both to contribute to broader public policy debates around responses to the crisis and to assist in private planning.

Scope of insurance cover
Differences have arisen between insurer, customer and government/regulator views on outcomes which are covered by insurance. Emerging from these differences, it is necessary to consider whether insurance cover is sufficient and how communications with customers can be better managed.

Extensions in cover may be necessary in the future in order to deal effectively with extreme events and provide the supplementary

cover needed in times of economic crisis. Collaboration between the public and the private sector, e.g. in public-private-partnerships, might be able to develop a combination of innovative reinsurance coverage, Catastrophe Bonds and pandemic pools to address the shortage of coverage. Further extensions of coverage will definitely require public backstops, as for other global risks with strong economic impact.

The AAE will be available to provide input to considerations around structuring of such cover extensions, including regulatory and capital implications of alternatives.

THE AAE AND COVID-19
Some of the areas where the AAE and individual actuaries are contributing during this crisis are listed above.

The AAE will be available to all of its Member Associations to ensure that insights to COVID-19 outcomes can be brought to bear across Europe. We are committed to acting as a hub to share information, set appropriate standards for actuarial practice and education, and collaborate with European institutions to foster positive outcomes for customers and other stakeholders. We will also consider the implications of the pandemic for future education requirements of actuaries, to ensure that actuaries remain fully equipped to support (re)insurance companies and pension schemes through all scenarios emerging.

This article was written mid-June.

ON THE **MULTIVARIATE MODELING** OF PUBLIC PENSION BENEFITS

BY **BY KIMONNTOTSIS, MARIANNA PAPAMICHAIL, PETER XATZOPOULOS** AND **ALEX KARAGRIGORIOU**

1   INTRODUCTION

The purpose of this work is to identify the appropriate factors and create a satisfactory forecasting model for the Public Pension Expenditures as a percentage of Gross Domestic Product (hereafter, PPE) of various European countries. This communication briefly presents the findings of a work published in Communications in Statistics *(see Ntotsis et. al[1] for the full paper)*.

2   PREFERENCE DATA

The modeling of PPE is based on 20 explanatory variables of 20 European countries chosen based on the completeness of available data. Annual observed data cover four periods (Models) 1. 2001-2005, 2. 2006-2010 3. 2011-2015 and 4. Overall 2001-2015. The value of each variable of each period is the period's average standardized.

Some of the variables in TABLE 2 are directly related to PPE like INF, CAB, and GDP while others as UR are indirectly related.
The purpose of this analysis is to identify those variables/factors and the way they affect the PPE.
The relevant analysis is presented in SECTIONS 3, 4 and 5.

TABLE 1:   SELECTED EUROPEAN COUNTRIES

Austria (AT)	France (FR)	Latvia (LV)	Republic of Slovenia (SL)
Belgium (BE)	Germany (DE)	Netherlands (NL)	Spain (ES)
Czech Republic (CZ)	Greece (GR)	Poland (PL)	Sweden (SE)
Denmark (DK)	Iceland (IS)	Portugal (PT)	Switzerland (CH)
Finland (FL)	Italy (IT)	Slovak Republic (SK)	United Kingdom (GB)

TABLE 2:   SELECTED POSSIBLE EXPLANATORY VARIABLES (COVARIATES)

Compensation of Employees (CoEM)	Gross Domestic Product (GDP)	Median Age of Population (MAGoP)	Total Household Savings (THSV)
Consumer Price Index (CPI)	Imports of Goods & Services (IoGaS)	Net Number of Migration Flows (NNoMF)	Total Household Spendings (THSP)
Current Account Balance (CAB)	Inflation (INF)	Net Number of Births (NoB)	Total Labor Force (TLF)
Demographic Dependency (DD)	Investments (INV)	Private Sector Debt (PRSD)	Total Saving Rate (TSR)
Exports of Goods & Services (EoGaS)	Long-term Interests Rates (LTIR)	Short-term Interest Rates (STIR)	Unemployment Rate (UR)

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3 DIMENSION REDUCTION (DR)

3.1 Feature Selection – Beale et al. technique

To eliminate minor factor contribution, at first a configuration of discarding variable technique was used, resulting to the subtraction of the highlight variables in TABLE 2.

3.2 Feature Extraction - Principal Component Analysis (PCA)

PCA was the optimal following DR technique for the processing of the remaining 15 variables; due to severe multicollinearity. The interdependent dataset was converted into a new uncorrelated one, arranged in descending order based on variability, PCA transformed covariates *(principal components (PC))*. Notably 7 variables Zj emerged as statistically significant (s.s.) in those PC can be seen in TABLE 3. They encompass 90% of the original variability, which leads to their selection.

TABLE 3: PRINCIPAL COMPONENTS ANALYSIS
7 primary Components Zj with the corresponding statistically significant emerged variables

Dataset	2001-2005	2006-2010	2011-2015
1st Component $(Z_1)^a$	GDP (0.96)	GDP (0.96)	GDP (0.98)
	Imports of Goods and Services (0.94)	Imports of Goods and Services (0.93)	Imports of Goods and Services (0.95)
	Inflation (0.89)	Inflation (0.94)	Inflation (0.76)
	Investments (0.79)	Investments (0.83)	Investments (0.81)
			Net number of Migration Flows (0.95)
	Number of Births (0.90)	Number of Births (0.90)	Number of Births (0.90)
	Private Sector Debt (0.93)	Private Sector Debt (0.95)	Private Sector Debt (0.87)
	Total Labor Force (0.91)	Total Labor Force (0.93)	Total Labor Force (0.92)
2nd Component $(Z_2)^b$	Median Age of Population (-0.70)	Median Age of Population $(0.71)^c$	Unemployment Rate $(0.81)^d$
	Long-term Interest Rates (0.75)		
3rd Component (Z_3)	CAB (0.70)	CAB (0.65)	CAB (-0.71)
4th Component (Z_4)	Unemployment Rate (-0.80)	Unemployment Rate (-0.54)	CAB (-0.46)
5th Component (Z_5)	CPI (-0.45)	Demographic Dependency (0.46)	Compensation of Employees (-0.42)
6th Component (Z_6)	Compensation of Employees (-0.52)	Compensation of Employees (-0.60)	Compensation of Employees (-0.46)
7th Component (Z_7)	Investments (-0.33)	Investments (-0.40)	Investments (-0.34)

[a] Z_1 holds at least 50% of the total variability of the original dataset - can be viewed as a fusion of macroeconomic, demographic, and microeconomic variables.

[b] Z_2 holds roughly 20% of the total variability of the original dataset –can be viewed as a fusion of macroeconomic and demographic variables.

[c] The second highest variable coefficient belongs to the CPI (0.68).

[d] The second highest variable coefficient belongs to the Median Age of Population (0.65).

Highly indistinguishable is that the emerged variables in every PC were almost identical, except for period3 probably attributed to the 2010 European Crisis *(ES, GR, IR, IS, and PT)*.

4 THE MODELING OF PPE

4.1 Model selection, assessment, and comparison

Aiming to an '*ideal*' model, stepwise Regression Analysis is performed by using the 7 PC of TABLE 3 as explanatory variables and the logit(PPE) as the response variable (Y). With multicollinearity checked and corrected in SECTION 3 and based on TABLE 4, only Z1 and Z2 should be used for modeling (SECTION 3.2). Thus the amount of variability explained is high; retaining a considerable degree of the internal datasets' structure as each Zj contains all 15 covariates resulted from SECTION 3.1.

TABLE 4: MODEL SELECTION FOR ALL TIME-BASED DATASETS
Contains the top 3 of 7 models, with the omitted ones being associated with at most 2% improvement

Model	2001-2005			2006-2010			2011-2015			Overall Model		
	R	Adj. R²	S.E.	R	Adj. R²	S.E.	R	Adj. R²	S.E.	R	Adj. R²	S.E.
1	0.527[a]	0.238	0.217	0.497[a]	0.205	0.218	0.585[a]	0.306	0.192	0.545[a]	0.258	0.201
2	0.664[b]	0.375	0.197	0.687[b]	0.410	0.188	0.656[b]	0.363	0.184	0.622[b]	0.314	0.193
3	0.727[c]	0.440	0.186	0.770[d]	0.517	0.170	0.673[e]	0.350	0.186	0.651[f]	0.316	0.193

Predictors: α: (Constant), Z1 or Z2; b: (Constant), Z1, Z2; c: (Constant), Z1, Z2, Z4; d: (Constant), Z1, Z2, Z7; e: (Constant), Z1, Z2, Z5; f: (Constant), Z1, Z2, Z6; A. R2: Adjusted R squared; S.E.: standard error of the estimate

4.2 Regression

TABLE 5: ANALYSIS OF VARIANCE FOR ALL DATASETS BASED ON THE SELECTED MODEL

Model	2001-2005			2006-2010			2011-2015			Overall Model		
	SS	F	Sig.	SS	F	Sig.	SS	F	Sig.	SS	F	Sig.
Regression	0.522	6.699	0.007	0.540	7.606	0.004	0.439	6.415	0.008	0.402	5.354	0.016
Residuals	0.663			0.604			0.581			0.638		
Total	1.185			1.144			1.020			1.039		

KIMON NTOTSIS

TABLE 6: REGRESSION COEFFICIENTS OF PPE

Model	2001-2005			2006-2010			2011-2015			Overall Model		
	Coefficients		Sig.	Coefficients		Sig.	Coefficients		Sig.	Coefficients		Sig.
	B	S.E.		B	S.E.		B	S.E.		B	S.E.	
(Constant)	-2.247	0.044	0.000	-2.454	0.042	0.000	-2.271	0.041	0.000	-2.324	0.043	0.000
Z_1	0.017	0.006	0.010	0.016	0.006	0.012	-0.009	0.006	0.125	0.037	0.017	0.039
Z_2	-0.040	0.018	0.040	0.045	0.017	0.015	0.057	0.018	0.005	0.088	0.056	0.133

The R coefficient TABLEs 4-6 ranges from 49% to 77% and at least one statistically significant explanatory variable exists in each case, verified by the appropriate t-test.

TABLE 7: CORRELATION SIGNS BETWEEN Y AND THE 15 VARIABLES XI SECTION 3.1, BASED ON LITERATURE

Public Pension Expenditures/ GDP	Y	Signs	Variable Classification
GDP	X1	-	Macroeconomic
Unemployment Rate	X2	+	Macroeconomic
Total Labor Force	X3	-	Macroeconomic
Imports of Goods and Services	X4	-	Microeconomic
CAB (Negative/Positive Amount)	X5	+/ -	Macroeconomic
Investments	X6	-	Macroeconomic
CPI	X7	-	Macroeconomic
Median Age of Population	X8	+	Demographic
Number of Births	X9	-	Demographic
Net Number of Migrant Flows	X10	-	Demographic
Demographic Dependency	X11	+	Demographic
Inflation	X12	-	Macroeconomic
Longterm Interest Rates	X13	+	Macroeconomic
Private Sector Debt (Negative Measure)	X14	-	Microeconomic
Compensation of Employees	X15	-	Macroeconomic

MARIANNA
PAPAMICHAIL

5 MACROACTUARIAL JUSTIFICATION

5.1 Country Interpretation

It can be stated (FIGURES 1-4) that our model fits well country measures except for few divergent ones AT, CZ, LV, PL, SK – Eastern EU countries- and ES.

Reasons may be the heterogeneity between periods, due to major pension reforms, reversal of migration flows (FIGURE 5), and remarkable income inequalities (GINI index for Eastern EU countries)

Comparison of the Actual (Observed) values with the dependent variable Y

FIGURE 1. 2001-2005 MODEL, (Z1 AND Z2) — Actual Values — Estimated Values
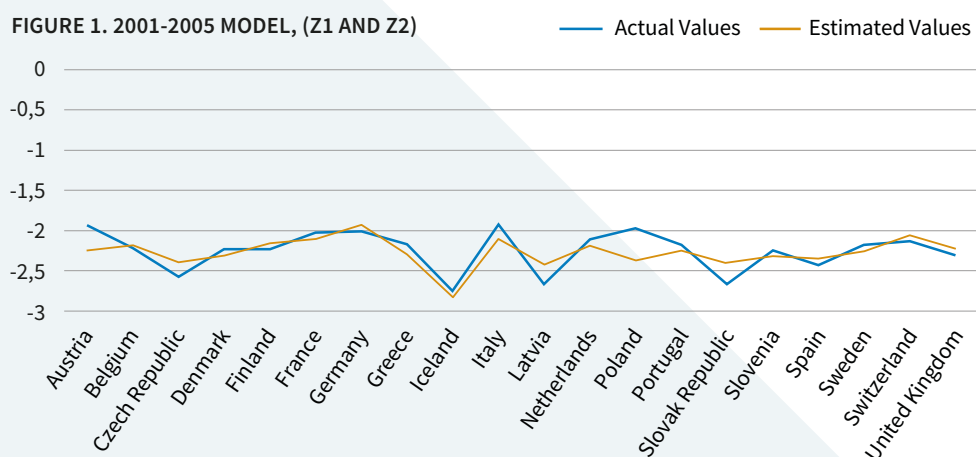
FIGURE 2. 2006-2010 MODEL, (Z1 AND Z2) — Actual Values — Estimated Values
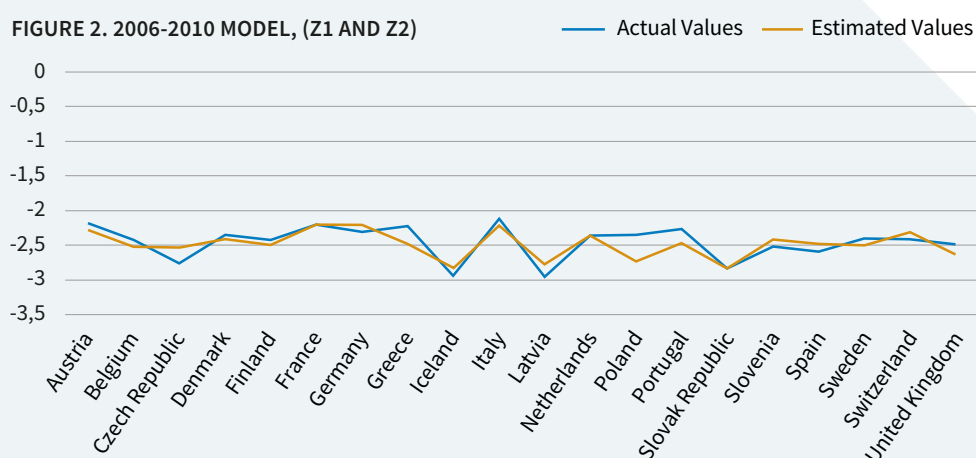
FIGURE 3. 2011-2015 MODEL, (Z1 AND Z2) — Actual Values — Estimated Values
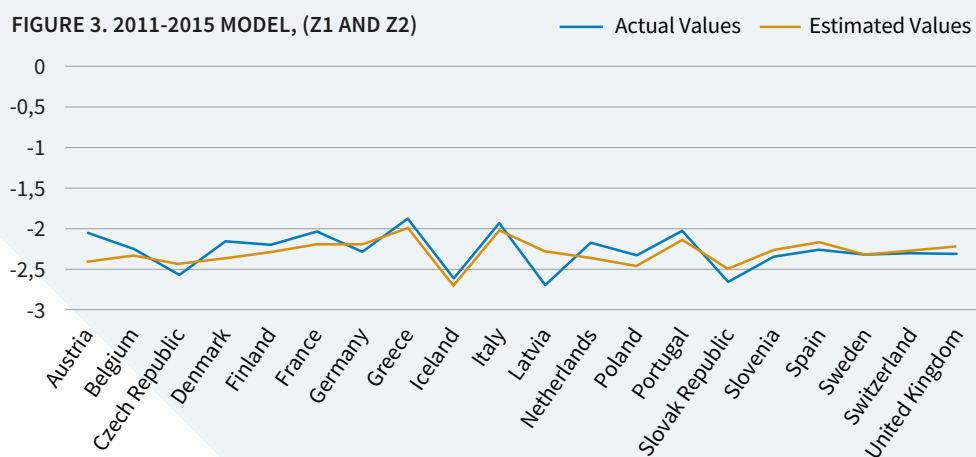
FIGURE 4. OVERALL MODEL, 2001-2015, (Z1 AND Z2) — Actual Values — Estimated Values
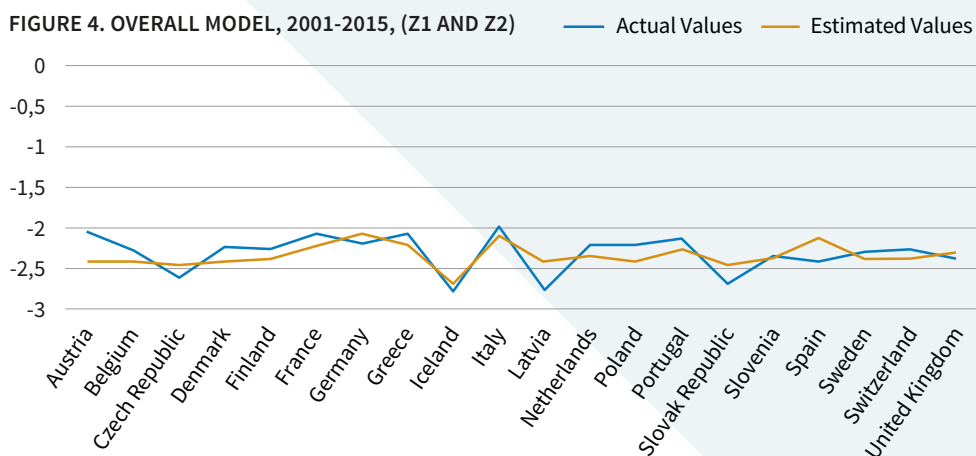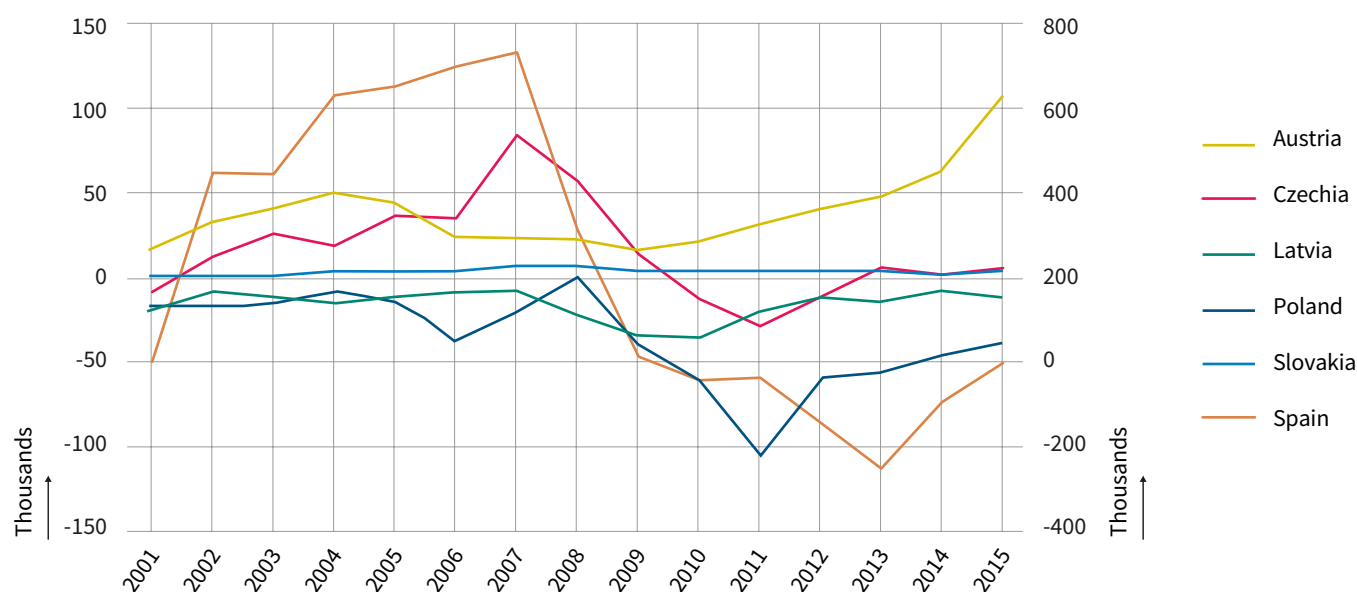
FIGURE 5. NNOMF 2001–2015 FOR AT, CZ, LV, PL, SK AND ES (RIGHT AXIS)

5.2 Period 1 and 2 Interpretation

Always 7 variables emerge as the most important in Z1: $GDP^{(X1)}$, $TLF^{(X2)}$, $IoGaS^{(X4)}$, $INVs^{(X6)}$, $NoB^{(X9)}$, $INF^{(X12)}$ and $PRSD^{(X14)}$ (TABLE 3). Nearly all information needed for Y is included in $GDP^{(X1)}$. Actually another important component is the net indirect taxes upon $IoGaS^{(X4)}$, defined as VAT, represents one of the ingredient components of $GDP^{(X1)}$ from the income side. Identical correlations are displayed, between Y and the considered explanatory variables (excluding $CAB^{(X5)}$ and $MAGoP^{(X8)}$) as the relative literature reviews (TABLE 7). $CAB^{(X5)}$ represents yearly the output Gap of a country's economic activity. Apart from DE, $CAB^{(X5)}$ for the majority of the countries, is always negative. In DE it is positive and negatively correlated to Y.

$INF(X12)$ is usually the same as the GDP deflator and when Y rises, it falls. As the Pay As You Go system is adopted by countries, demographic variables like $NoB^{(X9)}$ and $MAGoP^{(X8)}$ are important (TABLE 3). $LTIR^{(X13)}$ is significantly affected by the country's deficit accumulations as lower PPEs lead to more favorable

pumping money solutions. In the 2nd period $UR^{(X2)}$ grows more important, outlying the increasing dependency of the system to the labor market also acknowledged by $TLF^{(X3)}$. Demographic $DD^{(X11)}$ too gains importance.

5.3 Period 3 Interpretation - the Migration Effect during 2011- 2015

An eighth variable $NNoMF^{(X10)}$, concerning population changes, enters into the 1st Component, although meaningless in previous periods. Migration here plays a role of accelerating importance since EU countries continue to attract large immigration flows, 18 million for the whole period. In this context, future analysis concerning the period 2016- 2020 might verify these findings.

6 CONCLUSIONS - FUTURE RESEARCH

In conclusion, the proposed model results in two Components, containing more than 70% of the total variability of the original dataset and provides, with a minimum average error of less than 6‰. It is possible, according

to data availability, to develop an evolved time series predictive model for the PPE for 10-15 future years.

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REFERENCES:
1. Kimon Ntotsis, Marianna Papamichail, Peter Hatzopoulos & Alex Karagrigoriou (2019): On the Modeling of Pension Expenditures in Europe, Communications in Statistics: Case Studies, Data Analysis and Applications, DOI: 10.1080/23737484.2019.1690598.

SHEDDING LIGHT ON
COVID-19 DATA

BY **MATTHEW EDWARDS**
AND **STUART MCDONALD**

Anumber of actuaries have come together to form a COVID-19 Actuaries Response Group with a multitude of informative papers put together at **www.covid-arg.com** including a weekly bulletin summarizing major developments. This is informed reading for those wanting to keep abreast of current thinking.

Issues now under active investigation include the development of the R number of infections passed on on average from each infected individual to help inform assessments of the wisdom of various stages of relaxation of lockdown policies.

One particular issue recently addressed by Matthew Edwards and Stuart McDonald (who also co-lead the Group above) is the question of how many victims would have died in the ordinary course of events. A fuller version of this article appears in the May

2020 UK issue of The Actuary. Further work looks at the impact of COVID-19 deaths on the likely mortality to be experienced in the coming years to assist actuaries in setting their assumptions.

STUART MCDONALD

HOW MANY COVID-19 VICTIMS WOULD HAVE DIED ANYWAY?

There has been comment and speculation in the media about the actual and likely future life expectancy of COVID-19 victims –

often downplaying the impact of the virus, as 'they were about to die anyway'. One epidemiologist, Professor Neil Ferguson, said in late March that 'the latest research suggested as many as half to two-thirds of deaths from coronavirus might have happened this year anyway, because most fatalities were among people at the end of their lives or with other health conditions'.

HOW THIS VIEW HAS ARISEN

The strongest case we have seen for the 'they would die soon anyway' position is based on use of Bayes' theorem. Most readers will realise how this will apply here: we can calculate 'probability of COVID-19 causation given death' from an assumption about 'probability of death given COVID-19' (ie the case fatality rate, [CFR]), along with equivalent probabilities of deaths from other causes. If the CFR is very low compared with the '*other causes*' probability of death for an individual, it follows (via Bayes) that their death in any year can be attributed largely to natural causes, not COVID-19.

The other argument for this case arises simply from observing that many of the deaths reported from COVID-19 have been deaths of people with existing medical conditions. For instance, 17% of Italian COVID-19 patients in intensive care had a history of diabetes, and 49% had hypertension (*bit.ly/2KhdrsP*).

The reporting of such aspects, along with other risk factors such as obesity or smoking, has generally been '*crude*' in
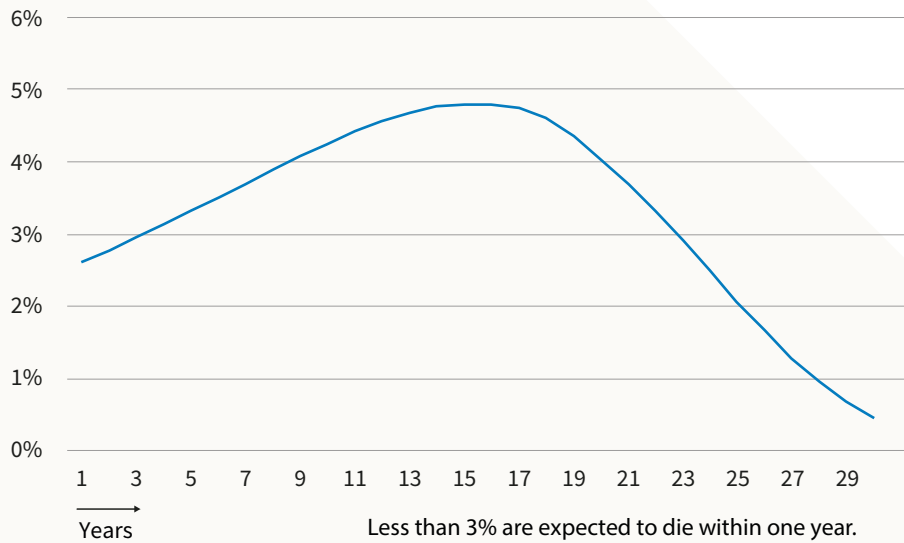
MATTHEW EDWARDS

the sense that it has not been adjusted for age. However, deaths from COVID-19 have generally been occurring at high ages. For instance, early data in Italy showed that 84% of male deaths have been in those above the age of 70 and that 93% of deaths in the UK were in those older than 65.

While the differences between countries reduce comparability, it is clear that the prevalence of existing conditions at high ages is not massively out of line with the proportions being seen among those dying from COVID-19.

DISTRIBUTION OF DEATHS OVER FUTURE YEARS - DIABETIC MALE SMOKER AGED 60

Less than 3% are expected to die within one year.
Less than 15% are expected to die within five years.

TYPICAL LIFE EXPECTANCIES OF IMPAIRED LIVES

When considering the life expectancy of people with conditions such as those above, a useful approach is – do they have just months to live, or many years?

For this, we have made use of a proprietary underwriting engine that calculates life expectancies for people according to age, gender, disease history, lifestyle (body mass index, smoking habits) and various other factors. Using this underwriting engine, a life expectancy below a couple of years can be found only by assuming acute cancers, or other serious but less critical conditions at ages above 90, or such conditions conjoined with adverse risk factors (eg smoking) from the mid-80s. For anything else, life expectancy is typically five years or more.

By looking at men rather than women (men having a lower life expectancy), considering the '*obese smoker*' subset of these impaired

lives, and assuming no future mortality improvements, we do not see life expectancies below one year, and it takes a lot of '*forcing*' the factors in the engine to find life expectancy as low as two or three years.

Of course, life expectancy is an average, and some of these cases would still die during the course of a year in the absence of COVID-19. In most instances, though, the number is not high. For instance, *the graph above* shows the distribution of deaths for a cohort of 60-year-old obese diabetic male smokers as per the above table – fewer than 3% are expected to die in the next twelve months.

UK INTENSIVE CARE EXPERIENCE

ICU supports failing organs while a patient's underlying illness is treated, and is usually only helpful when the patient has a potentially reversible condition.

The Intensive Care National Audit and Research Centre's (ICNARC) report of 17 April 2020 (**bit. ly/3bzWGoI**) on COVID-19 critical care patients and their outcomes presented a useful profile of the 5,578 patients recorded.

Most patients (72%) are male and, on average, 60 years old; 38% are obese (BMI > 30), compared to 30% in the general population. Just 7% have very severe comorbidities and 7% needed some assistance with daily activities prior to contracting COVID-19. (ICNARC also provides corresponding numbers for normal viral pneumonia cases during the past two years, where we see 24% of patients with very severe comorbidities, and 26% needing assistance with daily activities). It seems clear from this high ratio that the majority of deaths can be regarded as being due to COVID-19, not to other conditions.

> *Only a tiny fraction of impaired lives have life expectancies of the order of one year.*

ARE ICU PATIENTS REPRESENTATIVE?

ICU patients are obviously not representative of the general population – it would be worrying if they were – but, other than the severity of the disease, are they broadly representative of all those known to have COVID-19? In other words, is the triage process applied to COVID-19 sufferers likely to have removed, for instance, those deemed incurable or too frail, given that the numbers of potential ICU patients may exceed the number of spaces?

We have examined the characteristics of those placed into ICU with those of the larger population of Covid sufferers and we can cautiously conclude that the current ICU population is not highly selective and therefore the disease is making significant numbers of individuals who were otherwise fairly healthy seriously unwell.

This conclusion is consistent with our discussions with two critical care consultants, who have confirmed that COVID-19 ICU patients are broadly representative of general hospital patients (albeit with the most and least healthy tails of the distribution removed) and that 'COVID-19 patients admitted to our ICU are generally healthier than our normal patient population, but despite this, have a high mortality. People are dying in middle age, with many years ahead of them.'

CONCLUSION

COVID-19 does seem to disproportionately affect people with chronic health problems.

On the other hand, while it affects the old more than the young, and a large proportion of the elderly will have chronic health problems, only a tiny fraction of impaired lives have life expectancies of the order of one year.

Therefore we feel it is unfounded to claim that a large proportion of those who have died from COVID-19 in 2020 would have died in any case this year.

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INSURABILITY OF PANDEMIC RISKS?

BY **FRANK SCHILLER, RAINER FÜRHAUPTER** AND **DETLEF FRANK**

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The current corona pandemic is the first global pandemic after the Spanish flu almost exactly 100 years ago, with drastic consequences for millions of people and the global economy.

As a natural, person-related event, a pandemic is insured in individual health and life insurance without restrictions. For the insurance companies (in Germany), there are hardly any underwriting problems due to compensating effects, but

there are risks of losses on the investment side due to the overall economic situation. Insurability is also ensured in private non-life insurance. The picture, however, differs in commercial non-life insurance.

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Based on experience gained from previous pandemics or epidemics, such as the Spanish flu, SARS and Ebola, the private insurance industry worldwide has attempted to implicitly limit or even explicitly exclude the insurance of pandemic risks for these commercial risks. This is because if almost all the insured in a portfolio are affected, the basic principles of private insurance cover are no longer fulfilled. In the corona pandemic, customers and politicians question these exclusions for some products. In addition to insurance against event and credit claims, the industry is looking for viable solutions for future cases of widespread business interruptions in industries and closures in hotels and restaurants, for example. The following section deals with the question of the extent to which private insurance cover for extreme pandemic risks in property and casualty insurance can be made available for commercial risks from an actuarial perspective.

HOW DOES PRIVATE INSURANCE FOR EXTREME EVENTS WORK?

The basis of private insurance is the compensation of claims from independent risks collectively and over time. This spread of risk is approached methodically from two perspectives: One is the risk-theoretical model of premium calculation with a focus on the average expected claims experience per year and its fluctuations over several years. Another is the capacity of an insurance company to absorb rare but extreme fluctuations in claims experience in relation to its annual balance sheet.

Based on a precise, legally binding description of the risk within the framework of the insurance conditions and risk descriptions, actuaries calculate the claims expectation and its possible deviation. In addition to the claims or losses normally expected each year, special attention is paid to major losses and so-called accumulation losses, since these do not occur on a comparable scale every year.
Accumulation losses simultaneously affect a large proportion of the insured risks, where the criterion of independence from risks may be violated, since they are affected simultaneously or '*infectiously*' by the same cause of claim. The major losses and accumulation losses are considered over a period of many years up to centuries (!) - these are known as return periods - and are mathematically modelled. They are included with corresponding proportions in the calculation of the total loss to be expected per year (expected loss value). It is intuitively clear that insurance portfolios with a high potential burden of major losses or accumulation losses involve a considerable risk of fluctuation in the expected loss value. Insurance companies can only bear these risks as part of their long-term strategic planning using the following risk policy instruments:

Portfolio mix: The individual insurer offers many different products and uses them to form independent sub-portfolios, which are unlikely to be affected simultaneously by major losses and accumulation losses. Within a financial year, for example, this allows a certain degree of equalisation of the claims burden from major losses and accumulation losses between the sub-portfolios.

Special provisions / equity components: For property and casualty insurers, the equalization reserve under the German Commercial Code offers an important instrument for the spread of risk - during the period in which, according to clearly defined rules, reserves are built in years with few claims and are released in years with a high claim burden. Other accounting regimes do this analogously by means of the tax-free accumulation of special equity capital shares.

Reinsurance / retrocession: Across (many) insurance companies, reinsurance and retrocession (reinsurance of reinsurance) are considered a suitable instrument for making major losses and accumulation losses sustainable. Each of the insurance and reinsurance companies involved assumes part of the extreme burden of claims. Here, too, it is important for each participating company to structure its own portfolio

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excess burden of claim up to a maximum amount in excess of a maximum liability sum for the entire insurance industry. On the other hand, the distribution of the burden among the participating insurers is also regulated in detail. In Germany, for example, the maximum liability of the special insurer EXTREMUS in the case of terrorism is limited to 2.52 billion euros, with the state bearing a further 6.48 billion euros. There is a statutory maximum liability limit of 2.5 billion euros in the event of a nuclear power plant accident, with the insurance industry bearing up to 256 million euros via the German Nuclear Reactor Insurance Association. After that, the joint and several liability of the power plant operators is limited to the maximum liability limit. National pools generally provide each other with worldwide reinsurance cover and thus contribute to a further collective balance.

EFFECTS ON INVESTMENTS OF PARTICULAR SIGNIFICANCE

Up to this point, the pure underwriting instruments of risk assumption have been listed, which are also used in underwriting modelling. In addition, a cross balance sheet risk assessment must determine, for example under Solvency II, what financial resources are available to bear the risk of an extreme event occurring. Besides other underwriting effects, such as expenditure and relief in classes of business not directly affected, the situation on the assets side of the balance sheet and the development of shareholders' equity are decisive in this context.

FRANK SCHILLER

mix in such a way that the risk of simultaneous claims for sub-portfolios is suitably limited.

Pooling and limitation of the burden of claims and state assumption: Special instruments have been created for clearly defined extreme events such as nuclear power plant accidents or terrorist claims. On the one hand, these limit the burden of claim for the entire insurance industry, in which the states assume the

In particular, the question arises as to whether the extreme event could have a positive impact on investment results, which could be possible, for example, after a natural hazard claim because of the upswing in the construction and consumer goods industry, or whether the investments are likely to be adversely affected.

In the current corona crisis, we are observing that the global economy is facing a severe recession because of the lockdown. Nearly all investments, not only equities but also fixed-income investments and to a certain extent real estate, generate significantly lower returns and show considerably higher volatilities. They thus represent a greatly increased investment risk. If this were to be the case at the date of the annual financial statement, the equity capital of the insurance companies, which serves primarily to ensure that insurance obligations can be fulfilled on a permanent basis and to maintain the companies' ability to conduct business, would be consumed and cannot be used for the short-term compensation of claims.

WHAT DOES CORONA SHOW FOR THE FUTURE INSURANCE OF PANDEMICS?
In principle, pandemic risks and war risks in the private insurance industry can be systemically excluded for commercial property insurance. This is because:

- Firstly, the criterion of independence of risks is clearly violated;
- Secondly, unlike a clearly describable property loss event such as a storm, the triggering of the claim event cannot be clearly delimited; and

- Thirdly, the extent of the loss payments for the insurers in the event of such an event affecting the entire economy does not appear to be effectively limitable.

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A comparison with the insured sums, for example for the insurance of a nuclear power plant accident or a terrorist attack, shows a large discrepancy to the amounts currently brought into play by the state as aid to the economy in the case of Corona. Given the level of the premiums required and the balance sheet capacity of the entire German or European insurance industry, it is not possible to present a private insurance company that can cover total claims in the double or even triple-digit billions. The article will examine this in more detail below with a view to the possibilities offered by insurance.

The current corona pandemic is proving to be an extreme event for potentially affected products and parts of non-life insurance for commercial risks, affecting the insured risks almost entirely. This means that there is no balance in the collective at the level of the sub-portfolios. Even a compensation in the near future cannot be realised at the level of the sub-portfolios due to the long return period of many decades. As a result, companies are not in a position to build up appropriate risk provisions.

COMPENSATION VIA OTHER SUB-PORTFOLIOS POSSIBLE?

Compensation through other sub-portfolios that are not affected by the corona pandemic

or even relieved of the losses can theoretically be achieved. Changed risk parameters can limit the positive effects from the companies' point of view. These include a reduction in the annual mileage of passenger cars in motor insurance or premium reductions and refunds in line with conditions or premium deferrals and cancellations due to financial bottlenecks on the part of customers. In addition, provisions and the investments covering them in unaffected sub-portfolios cannot be used for legal reasons, i.e. due to accounting law.

Although reinsurance solutions can have a positive effect on the viability of insurance companies, there are only limited compensatory effects because risks are affected worldwide or are not independent. As already mentioned above, the global reinsurance market will not be able to absorb the full financial consequences of a pandemic without limitation, for example in the area of business interruption.

This is illustrated by the following indicative calculation: In non-life insurance, the total claims expenditure of the German insurance industry in 2018 will amount to 52.5 billion euros and premium income to 70.7 billion euros. A pandemic insurance with a return period of approximately 100 years would allow an annual premium income of no more

than 1 percent of the maximum liability sum, i.e. a maximum of 10 million euros for a billion euros. It must therefore be possible to provide additional cover for major pandemic damage over and above the financial resources of the insurance companies shown so far. This only seems possible with market-wide compensation funds in the small single-digit billion range.

PRECISE DEFINITION OF SERVICES AND GOOD COMMUNICATION INDISPENSABLE

For higher amounts, comparable to terrorism risks, only pool solutions with limitation of the maximum claim for the entire insurance industry remain as substantial private-sector insurance solutions for extreme pandemics. Actuaries can model under which conditions which maximum amounts can be represented nationally or globally by the insurance industry for such extreme events. However, due to the nature of pandemic risks, the mutual spread of risk via pools on a global level will only function to a limited extent, unlike nuclear power plant and terrorism risks. Beyond these maximum amounts, states must guarantee cover if all companies in the economy are to be helped on a nationwide basis.

The current Corona crisis shows that the concrete construction of supplementary insurance cover

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for the private sector is a very challenging task because of the many individual governmental measures, such as short-time working benefits and economic stimulus measures at several levels, which have an impact on the economy as a whole and on the individual companies affected. The fundamentally different objectives of overarching aid measures, which are aimed at the national economy as a whole and the definition of the individual insurance cover of a single company are a particular challenge when determining the legal basis of the cover.

In view of the existential threat and the high sums at stake, a clear description of future expectations of insurance protection under private law in the event of pandemics is of utmost importance. In addition, it is indispensable to accompany new insurance offers in a very transparent manner during their development, introduction and mediation and even more so when they are taken up, in order to clearly describe the scope of services of the entire coverage for everyone.

CONCLUSION: JOINT AND SEVERAL COMMERCIAL INSURANCE COVER ONLY POSSIBLE WITH STATE LIABILITY

Despite the lack of independence of risks, pandemics are an acceptable risk for the private insurance industry in the area of person insurance and private non-life insurance, although the profitability of investments may be negatively affected by the macroeconomic lockdown. The coverage of commercial risks of non-life insurance policies is only possible to a limited extent and only with supplementary risk coverage by the state according to the model of the insurance of nuclear power plant accidents and terrorist threats; because entire portfolios may be affected at the same time and the principles of private insurance protection may be undermined. Actuaries of the Actuarial Association of Europe (AAE) are available to discuss the possibilities of such a model.

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HOW DO **MODEL USERS SEE** THE COVID-19 CRISIS?

BY **LOUIS DE LOUVENCOURT**

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Covid-19 was named like this because this new corona virus infected humans first in December 2019 in Wuhan, China. It would have been better called Covid-20 given the huge footprint it will have on the whole year 2020, and beyond…

Writing about the impact of Covid-19 in April 2020, only four months after the outbreak is a difficult task. As I hold my pen, most insurance companies are still watching claims rising and premiums not being written. They strive to keep organized, while staff are learning to work from home, in quarantine, often in a stressful situation.

The financial losses from all types of businesses due to the lockdown will probably amount to hundreds of billions of euros. Insurers cannot take on such a sum without support from European states. This is by the way the reason why pandemics, revolutions and wars are normally excluded from contracts: these events don't allow for risk mutualisation; the risk can't be spread among policyholders when an event affects everyone at the same time and with strength.

Nevertheless, the impact estimated today is only the tip of the iceberg. This is why a forward-looking risk assessment is paramount. This is a necessary exercise in order to take the right decisions, to limit losses, to inform supervisors and policyholders, and to demonstrate ownership of one's business.

For internal model users[1], that is a use test: an opportunity to demonstrate how fit the model really is to estimate impacts from different scenarios on the undertaking's solvency; how much management relies on the model, and how reactive are the processes and systems to adapt to a urgent situation. An extraordinary reporting using the internal model, e.g. on weekly basis, is only a first step.

In Europe, 195 insurance and reinsurance companies are authorized to use an internal model (total or partial)[2]. They represent around 40% of the total volume, whether in terms of assets, technical provisions, liabilities, premiums or Solvency Capital Requirement.

For the most diversified insurers, underwriting several lines of businesses and undertaking both biometric and P&C risks, impacts will be softer. But model validation teams will see an opportunity to challenge modelling assumptions, and in particular the correlations between main risk categories. In the current turmoil, health (and health catastrophe), life, P&C, market, credit and operational risks are realised simultaneously or in chain.

The outcome of this exercise will be very different across insurers depending on their exposure, risk profile and operating markets. The following paragraphs explore several insurance activities affected now, as well as a few scenarios which could affect insurers in the near future. In each case, the primary step is to assess the appropriateness of the best estimate. Then, model users need to assess the impact on the SCR, i.e. the 99.5th scenario[3].

BUSINESS INTERRUPTION INSURANCE

Insurance contracts covering business interruption are classified as Miscellaneous financial loss (class 16). Part of these contracts across Europe do not exclude losses caused by pandemic[4]. Litigation between businesses and their providers may also generate legal expense claims. Furthermore, strong social and political pressure is put on insurers to compensate for business interruptions, which might apply retroactively to cases since March 2020. All this creates uncertainty; there is a high chance that premiums will not match insurers' expectations and that
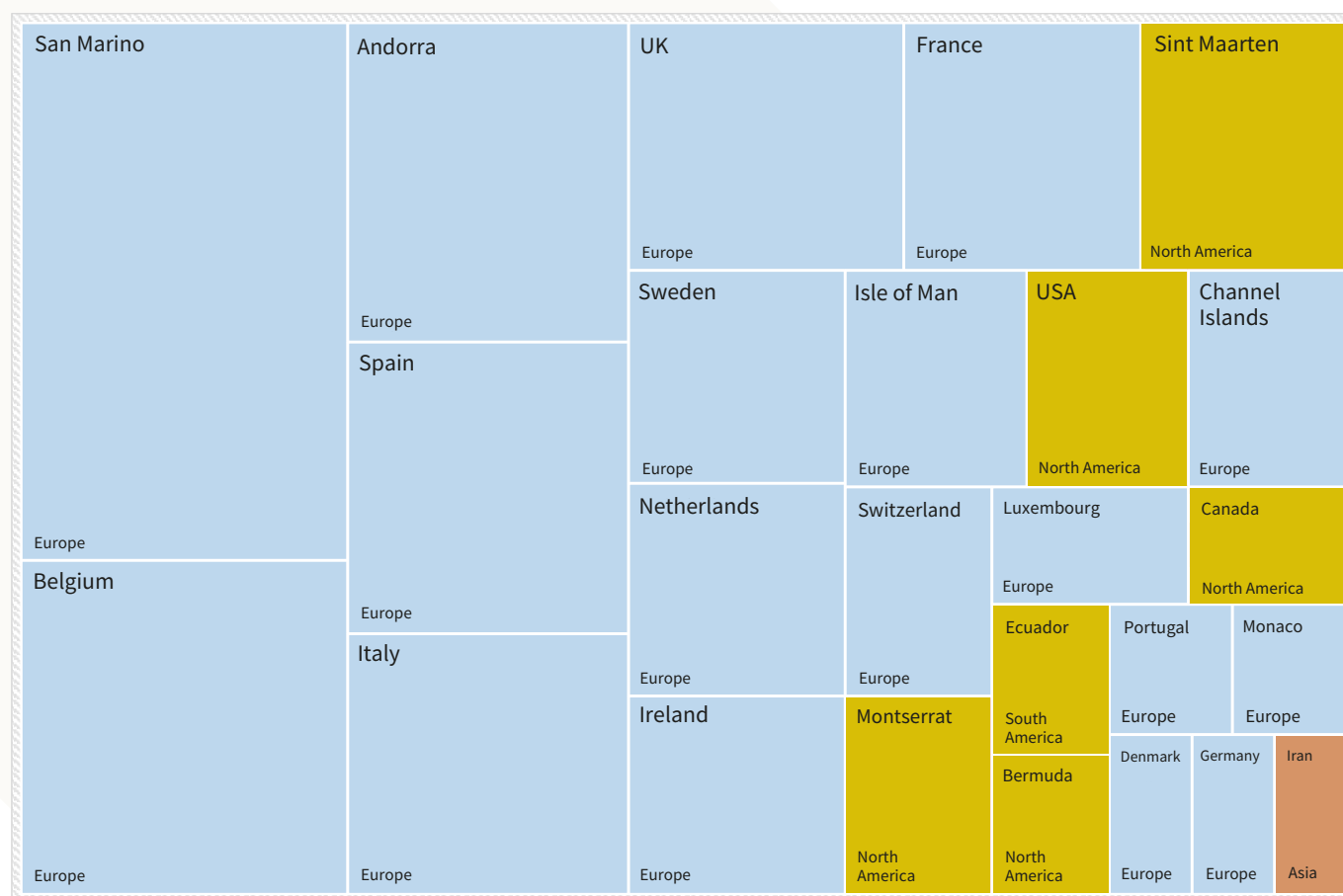
1 *'Model users'* considered in this article include senior management, actuarial function holder, and model validation department.

2 According to statistics from the European Insurance and Occupational Pensions Authority (EIOPA)

3 There should be consistency between the *'middle scenario'* (i.e. the 50th percentile) from the probability distribution forecast used to derive the SCR, and the best estimate.

4 While business interruption insurance is in general not covered (because it is usually conditional to property damage), business closure insurance might cover losses resulting from the closure of a company due to official orders, e.g. because of infectious deseases or pathogens.

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TREEMAP OF 25 COUNTRIES WITH HIGHEST COVID-19 DEATH RATES (BLUE=EUROPE)

San Marino	Andorra	UK	France	Sint Maarten
Europe	Europe	Europe	Europe	North America

(treemap regions: Spain — Europe; Belgium — Europe; Italy — Europe; Sweden — Europe; Isle of Man — Europe; USA — North America; Channel Islands — Europe; Netherlands — Europe; Switzerland — Europe; Luxembourg — Europe; Canada — North America; Ireland — Europe; Montserrat — North America; Ecuador — South America; Portugal — Europe; Monaco — Europe; Bermuda — North America; Denmark — Europe; Germany — Europe; Iran — Asia)

reserves will not match actual claim payments. Model users will need to revise their assumptions to ensure that this new uncertainty is well captured.

CREDIT INSURANCE

The insurance class number 14[5] includes coverage against insolvency and against various forms of credit events. And without doubt, many small, medium and large businesses will go bankrupt, either from the falling demand, or as collateral damage from their own providers going belly up. This activity includes portfolios of mortgages and loans. Model users will need to update their underlying databases, taking into account this experience which brings plenty of new data points, whereas information was limited so far. As a result, assumptions of correlation between credit events will need to be challenged too.

HEALTH INSURANCE

Health insurance policies can cover the cost of care or hospitalization, and is therefore exposed to Covid-19. But in several countries, much of these costs are covered by the public health system. For model users, it will be important to assess the boomerang effect of health costs: indeed the lockdown leads many doctors and patients to postpone certain non-vital operations and medical treatments which appears to reduce temporarily the costs for insurers. However, one can expect a more intense medical activity once Covid-19 ceases to be the top priority. For insurers modelling health or/and life catastrophe risk explicitly, the Covid-19 experience

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5 Annex I of the Solvency II Directive.

6 **www.worldometers.info/ coronavirus/** as at 10th May 2020.

may trigger model validation teams to reassess the current calibration for pandemic risk.

LIFE INSURANCE

Among the 25 countries with higher Covid-19 death rate, 18 are European Economic Area countries[6]. Although the mortality due to Covid-19 remains limited compared to '*normal*' mortality, Europe is the most severely hit continent. For life insurance policies, the payment of benefits in case of death is the main impact. After the epidemic has passed, no after-effect is expected.

OPERATIONAL RISK

Insurers should carefully consider and effectively manage the increased risk exposure to fraud, other criminal activity, cyber security and data protection due to the disruption of society and, in particular, staff working remotely.

REAL ESTATE SCENARIO

If current trends continue, the coronavirus crisis will seriously hurt the office: in some cases a rental holiday was granted for a few months and in other cases the renters just stopped paying the rent. Many businesses are not expected to reopen once the crisis passes, leaving much unoccupied office space; others may allow their employees to continue working from home or opt to save money by taking advantage of more flexible co-working spaces. Hubertus Heil, Germany's Labour Minister, is currently drafting a law to give people the right to work from home even after the crisis. Not only offices, but also spaces rented out to restaurants, cafés,

bars and discos will also take a hit. It will require experts some effort to update model parameters regarding future real estate prices, and assess the important uncertainty around it.

SCENARIO TESTING AND REVERSE STRESS TEST

During the crisis, lapse rates might rise as policyholders need cash. This mass lapse could be worsened by a loss of confidence in the insurance sector, leading to very low renewals and low volumes of new business overall. With no cash in-flow, depleted value of assets and a high number of claims (e.g. from life and health contracts, or from credit insurance), insurers would experience a liquidity stress, which is the front door to insolvency. Model users are well placed to assess the combined effect of different causes; and proper anticipation using realistic scenarios allows appropriate mitigation. Reverse stress tests will tell an insurer how bad a scenario can be until it leads to bankruptcy.

Independently from scenario testing, model users will have to reassess their correlation assumptions. Among other effects, the decrease in interest rates and spread widening during the crisis might put in question some of the current correlation parameters for interest rate risk and spread risk; the crisis might also give rise to additional correlation tail events for market risks and lapse risk and suggest an increase of the corresponding correlation parameters.

OTHER LONG TERM SCENARIOS

Rapidly after the start of the

epidemic in Europe, some governments and politicians expressed the need to switch back to local providers, using short supply chains. As a consequence, insurance on goods and transport would fall. But will Europe give up on its Thai rice, coco milk and trendy tofus?

Growing online activities, from grocery shopping to homeworking is also leading to increasing cyber risk, making more people and businesses targets for hackers. It might be time for governments to invest in cyber security, but insurance should also be ready for this rising opportunity/threat.

A temporary pause in car claims means a gain for motor insurers. But it might also trigger a trend to lower use of cars after the crisis. From Berlin to Bogotá to Vancouver to Milan, cities are already taking steps to broaden bike lanes and allow more cycling. Insurers should be anticipating a general drop in demand, with consequences on claim volatility and on expenses/ fixed costs.

Of course, the airline industry was temporarily grounded, but it could also '*fly low*' for many months, and with it travel and plane insurance.

Finally, the crisis has convinced many that the current medical set-up doesn't work for Europe. More than 6,000 personalities, including former prime ministers, commissioners and a Parliament president, signed a petition arguing that it is time to make health a shared EU competence, and give Europe the ability to act as a federal state in health emergencies. This would have significant impacts on certain insurers in the long term.

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COLUMN

WELLBEING AND PANDEMIC

When I read the news stories last December on the Corona virus developments in China, I couldn't believe that we would ever lockdown countries, provinces or even cities. China did it. In March European countries did it as well. Challenging times. Challenging from a financial point of view as the global capital markets came down rapidly and we entered the biggest global recession since hundred years.

Actuaries have a lot of knowledge when it comes to pandemics. I have been intrigued by some papers on pandemics of some twenty years ago. I remember the paper by Henk van Broekhoven (Actuarial Association of Europe) and Anni Hellman (European Commission DG SANCO) on pandemics that was published in 2006. The paper was triggered by the emergence of the bird flu. They concluded that the consequences of a pandemic could be very severe. The costs were estimated between 0.5% and 6.5% of GDP. The likelihood of pandemic in the next ten years was assessed as high.

Sometimes I had the impression that in our society it is all about money. The lockdown made me aware that I was wrong. Governments took a brave decision as to save lives, despite of the immediate financial costs that resulted from this decision. Our prime minister stated that these two are not in contradiction. On the longer term the economy would need healthy people. I couldn't agree more. It does add to my view that we need to find measures that go beyond financial data.

As Nobel laureate Joseph Stiglitz says: GDP data fails to capture the impact of climate change, inequality, digital services and other phenomena shaping modern societies. I am encouraged by the movement in New Zealand, Iceland and Scotland, where the prime ministers (all female!) have adopted a well-being budget, which includes a variety of social indicators besides traditional GDP data. I am convinced that the actuarial profession can contribute to wellbeing indicators that could be used by insurers and pension funds. Polling policyholders and members of pension schemes on what they really value could result in a fundamental change to how we implement ESG policy and create customer focus. This would be a great contribution to the wellbeing of society.

Falco Valkenburg