Insurability and pandemic (or more generally, shared resilience) risk

Executive Summary

With Covid-19 causing a high number of deaths the insurance sector has managed without disruption the life and health cover it has underwritten. A more difficult discussion has emerged in the area of business interruption cover where many current policies do not have a state lockdown as a trigger for compensation. Not much can be done to make coping with the current situation easier. It is however important to discuss how we can be better prepared for something similar in the future. One thing to be learned from Covid-19 is that the crisis evolved in a way not anticipated before. It is important to try to understand what kinds of crises are possible in our modern highly networked societies.

We will first show that in its current form the consequences of a pandemic in business interruption are impossible to fund ex ante. We will look at possible macroeconomic tools and the creation of an ex ante fund to cover the losses. They are either impossible in practice or prove too costly to be of much use.

Counter-cyclical macroeconomic tools for banking have been successfully used during this pandemic to boost economies. However, due to the different role insurers play these rules cannot be copied into insurance. Unlike in banking the release in a downturn of a counter-cyclical capital buffer built up during good times would not result into a leveraged boost for the economy in bad times. Therefore, the introduction of such measures into insurance would not help societies in coping with future incidents.

A second possible, but only theoretical, concept could be to have ex-ante preparedness (i.e., some form of insurance) for the next crisis with a private market solution. This would entail building up a huge fund. Maintaining such a fund would create a cost for the capital. It can be estimated that this cost would equal 0,5 % points or more of the global GDP. Additionally, when compensations were triggered, the liquidation of such a fund could create problems in the capital market. The conclusion is that a full-scale private market ex-ante solution would be too costly and could also turn an insurance crisis into a capital market crisis. On the level of societies, financing might be cheaper with an ex-post solution as developed economy governments can typically borrow near risk-free.

From these analyses it seems clear that actuarial techniques do not offer possibilities for a totally private sector solution in anticipation for the next crisis: the size is too large and there is too much correlation across the world. Without modifying how a pandemic evolves we will be in this same situation also in the future. The situation resembles ones experienced with, say, terrorism or natural catastrophes. After initial confusion these latter risks have been modified into ones where insurance cover can be maintained. This has meant, e.g., better prevention measures, advances in how the triggers of the compensations are defined, and solutions based on some public private partnership to limit excessive risk accumulation to the undertakings involved. In these areas safety measures have initially caused opposition (like security screening in the airports), but later on such measures are easily accepted.

A possible way forward could be found in the form of a public-private partnership. This could involve insurers or other actors from the private sector. The strength of insurers is that they manage similar risks in their ordinary operations. All this would make risks insurable – where insurability does not mean that only insurers could be the actors putting the arrangements into action.

When designing a solution based on a public-private partnership and containing risk-sharing of the insurance type the following aspects need to be observed:

- risks will be heavily correlated which means there needs to be a public backstop to avoid excessive accumulation of losses,

- the rules on what is to be covered and the trigger for compensation being paid by the partnership need to be fixed ex-ante,
- due to high correlation the premiums could prove to be unrealistic but, when adjusted to a more realistic level, they should still be as risk-based as possible,
- adverse selection can be addressed when definitions of cover are clear, but if this is not the case then participation should be made compulsory,
- it is essential to align the interests of involved parties with one another to avoid excessive moral hazard (especially for the public sector, if it can impose societal lockdowns without taking care of the consequences), and
- public involvement needs to be fine-tuned in such a way that it is exercised when it is efficient, while private sector arrangements are used when they are better.

An element that is important in any solution is that there should be incentives for loss prevention. This could come from making clear beforehand what is covered to incentivize businesses to seek other ways to minimize risks not covered. It is also important that when there are premiums for the cover, the premiums are risk-based so that businesses again have correct incentives to take care of their risks.

It is a good ambition to create a solution that would be operational in all large-scale disasters (a shared resilience solution in the language of EIOPA). It will however be extremely difficult to anticipate everything that is possible in our modern highly networked societies. It is probably better not to aim too high and rather have a solution that is workable in some more easily understood crises.

1. Background

Covid-19 has caused a huge disruption to European societies and caused large human suffering. It has also had a severe economic effect, the consequences of which should be quickly addressed. There is the natural question on compensation from insurance, especially in the area of business interruption.

Currently in insurance, business interruption compensation is normally triggered by a physical cause (fire, flood etc.). There are also rare cases (typically in food industry) where the trigger is the contamination of a plant leading to authorities forcing a closure. In all cases, however, there needs to be a direct cause related to a site that triggers business interruption cover.

In the case of Covid-19 different enterprises were forced to close their operations based on an order from the authorities without any direct physical cause. Whether this has triggered business interruption pay-outs under current business interruption insurance contracts is being debated by insurers and their customers, but in many instances it may not have done so. Probably this kind of a risk was not anticipated – even if insurers had included such a trigger into the contracts, clients would hardly have been willing to pay the price of this element. The problem at hand is whether it will be possible to have a novel kind of Non-Damage Business Interruption (NDBI) cover introduced into insurance contracts that would help in future pandemics.

There is the understanding that very little can be done to achieve private sector solutions for the mutualization of risks that have already happened, including ones that would help with the consequences of the current Covid-19 wave. Therefore the relevant questions are:

- what can be learnt from today's situation to be better prepared for the future,
- what would be the measures needed in order to cope with the next pandemic, and
- can there be a more general approach, so-called Shared Resilience Solutions (SRS), that could address not only a future pandemic but also other large-scale disruptions that could hit our highly networked societies?

EU Institutions are currently trying to find solutions to these questions. The discussion has centered around EIOPA and the European Commission with insurance industry being strongly involved in the

discussions. EIOPA has produced on 27 July, 2020 a staff issues paper on shared resilience solutions[1]. This issues paper was open for comments until 25 September, 2020 and the AAE sent its comments[2]. EIOPA has published on 12 February, EIOPA staff paper on measures to improve the insurability of business interruption risk in light of pandemics[3]. The AAE has sent a short comment on this later staff paper[4], more or less promising that some topics in it will be addressed in this AAE note.

The AAE has entered into mutual discussions both with EIOPA and the European Commission (Insurance Unit of DG Fisma). The AAE will look at how actuarial techniques work when it comes to disruptions like Covid-19. Also, it will give its thoughts on possible measures to help make the risks better adapted to mutualization.

The AAE will not look at the issue with the idea of making risks easier to cover just by the insurance industry. Instead our viewpoint will be to think how the risk could be better mutualized. Insurers might be well-placed in eventually implementing what is needed but we do not count out the possibility of other actors or institutions having a role.

2. Where was insurance when it was needed – Could macroprudential tools for insurance make sense when preparing for phenomena like Covid-19?

After the 2008 financial crisis more and more so-called macroprudential regulation has emerged on top of the traditional microprudential regulation. Microprudential regulation adjusts capital based on an individual institutions' risks, while macroprudential regulation adjusts overall levels of capital based on the financial cycle and systemic relevance to guard against systemic risk buildup. Both micro- and macroprudential supervision have also other tools than capital requirements. Tools related to capital requirements are however those that perhaps have highest relevance to the topic at hand. In what follows we also focus mainly on general insurance (i.e. not life or health insurance) as business interruption is a type of non-life risk.

Macroprudential tools are now commonplace in banking while in insurance, especially when compared to the banking world, the emphasis can be said to be in the microprudential area. EIOPA has extensively studied macroprudential tools for insurance[5] and continued this in a discussion paper[6]. European Systemic Risk Board (ESRB) has also addressed macroprudential tools for the insurance sector[7]. Preparations in this area have led to fairly extensive proposals in EIOPA's opinion on the 2020 review of Solvency II[8].

Macroprudential tools have roles both during 'normal times' as structural tools and during downturns to alleviate the consequences. For the purpose of our topic it is enough to discuss such tools in connection to a downturn. According to an IMF article[9], '*Tensions during the downturn are also less likely to occur if policymakers encourage the buildup of shock-absorbing buffers in good times, and if effective resolution mechanisms are in place that allow unviable institutions to die safely*'.

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[1] EIOPA (2020). Issues paper on shared resilience solutions for pandemics. European Insurance and Occupational Pensions Authority

[2] AAE comments to EIOPA's paper on Shared Resilience Solutions (SRS), 24 September, 2020

[3] EIOPA (2021). EIOPA staff paper on measures to improve the insurability of business interruption risk in light of pandemics

[4] AAE response to EIOPA staff paper on measures to improve the insurability of business interruption risk in light of pandemics, 30 March, 2021

[5] EIOPA (2018), Other potential macroprudential tools and measures to enhance the current framework

[6] EIOPA (2019), Discussion Paper on Systemic Risk and Macroprudential Policy in Insurance

[7] ESRB (2020), Enhancing the macroprudential dimension of Solvency II

[8] EIOPA (2020), Opinion on the 2020 review of Solvency II

[9] Macroprudential and Microprudential Policies: Toward Cohabitation,Prepared by Jacek Osiński, Katharine Seal, and Lex Hoogduin, International Monetary Fund, June 2013

In banking the basic idea of counter-cyclical macroprudential tools connected to downturns is to have stricter rules in normal times that can be made lighter during a downturn. A good example of this is the counter-cyclical capital buffer of banks. Without going much in the details (i.e., a detailed description of the tool etc.) or into the problem of deciding when a downturn is severe enough, we can think of the consequences of easing the measures during a downturn. The objective of eased rules is mainly to make granting of credit easier and to make it possible for debtors to delay their dues (so-called debt moratoria).

The role of moratoria is quite self-evident while granting of credit might need some further consideration. Banks create deposit money by granting loans and buying securities. In both areas banks have restrictions originating not only from prudential regulation and monetary policy but certainly also from how they can access capital from financial markets. If regulation is eased and there is demand for loans by customers banks can increase money in circulation quickly. This can greatly contribute to societies, especially in a downturn. Macroprudential regulation has tools to help banks in playing this role in a downturn.

Could there be similar macroprudential tools for the insurance sector? EIOPA's study mentioned above already discusses this and concludes that a counter-cyclical capital buffer is not recommended for insurance. The basic business of insurers is to spread individual risks to a larger insured community, a pool. There are systemic elements in this activity and there are measures and initiatives to address the systemic risks arising from these activities. These measures and initiatives however fall more into the category of structural macroeconomic tools and not into the counter-cyclical category. Insurance undertakings have also engaged in activities that have traditionally been the area of banks (so-called non-traditional, non-insurance NTNI activities) where also regulation should be similar with that of the banking sector.

Insurers do not have a similar role with banks of 'creating money'. Instead, insurers typically collect small premiums from every insured to cover the losses of the few. It is difficult to imagine ways of easing regulation to have insurers compensate for losses that were not insured before the loss occurs. It would possibly also be unfair to the pool if assets collected from the pool were used to pay claims that were not anticipated when the pool was created. Insurers sometimes build up catastrophe reserves to anticipate years with lots of claims. These reserves are however used to compensate for losses according to the terms and conditions of the policies in force, not to give out money for other purposes.

In analogue with the banking world insurers could naturally have a counter-cyclical capital buffer. This would mean that, in order to fulfil the higher capital requirements, insurers would need to charge somewhat higher premia during normal times. In a downturn the requirements could be lowered, which probably in connection with a prohibition to pay dividends would lead to insurers charging lower premia. This would however not help the insured to any significant degree due to the fact arising from the insurance business logic: the premia are small compared to the losses to be covered.

Insurers could certainly also give cover more easily with lower prudential regulations. This would however not give immediate help to the societies during a downturn. Instead, it would rather pile up risks for the insurer that would jeopardise the health of the insurer in the years to come. In this way such a move could rather make the recoveries of the societies slower and still not help them through the trough of the downturn.

It should be noted that insurers certainly play other roles in addition to the pooling of risks. Along the core business of pooling of risks insurers are also investors and in that area macroprudential regulation can be utilized to avoid, say, forced selling of assets during a downturn. Life insurers are in addition active in collecting savings and in that area some measures copied from banking could play a role. But these additional areas do not change the fact that it is hard to believe in macroprudential tools that would help insurers in, say, being more generous in business interruption cover during a downturn.

The conclusion from the above is that there are unlikely to be specific macroprudential measures that could directly help insurers with their coverage of business interruption risks of the sort recently experienced with Covid-19. In banking a small easing of capital requirements leads to a leveraged increase in the supply of credit while such leveraging is not possible in insurance. Basically the only way for insurers as an industry to be prepared for cyclical huge increases in, say, business interruption claims would be to insure them according to normal insurance practices and build reserves that would suffice to cover the mushrooming claims. The remaining question is whether the market would be ready for such premia and whether the pile-up of such huge reserves could be possible.

Conclusion: Macroprudential tools copied from the banking regulation will not have a role in pooling risks to make it easier for societies to cope with business interruption. In other roles where insurers operate in the market in a similar manner with banks such tools could play a limited role.

3. Eating the elephant as a whole – capital cost of ex-ante preparedness

To be prepared the insurers would need to collect fairly huge reserves ex ante which could be difficult in practice. Let us however assume that the world had prepared for the losses due to Covid-19, by insurance or by some other means. According to the World Bank the total pandemic induced losses[10] for the year 2020 were € 3 700 trillion. There are also higher estimates, e.g., Swiss Re forecasting losses of € 9 900 trillion. One can ask at least two questions:

- what would be the annual cost of holding the capital to pay such losses, and
- what would be the impact on the global capital markets of immediate payment of these losses?

The idea here is not to analyse all possible aspects of an ex-ante solution. Rather, the idea is to create a 'toy model' to gauge some estimates on the cost of an ex-ante financed solution. Aspects not taken into account here are, e.g.,

- Having full preparedness to carry the cost would not be possible immediately while the loss could materialize sooner rather than later. This would create high uncertainty because of the potential volatility of associated cash flows year-on-year and because of their uncertain sizes and timings.
- The size of an ex-ante fund would be large even in relation to some of the world's largest sovereign wealth funds. This would create problems in finding a suitable and reliable governance[11] structure for the fund even in case it would be split into smaller chunks.
- Uncertainty over the extent of any envisaged crisis makes the situation difficult. Especially if the solution should cover other phenomena than a pandemic the uncertainty on the size on the fund needed would create problems. In the case of Covid-19 the extent of losses resulted from societal lockdowns that were hardly anticipated before the crisis. Partly this is revealed by the fact that the WB has talked of a € 413 million pandemic emergency funding facility which is very small in relation to the losses from the current pandemic.
- An ex-ante solution, especially in the form of a capital market solution, would need to overcome the disconnect between what buyers of the risk think is a 'reasonable' risk premium to receive and what sellers of the risk think is a 'reasonable' risk premium to pay away. Only if the gap is bridged is a capital market solution practical. The amounts and uncertainties involved in defining the losses to be covered would make overcoming this difficulty extremely difficult.

The first question, i.e. the annual cost, could be discussed either in an insurance setting or by looking at a capital market solution or some other alternative method. The problem however seems to boil down to the problem of the cost of the capital whatever financing would be used. The cost of the capital

[10] Sums in the original texts are in USD and they are converted to euros with an exchange rate of 1 USD = 0,826275 EUR. We however use the word 'trillion' in its US meaning, i.e. a trillion is a thousand billion.
[11] Global body to handle?

depends on the risk, i.e. how often the risk is expected to materialize. On this issue we are certainly on a very shaky ground – we do not know how often a pandemic will strike (is this the next after the Spanish flu, i.e. with a return period of one hundred years, or do we think that the circumstances have changed so that we will have pandemics more often?). Additionally, if we think that the solution should apply to other risks (i.e., SRS), the risk would be higher. All of this is still aggravated by the fact that we are not just talking of a physical trigger but additionally of losses connected to a societal response. Therefore whatever we say on this issue can only be indicative.

Because of the shaky ground it will be easier to do a very simple calculation in order to have at least a tentative lower bound for the cost. Let us assume there would be room in the capital markets for an SRS bond to cover the losses. Let us assume that investors would demand a coupon of risk-free interest plus x percentage points to buy the bonds. The proceeds would be invested risk-free and the annual cost would be x % of the nominal amount (€ 3 700 to 9 900 trn or more) of the bond.

According to the World Bank, the 2019 global GDP was € 72 462 trn. The annual cost of an SRS bond would therefore be 3,7 / 72,5 * x % of the global GDP, i.e. 0,0513 * x % of the global GDP.

With this we are left with the uncertainty on what would be the x in this approximation. The x represents the riskiness of the investment. Basically, as stated already above, it is a question of whether the risk would materialize statistically once in, say, ten years or in 100 years. The variance in the return period plays an additional role when thinking of the risk.

The World Bank has launched pandemic bonds in June 2017. They were well received by the market. Class A bonds had a spread of 6,5 % and the triggers were flu and coronavirus while class B bonds had a wider trigger (Filovirus, Coronavirus, Lassa Fever, Rift Valley Fever and Crimean Congo Hemorrhagic Fever) and a spread of 11,1 %. With current experience of Covid-19 one could say that the risk is higher than in 2017 and the spreads should be higher. Taking the World Bank spreads as a basis we would get a cost of 0,33 to 0,57% of Global GDP, which would be a lower bound for the cost. The appendix contains a model to approximate the level of the yield x required by investors which gives good motivation to think that the cost can be substantially higher. The World Bank bonds were also much smaller than the € 3 700 trn talked about here. Probably such a larger bond would also increase the spread.

We can do the same calculation for some European countries where the results have been slightly lower. One could probably say that the lower bound of the annual cost would be from around 0,2 to 0,3 % of the GDP. If the covered phenomenon would be something like a general SRS, the cost would apparently be substantially higher. It needs to be recognized that our European estimates might be lower than the global ones because the loss amount we used for European countries might be inconsistent with the World Bank figure (do we talk of all losses due to the pandemic or just NDBI, and do we talk just of the first wave or the total of 2020-2021

Additionally, one can ask whether the estimate of € 3 700 trn is correct and whether this has a bearing on the cost. If we think of a capital market solution this will make no difference since the nominal amount of the bond needs to be fixed in advance. Fixing the amount also fixes the cost but limits the possible compensations – in an insurance solution the compensations could be uncapped but the cost would be higher.

For simplicity this approximation was done by taking a capital market solution as the basis. One can question whether the result would be different in an insurance context. Also in such an insurance context there would be a need for capital. This capital always comes with a cost. Therefore we believe that this lower bound for the cost is also valid in an insurance context.

The second question is about liquidating assets worth € 3 700 trn or more to pay the claims. According to SIFMA Capital Markets 2020 Fact Book , 'Global bond markets outstanding value increased by 5.4% to $105.9 trillion [€ 87 500 trn] while global equity market capitalization increased by 23.8% year-over-year to $95.0 trillion [€ 78 500 trn] in 2019.'

If we had ex ante funds to cover the losses, this would mean the need to liquidate assets worth € 3 700 trn fairly quickly. That would equal to 4,2 % of the total outstanding bond market or 2,2 % of the total combined bond and equity market. It needs to be evaluated whether this could be possible or whether this would actually lead to the systemic risk of spreading the pandemic/SRS risk to the capital markets.

The conclusion of this is that, in considering an ex-ante funded solution, one should evaluate whether

- **we can motivate a cost of at least 0,2 – 0,3 % but probably much more (at least 0,5 %) of the GDP annually when looking at the benefits of such a solution, and whether**
- **we can cope with the risk of a future incidence creating a systemic risk for the capital markets and therefore actually aggravating the risk.**

Considering the cost of capital and comparing this to current yields of government bonds one can say that eating the elephant in pieces could make more sense: instead of building a huge ex ante reserve the consequences could be financed with a substantially lower cost ex post with government lending. This however does not mean that targeted insurance etc. solutions could not make sense on a smaller scale, maybe connected to a public private partnership.

4. Actuaries on the issue of pandemics in 2006

The European actuarial profession has produced in 2006 a note on pandemic risk. This study is a comprehensive study on the 'near misses' experienced until its date of writing. The consequences of a pandemic were mostly seen in the areas of mortality and morbidity. The amounts of economic losses were taken from different sources and they were understood to be substantial but also smaller than what is happening with Covid-19:

'*The estimates of economic costs of human flu pandemics vary substantially depending on the scenario assumed. The average approximation of the economic cost lies between 0.6% - 1.3% of GDP loss (US National Center for Infectious Diseases 1999). The World Bank estimates warn of costs reaching up to 2% of GDP of affected countries, while the Asian Development Bank (2005) cautions that the costs can reach up to 6.5%, especially in cases of more vulnerable Asian economies.*'

It seems that the Asian Development Bank was closest to the outcomes of today but still took the issue to be more a regional than a global one. Insurance sector would be mainly impacted in the life and pension areas. Non-life insurance would mostly take a hit in the area of investments. It is however noted that '*Non-life insurance would probably not be very much impacted by a pandemic, except maybe for some special lines like business interruption.*' It is also noted that *'It could be noted, finally, that many non-life insurers have catastrophe reserves that could be released in case of heavy increases in claims.*'

The AAE note represents an overall understanding on how a pandemic would hit societies and insurers. The meaning is not to criticize the earlier note but with hindsight one could say that together with other pre-Covid-19 texts it did not foresee the extent to which a pandemic might lead to societies shutting down.

One could say that the Covid-19 pandemic is different from other pandemics before. This time it is more about the capacity of social health institutions and societal lockdowns than for instance about death rates. The next pandemic could be fully different from this one. An important topic for the EU could be to think of possible different pandemic categories. As a simple example, long incubation and small death rates vs. short incubation and high death rates, etc. One could play different scenarios on how the societies would cope with these.

Conclusion: Covid-19 has proved that we did not anticipate what impact a pandemic might have in modern networked societies. There is a need to build scenarios of different forms of pandemics and related forms of societal response.

5. The concept of insurability

From what is said above it seems clear that solutions cannot be found with macroeconomic countercyclical measures or ex ante funded private sector solutions. This would apply in the future if we had a similar pandemic. In areas like terrorism, natural catastrophes etc. we have been in similar situations. After the initial confusion there have been developments that have made these phenomena easier to insure. We need to ask what should be done to the threat of a new pandemic to make it possible to be prepared with actuarial techniques. For this reason it is now important to look at the current situation and see where we have problems with insurability.

An insurance transaction involves the insured assuming a guaranteed and known relatively small loss in the form of payment to the insurer in exchange for the insurer's promise to compensate the insured in the event of a covered loss. The insured receives a contract, called the insurance policy, which details the conditions and circumstances under which the insurer will compensate the insured. The insurer may hedge its own risk by taking out reinsurance, whereby another insurance company agrees to carry some of the risks. The questions of insurability do not apply only to insurers but also in one or the other form to all ex ante actions to be prepared for a pandemic.

Conditions for a risk to be practically insurable:

- **Large number of similar exposure units**. Insurance operates through pooling of resources and the majority of insurance policies are provided for individual members of large classes, allowing insurers to benefit from the law of large numbers.
- **Definite Loss**. The loss takes place at a known time, in a known place, and from a known cause.
- **Accidental Loss**. The event that constitutes the trigger of a claim should be fortuitous, or at least outside the control of the beneficiary of the insurance. The loss should be ‘pure,’ in the sense that it results from an event for which there is only the opportunity for cost.
- **Large Loss**. The size of the loss must be meaningful from the perspective of the insured. Insurance premiums need to cover both the expected cost of losses, plus the cost of issuing and administering the policy, adjusting losses, and supplying the capital needed to reasonably assure that the insurer will be able to pay claims.
- **Affordable Premium**. If the likelihood of an insured event is so high, or the cost of the event so large, that the resulting premium is large relative to the amount of protection offered, it is not likely that anyone will buy insurance, even if on offer (unless they are legally required to do so).
- **Calculable Loss**. There are two elements that must be at least estimable, if not formally calculable: the probability of loss, and the attendant cost. Probability of loss is generally an empirical exercise, while cost has more to do with the ability of a reasonable person in possession of a copy of the insurance policy and a proof of loss associated with a claim presented under that policy to make a reasonably definite and objective evaluation of the amount of the loss recoverable as a result of the claim.
- **Limited risk of catastrophically large losses**. Insurable losses are ideally independent and non-catastrophic, meaning that losses do not happen all at once and individual losses are not severe

enough to bankrupt the insurer; insurers may prefer to limit their exposure to a loss from a single event to some small portion of their capital base.

While these general characteristics make a risk as such insurable there are additional requirements that influence the situation, creating often circumstances where insurability is threatened. Main issues in this area are:

- control of **adverse selection** – i.e. to avoid the insured collective of risks being biased towards those risks that are more risky than the average
- control of **moral hazard** – i.e. the situation where insurance cover leads to behavioral changes leading to an increase in claims,
- **insurance fraud** – where fraudulent claims increase compensations to be paid too much, and
- public support **crowding out private risk mutualization**

Insurance is not a static concept remaining the same over time. Insurers have developed different solutions to adapt the insurance technique in face of different challenges[12]:

- Risk prevention can limit risks to a tolerable level.
- Adjustments to terms and conditions can play a role, e.g., deductibles and co-payments to combat moral hazard, and cover limits to transform unquantifiable underlying risks into known maximum exporsure.
- Risk selection and pricing to reduce adverse selection and enable reacting to loss experience.
- Innovation to respond to demand for new risk covers.
- Reinsurance and securitization to provide additional capacity.
- Private/public partnerships when the free market fails to cover a critical risk.[13]

Conclusion: Criteria of insurability need to be taken into account whatever the nature of the proposed solution (and whether or not it is based on insurance).

6. Characteristics of pandemic/systemic risk

As Covid-19 has illustrated, pandemics (and societal responses to them) can create or amplify risks to the economic fabric of society. The lockdowns, stay-at-home orders and other responses adopted by governments to mitigate public health issues thrown up by the pandemic have had dramatic negative impacts on substantial parts of the economy. As with most economic disruptions, there have been some economic winners (e.g. firms providing online services such as video-conferencing) as well as many losers (e.g. the travel, leisure and hospitality sectors). Looking further out, it is difficult to say when, and even if, some of the worst hit sectors will recover. There is also scope for substantial second round impacts, e.g. to demand for different sorts of commercial property, depending on how employment patterns evolve as a consequence of the pandemic.

A commonly used way of exploring these dynamics is via the concept of 'systemic risk'. Various meanings can be given to this term, depending partly on what the system is that we are focusing on. Most usually, the focus is on the financial system or the broader economic system. A relevant definition in the context of the European Union financial system is the one used in the establishment of the European Systemic Risk Board (ESRB). The definition used in its founding instruments is "*'Systemic risk' means a risk of disruption in the financial system with the potential to have serious negative consequences for the internal market and the real economy*", see European Union (2010)[14].

[12] Adapted from Sigma No 4/2005, Innovating to insure the uninsurable
[13] Examples? Flood Re, terrorism
[14] European Union (2010). Regulation (EU) No 1092/2010. European Union

From a purely financial system perspective, the systemic risk aspects of Covid-19 have arguably so far been relatively contained. Granted, some financial markets have seized up, e.g. the commercial real estate market, with suspension of dealing in some funds investing in such markets, but these were typically markets that already had a reputation for being potentially relatively illiquid in times of stress. Equity markets nosedived shortly after lockdowns were first implemented but have in many cases recovered.

From a broader economic perspective, the impact has been much larger, principally focused on the 'real' economy. The relative resilience of the financial system so far is also in part a reflection of the very extensive fiscal and monetary support measures introduced by most developed world governments and central banks. In effect, central authorities have underwritten many of the economic costs inflicted by the pandemic on individual participants in their economies, via furlough schemes aiming to avoid employee lay-offs, via loan packages and fiscal measures to tide businesses through lean times and via monetary policies lowering interest rates with the aim of stimulating economic activity. In some member states, bankruptcy processes have been temporarily stayed, giving firms more time to react to challenges thrown up by the pandemic. A consequence of these support measures is that government deficits have jumped dramatically, and government debt to GDP ratios are doing likewise. From a big picture perspective, we might argue that governments have to a substantial extent mutualised or socialised many of the challenges the pandemic has brought to individual workers and businesses within their jurisdictions, with the costs likely to be borne via future tax increases (or possibly cuts in future public services). At a pan-European level, the EU has agreed to an unprecedented pooling of its own member state resources via joint debt issuance and its landmark recovery fund.

A corollary is that the overall impact of a pandemic is driven both by the pandemic itself and by how society responds to the pandemic. An ideal shared resilience solution needs to take this into account, e.g.:

(a) Losses borne by the private sector providers of protection against such events should as far as possible be independent of governmental responses to the problem, to avoid the equivalent of moral hazard on the part of governments;
(b) The solution should be clear on who bears what costs; and
(c) The solution should include appropriate incentives that target the use of society's resources in a manner that is as efficient as possible.

The larger the financial shock delivered by a pandemic or other similar challenge, the more likely it is that broad-scale public sector responses of the sort we have seen with this pandemic will be needed to avoid economic meltdowns. As EIOPA (2020)[15] points out, "*The wide-ranging nature of pandemics means traditional insurance risk transfer mechanisms are not always appropriate, making them too great a burden to be shouldered by insurance companies alone. Instead, solutions involving both the public and private sector are needed*". As the EU's landmark recovery fund indicates, some challenges can swamp even individual countries, and it is of course possible to conceive of shocks like asteroid strikes that are so large that they could swamp civilization as a whole.

Conversely, the vast majority of risks, even systemic risks, are not so large. In any case, the inevitably blunt nature of public sector responses makes them prone to many economic challenges, e.g. mispricing and inefficient allocation of resources, scope for free riding, favouritism etc. The inherent appeal of insurance is that it allows individual economic participants to pool risks they themselves face in a broadly equitable manner, with prices charged set competitively by the insurance market in a

[15] EIOPA (2020). Issues paper on shared resilience solutions for pandemics. European Insurance and Occupational Pensions Authority

manner that should broadly link the price paid to the risk being pooled. Whilst doing so, insurers typically also build up pools of capital which if suitably structured should contribute to long-term economic growth and broader societal well-being.

One might therefore expect that an optimal risk response to a pandemic or other similar challenge will, as EIOPA (2020) notes, involve shared private and public sector participation, playing on the strengths of the different possible risk owners, with the public sector predominantly carrying the most extreme risks and the private sector predominantly carrying the more contained risks.

A specific focus might be on the expertise the private sector has in pricing risk. For example, as noted previously, pandemic-related non-damage business interruption insurance has not so far been commonly included in European insurance solutions. A shared resilience solution could leverage insurance company pricing disciplines, to incentivise the insured to take reasonable steps to minimise the business disruption that a pandemic driven interruption might create (to the extent this was practical). However, it might still transfer risks not practically capable of being diversified by the insurer alone (even in combination with reinsurers) to a central publicly-supported body.

Theoretically, there is no specific need for private sector components of such a solution to be an insurer. However, it would in effect be behaving like an insurer and we should therefore presumably want it to be regulated like an insurer too, in order to maximise the likelihood that it will be managed sensibly and with sufficient capital to be likely to honour the promises it makes to its customers. How any relevant public sector component should be structured (and, in some cases, regulated) depends on many factors, some operational (e.g. how price differentiated should any coverage be, if ultimately the alternative is undifferentiated support for such activities from central government funds, and what sort of structure supports the best governance) and some more philosophical / political (e.g. how much we would want the relevant body to be able to stand on its own if its sponsoring government were itself to get into difficulties and/or to what extent we would want it to span multiple jurisdictions).

Alternatively, we might focus less on differentiation of risk ownership and more on differentiation of skill sets. Insurer skill sets not only include pricing but also claims management. During this pandemic, many governments have employed banks as agents to administer support loans the governments have extended to different parts of the economy. The logic is that the banks have better understanding of the business models of the organisations to whom loans might be advanced, so are better able to identify which ones are likely to have a sustainable business model once the pandemic eases. We might envisage insurers playing a similar agency role if the proposed shared resilience solution involves restricting the public sector insurance coverage component to only a subset of all potential insureds.

This brings us back to (financial) systemic risk. The larger the ownership of e.g. pandemic risk we expect specific players in the insurance industry to bear, the greater is the possibility that this risk exposure, if it crystallises, could spill over with undesirable consequences into other parts of the insurance industry or to the rest of the financial sector. For risks that are large enough to require shared resilience solutions, expectations and decisions about how much of the risk should be borne by the private versus public sector need to bear in mind what level of risk the private sector is realistically capable of bearing without potentially itself becoming a source of problems should a large enough risk event occur.

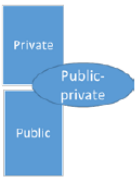
Conclusion: The economic consequences of Covid-19 are not a systemic crisis in the traditional sense of the term. To the extent a private relief is sought care must be taken for it not to give rise to systemic risk materializing in the financial sector. Insurance concepts managed by insurers or other operators functioning to a large extent like insurers will provide a solid ground to any possible public-private solution.

7. EIOPA's concept of a Shared Resiliency Solution

EIOPA is looking for NDBI for SMEs (small and medium enterprises), as the economic shutdown has greatly affected the SMEs that do not have the financial capability to withstand any sustained shut down of activity. According to EIOPA's paper: '*A simple product would allow policyholders to get quick coverage and would allow policyholders to understand the product and against what they are covered for. A clear statement of the conditions of the NDBI coverage, such as triggers and scope, as well as on the exclusions is therefore essential. Furthermore, if the premium is risk-based, it can be used as a transparent indicator of the risk and thus for monitoring how the risk evolves over time. It is also possible to reflect risk prevention measures in the premium, incentivising the policyholder to invest in risk prevention. By bundling the cover with other insurance products (e.g. fire and property), pandemic insurance would be made more accessible and there may be a possibility to benefit from some risk diversification. Bundling would also simplify the access to NDBI insurance, as policyholders would be automatically covered if they get a property insurance product, for example.*'

EIOPA would organize the cover in four layers:

Layers	Risk transfer mechanism
First layer	Insurance / insurance pool
Second layer	Reinsurance / ART / reinsurance pool
Third layer	Government support in excess of the private market participation, at national level
Fourth layer	EU overarching support mechanism, in excess of national level



EIOPA finds a role for a EU-level action: '*A layer including an EU-wide intervention could be justified by the pan-European nature of the pandemic crisis. The type of involvement could range from encouraging or promoting risk prevention and incentivising and coordinating national measures, to providing financial support for the recovery from the pandemic, through a funding-type mechanism or based on a reinsurance-type mechanism. EU interventions may have to consider solutions in place at national level, in order not to create or deepen economic fragmentation across Member States in the wake of a crisis.*' EU-level could at least offer a blueprint to national solutions and thus minimize the risk of increasing fragmentation.

EIOPA sees it insufficient to restrict the solution just to a pandemic: '*As the global economy relies on interconnected infrastructures and uninterrupted supply chains, other potentially systemic risks, such as cyber, climate change or terrorism risk also have the potential of being widely disruptive. Terrorism risks in particular, but to some extent also climate change risks and other risks, need shared resilience solutions in order to enable insurability. In many jurisdictions for example, governmental guarantees and similar schemes have already been implemented so that consumers have access to protection against terrorism risks as the market does not provide enough reinsurance capacity for such risks.*'

EIOPA sees additionally a need to

- improve the modelling of the risk,
- reflect prevention measures in NDBI insurance premiums and policy conditions, and
- create a platform for public and private coordination on prevention measures.

EIOPAs later paper in 2021 focuses additionally on three areas: (i) risk prevention, (ii) the role of capital markets in risk transfer and (iii) pooling of perils for addressing systemic risk.

Conclusion: It is essential not to be able to win the previous war but to be prepared for the future. Scenarios proposed in chapter 4 could be a good basis for blueprints of more extensive solutions.

8. Considerations on the insurability of pandemic/systemic risk

a. Large number of similar exposure units

A significant challenge emerging from Covid-19 is the definition of losses to be covered and insurance classes affected. In Covid-19 the cover needed is for NDBI while in other events the needs are probably different. For NDBI, the covered entity is a business which runs the risk of loss of income (lost profits, fixed costs, extra expenses) as a result of the outcome, especially societal lockdown, of a pandemic-type event. The extent of exposure of businesses to the event will depend on a number of factors, including:

- the **nature of the business covered**. For instance, certain IT businesses are not adversely affected whereas the majority of hospitality, travel and non-food retail businesses are significantly affected.
- the **extent and type of government intervention** following the event. Economies will be impacted differently, at macro level and at the level of individual sectors, depending on how governments react to the event, e.g. by population lockdown, forced business closure, social distancing, restrictions on large gatherings, provision of payments to affected employees, quarantines, etc.
- the **nature of the event itself**. The impacts of pandemic, tsunami, large scale cyber issue for instance could be quite different, which makes the categorisation of entities for insurance covering each of these eventualities complex.

Although business insurance (BI) coverage has been extended in some cases to cover loss of income even in the absence of physical damage to the premises of the insured, there is generally an exclusion relating to pandemic events following the SARS event in 2003.

The above challenges demonstrate the difficulty of identifying classes of members for this type of coverage. It may be that effectively addressing the challenges will result in a number of smaller sub-classes. These sub-classes may differ from the classes normally identified for BI insurance purposes. This may be viable from an insurability perspective provided resulting classes contain ”large enough” numbers, but not too much driven by a common factor (i.e., correlation) that the law of large numbers fails to apply.

Conclusion: In situations like this the number of similar exposure units is not the problem but the correlation between them makes insuring them difficult.

b. Definite loss/calculable loss

Certain catastrophic losses will be clearly identifiable in terms of the time, place or cause of the event. This will be the case for instance with a factory which is destroyed or damaged by fire. Apart from physical damage, the insured may also suffer a loss of business income from which to pay the expenses of the business and make a profit. They may also incur extra costs, such as renting alternative premises, to maintain the turnover of the business. All these losses are covered by business interruption insurance.

Other losses will be less identifiable. A pandemic for instance may not have an exactly identifiable cause, as is the case with Covid-19. The time at which a virus becomes active or infects individuals or groups may be uncertain and the place in which infection occurs may also not be known. This lack of certainty will make it difficult for claimants and insurers to identify the validity of a claim.

Both the probability of loss and the attendant cost do not readily lend themselves to calculation. These events are highly unusual and unforeseeable. They also vary in intensity and form of impact. As mentioned above, the extent of exposure of businesses to the event will depend on a number of factors. For instance, government intervention (e.g., paying a proportion of employees’ salaries, providing fiscal stimulus), or landlord forbearance in relation to property rental, can impact on cost, which is also subject to the severity of the event and the specific economic impact. The uncertainties

set out above mean that forecasting insured losses in a pandemic is very challenging and subject to significant variations.

Key characteristics of the forecast of an insurance claim are probability of occurrence and cost of the claim. Insurers' appetite is generally higher for cases with less prediction error as these result in better portfolio management, more accurate pricing and straightforward handling of claims. There are several issues due to uncertainties when handling and estimating the costs of the losses due to systemic and pandemic events. These are:

- Occurrence of event (Frequency)
    - Definition of event
    - Definition of cover
- Claims Handling and settling (Severity)

As has been demonstrated during Covid-19, pandemic insurance covers with NDBI bear a high level of reputational risk due to the potential uncertainties of event/cover definitions, which could lead to disputes and significant additional legal fees. These uncertainties have a significant impact on (re-)insurers' willingness to deploy capacity and overall levels of risk premium.

After Covid-19 there is in principle experience of how things evolved over the course of the pandemic. Future pandemics might present different problems, and additionally, if the meaning is to cover other possible disasters, it is even more difficult to define ex ante the losses that will be covered.

Conclusion: Any private sector ex ante solution will need detailed rules on what is to be covered and what triggers the compensation.

c. Accidental loss

Normally insurance covers losses from events that are accidental and independent of the will of the policyholder. The cases covered are also not speculative in the sense that their effects on the policyholder can only be negative. With respect to a societal lockdown it is natural to ask whether the loss is accidental or not.

Business interruption has traditionally covered losses arising from identifiable events or damage which relate specifically to that business. Coverage under consideration, possibly arising from catastrophic events, would not necessarily impact specifically on a business, in the sense that none of the businesses' assets, stock, property, etc. may be impacted. In the case of Covid-19, the impact on businesses has emerged from a variety of factors which are not directly related to the business itself, such as forced closure of businesses in general or people being confined to their homes. As mentioned above, BI policy coverage has been extended in some cases to cover loss of income even in the absence of physical damage to the premises of the insured, though generally with an exclusion relating to pandemic events following the SARS event in 2003.

Conclusion: Losses due to Covid-19 result less from the direct consequences of the virus and more from societal actions leading to the fact that the losses are not accidental in the traditional meaning. The trigger for the loss needs careful consideration especially in a wider SRS context.

d. Large loss

Insurers generally deal with two types of risk, which can be defined based on the frequency and severity of the events.

- High Frequency x Low severity
- Low frequency x High severity

The frequency of events has a significant impact on the predictability of losses, and subsequently on the level of expected loss ratio and capital/risk charge. Catastrophic risk is generally represented by low frequency losses with high severity, which typically leads to a lower expected loss ratio as insurers have significantly higher costs associated with capital requirements required. As seen during Covid-19 there was a significant impact on businesses and individuals and it created a significant demand for pandemic-systemic type of cover. Without government support the impact on economy and many businesses would have been far greater as this type of an event was not fully recognized by many businesses. It caught them unprepared without a specific plan how to adapt their operation to new situation/norm.

Conclusion: Losses due to Covid-19 represent clearly large losses. The societal lockdown was not anticipated which made ex ante preparedness insufficient.

e. Affordable premium

Insurance company portfolio management is based on the principle that portfolios of different sorts of risks differently correlated with one another will have negligible unsystematic risk, which leads to maximizing the return whilst reducing the volatility. There are several considerations for the insurer to underwrite certain risk such as, to name some main ingredients:

- Risk appetite / Capacity
    - Level of equity the insurer is willing to lose with certain probability / level of risk limit insurer is willing to offer.
- Scale
    - Size of the market and competition.
- Diversification
    - Individual risk diversification (a.k.a. maximizing the scale within the class, whilst staying within risk appetite), and
    - Diversification of the risk with the rest of the portfolio.
- Claim characteristics
    - Past Experience / Trends / Risk Emergence, and
    - Predictability.
- Rate
    - Levels of premium which can be obtained on the market for cover.

It should be noted that above criteria are connected and can have a high degree of dependence with each other. E.g., low capacity on the market with high demand would drive the rate up, which can encourage additional capital to be invested and drive the capacity up and lower the price.

Insurers generally have a very little appetite for pandemic-systemic risks such as Covid-19 with limited diversification ability:

- Limited geographical diversification (world-wide impact from a single event),
- Limited class of business diversification (majority of policies triggered by the event), and
- Limited cross class diversification (e.g. Financial lines, Cargo, Travel & Leisure).

Lack of diversification limits the insurers ability to write sufficient scale of the business, whilst maintaining reasonable level of capital and its associated costs. Key element for making the pandemic-systemic risk insurable is to ensure that there is enough capacity and excess risk borne by primary insurers can be passed to reinsurers and/or financial market (e.g. Catastrophic Bonds) or governments (e.g. TRIA, Flood Re).

Conclusion: Risks related to Covid-19 present very little possibilities of diversification making insuring them difficult.

f. Limited risk of catastrophically large losses

Losses due to catastrophic events are by definition large. They are typically more than a normal primary insurer can or would like to cover. A catastrophic event also hits the portfolio of a primary insurer on many fronts, i.e. there is a high correlation between the risks.

For 'normal' catastrophes like storms, earthquakes or terrorist attacks there is only little geographic correlation across wider areas. Therefore such risks are usually manageable by the global insurance system. Primary insurers can take reinsurance for the share of the risks in their portfolio that they cannot carry as an individual primary insurer. In addition to reinsurance a primary insurer can also use securitization for too large risks.

A pandemic can be very different from 'normal' catastrophes. A pandemic leads to highly correlated claims not only locally but also globally. This means that even the largest reinsurers would not be able to carry such risks with the same applying as well to the capital markets. The conclusion is that pandemic risks together with societal lockdowns would often lead to such global risks that would exceed the resources of any private insurance system.

Conclusion: Lack of geographic diversification is the greatest obstacle of insuring pandemic risks.

g. Adverse selection

Adverse selection refers generally to a situation in which sellers have information that buyers do not have, or vice versa, about some aspect of product quality—in other words, it is a case where asymmetric information is exploited. Asymmetric information, also called information failure, happens when one party to a transaction has greater material knowledge than the other party.

In insurance, adverse selection is the tendency of those in dangerous jobs or high-risk lifestyles to purchase products like life insurance. In these cases, it is the buyer who actually has more knowledge (e.g., about his health). Basic tools to address adverse selection in mutualization are either to use better differentiation and pricing of risks or to make insuring obligatory.

With better differentiation of risks all insureds in principle will pay a correct premium with respect to the risk. This should lead to a situation where adverse selection is no longer possible. There are basically two caveats in this approach:

- administration of such an approach can be costly or even impossible. This approach requires extensive knowledge of the situation of the insured, the collection of which needs resources. Full knowledge of all relevant information is additionally usually impossible. With exponential growth of the amount of digital data ('Big Data') and with improving predictive analytics there are however increasingly tools that make more exact differentiation possible and cost-efficient.
- there exist so-called protected attributes (gender, ethnic background[16], sexual orientation etc.) that cannot be used directly or indirectly to classify people. This is not relevant only to life insurance as it can play a role also in general insurance: if an area with a certain zip number is vulnerable to flooding but is also inhabited with people of a certain ethnic background, it can be difficult to have higher property insurance premiums for that region.

[16] Often referred also as 'race' although the latter term is problematic as in the true sense there are no races within human beings.

Creating mutualization of risks for a future pandemic or creating so-called shared resilience solutions will be an interesting case when we talk of adverse selection. This results mainly from the fact that the nature of the risk is obscure. For example, with Covid-19 it would have been difficult to anticipate the nature of the losses encountered. If the risk covered in a shared resilience solution is shady, it will also be difficult to see whether there is any adverse selection with respect to this risk.

This does of course not mean that the risk should be kept obscure. If there is the wish to have private risk mutualization there needs to be a clear view on what is the risk to be mutualized. When this is done adverse selection can be duly addressed.

If however adverse selection cannot be appropriately managed there is the option to make insurance cover obligatory. There are pros and cons with such a solution. The advantage of such a solution is that everybody (or all enterprises) is covered and everybody also bears a certain part of the costs. An obligatory solution can also be made affordable to everyone.

There are also serious drawbacks with such a solution. In obligatory insurance the link between risk and premium is usually not exact. This generally means that the riskier insureds pay less than the true price of their risk and vice versa. This can lead to riskier insureds having less incentives to manage their risks in other ways. It can even incentivize them to take more risk than would otherwise be feasible. Therefore insuring is usually made obligatory only when objectives are not otherwise attainable. If the objective is to include more than a modest amount of solidarity into the solution (i.e., transfer of wealth) then the only solution is to make insuring compulsory.

Conclusions:

- **there should be a clear definition of what should be covered – adverse selection can then be addressed with tools that are in common use with insurers**
- **if however adverse selection cannot be adequately addressed (or if excessive solidarity is included in the solution) then insuring needs to be made compulsory even if this is not the most efficient solution.**

h. Moral hazard

Moral hazard can be present at any time when two parties come into agreement with one another. Each party in a contract may have the opportunity to gain from acting contrary to the principles laid out by the agreement. Moral hazard is generally the risk that a party has not entered into a contract in good faith or has provided misleading information about its assets, liabilities, or credit capacity. In addition, moral hazard may also mean a party has an incentive to take unusual risks in a desperate attempt to earn a profit before the contract settles.

The concept of moral hazard comes originally from the insurance industry. Insurance companies have worried that protecting their clients from risks (like fire, or car accidents) might encourage those clients to behave in riskier ways (like smoking in bed or not wearing seatbelts). In insurance markets, moral hazard occurs when the behavior of the insured party changes in a way that raises costs for the insurer since the insured party no longer bears the full costs of that behavior. A second type of change is the reaction to the negative consequences of risk once they have occurred and insurance is provided to cover their costs (i.e., no incentive to limit the losses).

There probably can be no insurance with absolutely no moral hazard. The phenomenon is probably best addressed by finding out how to limit it to a tolerable level. Sometimes moral hazard is so severe that it makes insurance impossible.

Moral hazard is best controlled by aligning the interests of the insurer and the insured. This is achieved by creating a financial incentive to the insured to avoid making a claim. This can be done for example with a bonus-malus system or with a deductible or also by charging lower premiums for insureds practicing appropriate loss prevention.

When we look at a possible shared resilience solutions we have at least three aspects of moral hazard:

- the individual insured taking inappropriate benefit from the SRS,
- the insurer involved in the pooling taking inappropriate benefit from reinsurance cover, either from a commercial reinsurer or the state as the insurer of last resort, or
- the state taking inappropriate benefit from either a possible European cover or from the fact that certain consequences of its actions are borne by private mutualization of risks.

With respect to the individual insured or even the insurer the tools to control moral hazard are fairly traditional. For the insurer there are different forms of reinsurance leaving a certain part of the risk to the primary insurer and all these can be applied both when excess risk is borne by either a reinsurer or by the state based on a public-private partnership.

The difficult part of moral hazard concerns the role of the state. We can look at the Covid-19 case as an example. The losses related to the pandemic result from direct consequences of the disease and from different actions of states in the form of lockdowns etc. The direct consequences are not too difficult to mutualise by the private sector but the different actions of the states cause problems in many areas.

The first moral hazard problem comes from the fact that the state can act without thinking of the costs. The natural tool in this area is that the solution needs to be based on public-private partnership with the state covering a substantial part of the costs.

The second moral hazard problem can emerge in a situation where there is EU wide risk sharing. In such a case there might be the temptation to make other member states carry an inappropriate share of the costs. The moral hazard in this area needs to be addressed with clear and fair rules for the possible joint European compensation to a single state. There probably needs to be an independent assessment on what is understood to be the compensation in such an issue. The problem is very difficult as the difference among member states will make it difficult to compare situations in different countries. An example of the difficulties in business interruption is that undertakings have different options and costs in different member states for the layoffs of employees in case their business halts and employees are no longer needed.

Conclusion: Moral hazard presents many challenges to any solution. It should be countered by making the rules as exact as possible and by aligning the interests of involved parties with one another.

i. Insurance fraud

Insurance fraud is an attempt to exploit an insurance contract. Insurance is meant to protect against risks, not serve as a vehicle to enrich the insured.

More generally insurance fraud is an illegal act on the part of either the buyer or seller of an insurance contract. Insurance fraud from the issuer (seller) includes selling policies from non-existent companies, failing to submit premiums, and churning policies to create more commissions. Buyer fraud can consist of exaggerated claims, falsified medical history, post-dated policies, viatical fraud, faked death or kidnapping, and murder.

Insurance fraud in the context of shared resilience solutions probably does not need much additional thinking as the additional players in such a solution (member states and the whole EU) are probably not expected to commit fraud. Therefore insurance fraud should be addressed as is normally done in insurance.

Conclusion: Insurance fraud should be addressed as is normally done in insurance.

j. Crowding out of private risk mutualization

Public and private sector actions have their merits and drawbacks, depending on the situation. Depending on the case at hand some things can most efficiently be addressed by public sector actions. In other cases private sector solutions work better. With what is said below we are not advocating pure private sector solutions. Instead, we are trying to address issues that need to be taken into account if private sector solutions are sought.

With the pandemic we have a situation where there are huge public measures to alleviate the economic consequences. These measures are much needed and very well understandable. On the other hand they create expectations that there will also in the future be some kind of a 'bail-out' with unexpected risks.

This disincentivizes private actions to prepare for the future. Firstly, one can anticipate that it is a waste of money to insure against a certain risk or take other measures. Secondly, those who anyway take insurance or prepare for the future in some other way will pay twice for the risk as they will also pay through taxes the losses of those who acted more carelessly.

One way to counter these disincentives is to make insuring against the risk compulsory. As already discussed in connection to adverse selection, compulsory insurance is usually not the economically most efficient solution. It would also limit the extent to which the risk is carried by voluntary insurance. It should probably only be used if nothing else works.

Another possibility is to create in legislation binding rules for the future actions – i.e., what is covered by the state and what is not. The problem with such legislation is that there will be huge political pressure for the state to act in a future calamity.

When thinking of what should be covered by the state there needs to be good consideration on the most efficient way of acting. For some risks private mutualization will be the most efficient way. Some larger risks would however be so large that private mutualization would not be efficient or at least not credible. An analysis is needed about the risk-sharing between the public and private sectors to find a viable balance. The cover by the state should not crowd out such private sector mutualization where it provides an efficient way of handling risks. The limits of private mutualization should also be recognized, beyond which a private solution is either not efficient or credible.

Conclusions:

- **an analysis is needed on the extent to which private risk mutualization is an efficient and/or credible solution, and**

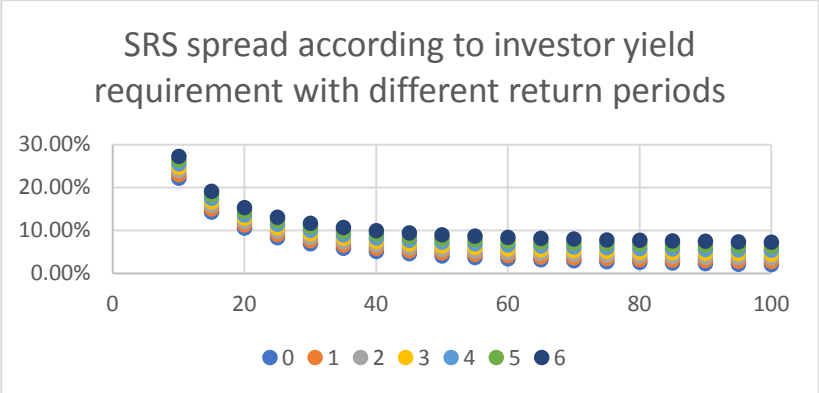
Appendix: How to quantify the spread of an SRS bond?

Assumptions

- an investor invests the amount C to the SRS bond
- the incidence triggering the use has a return period of **rp** years
- the incidence is expected to happen with probability 1/rp in a certain year during the return period (could happen more than once but there is no money for the second occurrence, could also not happen and then we can assume that the bond is not paid back – i.e. we assume that there is one occurrence with 100 % probability)
- the investor receives a coupon of risk-free rate (**rf**) plus spread (**sp**)
- the investor expects to have the capital C with a yield of rf plus yield (**y**) at the end of the return period
- the investor reinvests the coupon with a yield of rf plus y until the end of the return period.
- we fix everything else so that we can calculate the spread sp[17].

Calculation

- incident happening during the first year with probability 1/rp: investor loses everything
- incident happening during the second year with prob 1/rp: investor receives (rf + sp)*C*(1 + rf + y)^(rp – 1)
- third year: (rf + sp)*C*(1 + rf + y)^(rp – 1) + (rf + sp)*C*(1 + rf + y)^(rp – 2)
- etc.
- Expected value for the investor = (rf + sp)*C/rp * $\sum$ (rp – i) * (1 + rf + y)^(rp – i), where I goes from 1 to rp[18].
- The investor expects this to equal (1 + rf + y)^rp * C at time rp.
- Setting these equal we get sp = rp * (1 + rf + y)^rp / $\sum$ (rp – i) * (1 + rf + y)^(rp – i) – rf.
- we can be sure that the risk-free rate should not play much of a role here so a fairly exact formula would already be sp = rp * (1 + y)^rp / $\sum$ (rp – i) * (1 + y)^(rp – i)



[17] The yield y required by the investor apparently reflects the risk in the stream of coupons which could be to some extent measured by the variance in the stream. But here we think we can fix the y – at least we can find the spread with different values of the required yield.

[18] one can so to say change the 'order of summation' here but it does not lead to anything that is easier.