Project Report

Bulgarian Catastrophe Insurance Initiative

Feasibility Study

Draft

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Introduction

This report presents the results of almost a year long study carried out by the World Bank project team on the subject of catastrophe risk transfer in Bulgaria. The main objective of this work was to give some sense of the possible direction with regard to potential risk transfer solutions for the country to the Bulgarian government and the domestic insurance industry.

While no technical approach to catastrophe insurance is without fault, in a country so prone to natural disasters as Bulgaria one can hardly afford to wait for a perfect insurance scheme to arrive at the door step. Given that the country is located in the most earthquake prone region of Europe, it has been fortunate to experience only moderate earthquakes and damage over the past 75 years. In addition, in 2005 and 2006, the country experienced its first (in 50 years) significant flood losses of around USD 700 million.

Yet, the catastrophe insurance penetration among homeowners and small and medium size enterprises remains very low – only 1 out of 6 homes is currently insured against natural disasters. This lack of private insurance coverage puts the government in the position of the insurer of last resort – something which it cannot afford. According to the recent country risk assessment a large quake (with a return period of 1 in 250 years) will cost Bulgaria 18 percent of GDP or more than half of the government annual budget. Very little of that loss will be insured given the rather low level of catastrophe insurance uptake rate in the country. Putting quakes aside, even when one compares the cost of the recent large flood in Bulgaria (a relatively minor event compared to the loss potential from a large quake) with the existing financial resources allocated for the purposes of dealing with natural disasters in the national "Republican fund for liquidation, management and overcoming of disaster consequences" (total US$31.5 in 2007), a discrepancy becomes rather obvious. It would have taken 24 Republican funds to cover the costs of 2005 floods in Bulgaria.

The question then becomes is where to go from here. One solution would be to create a national catastrophe insurance program similar to those that exist in Turkey, California and another dozen disaster prone countries. In this program the public and the private sector can join forces to gradually shift the financial burden of future natural disasters away from homeowners and the government to the global reinsurance market. However, given the small size of the country such an approach is likely to produce only limited benefits as the size of the national risk pool will be rather small to achieve sufficient diversification while the transaction costs involved will be significant. In addition, to make a national catastrophe insurance program work in a small country like Bulgaria it must be made compulsory – a difficult decision to make for any government. An alternative solution for Bulgaria is to join a regional catastrophe insurance pool which is currently being created with assistance from the Bank for the countries of Southeastern and Central Europe under the World Bank Disaster Risk Mitigation and Adaptation Program. Under the regional catastrophe insurance program, Bulgaria will benefit from being a member of a larger and more diversified pool of risk, significantly lower program start-up costs, world-class private insurance expertise and the advanced best-practice

Swiss insurance supervision that will ensure program's solvency and uncompromising operational performance.

However, regardless of the option that will be chosen by the country in the end, we hope that this report will help the Bulgarian policy-makers and insurance professionals in their efforts to reduce the financial vulnerability of the country to natural disasters and will increase the public awareness of the benefits catastrophe insurance can bring.

The report consists of two main Sections and Technical Annexes. Section I first reviews the international experience in catastrophe risk transfer; it then analyses three different design options for the Bulgarian Catastrophe Insurance Pool and offers a detailed vision for the organizational, operational and financial organization of the national insurance program. Section II presents a preliminary actuarial pricing model for earthquake risk in Bulgaria that allows to price different catastrophe insurance products in each of seven cities chosen for the study. The Technical Annexes present the indicative prices for different insurance products as well as the proposed design of the catastrophe insurance policy that may be offered by the Bulgarian insurance pool.

Chapter I
A Brief Survey of the Bulgarian Insurance Market

The current state of the Bulgarian non-life insurance market

During the last 3 years the non-life insurance market in Bulgaria has experienced significant growth. For instance, as compared to 2006, in 2007 the volume of non-life gross insurance premium written by the Bulgarian market has increased by more 32 percent [1]. During the same time, the volume of property and property catastrophe insurance has grown from 118,792,519 leva in 2006 to 137,652,604 leva in 2007, or a more than 16 percent increase. This growth has been driven in many respects by the considerable improvement in the overall economic situation in the country which has experienced economic growth of around 6 percent per year.

Nevertheless, once expressed as percentage of GDP non-life penetration and density figures are still a fraction of the European average and stand comparison only with neighboring transition economies which have experienced similar economic and problems early on during the transition period such as Serbia. The small size of the insurance market is largely the result of still rather low incomes. Nevertheless, behind the still rather low insurance penetration figures among households, one can clearly discern the pattern of robust growth driven by a surge in mortgage and consumer lending. For instance, only in two year, the catastrophe insurance penetration among homeowners has increased from 3 to 7 percent mainly due to the regulation of the National Central Bank that requires mortgage lenders to ask borrowers for a proof of insurance coverage, including catastrophe risk endorsement, as a precondition for extending a mortgage loan.

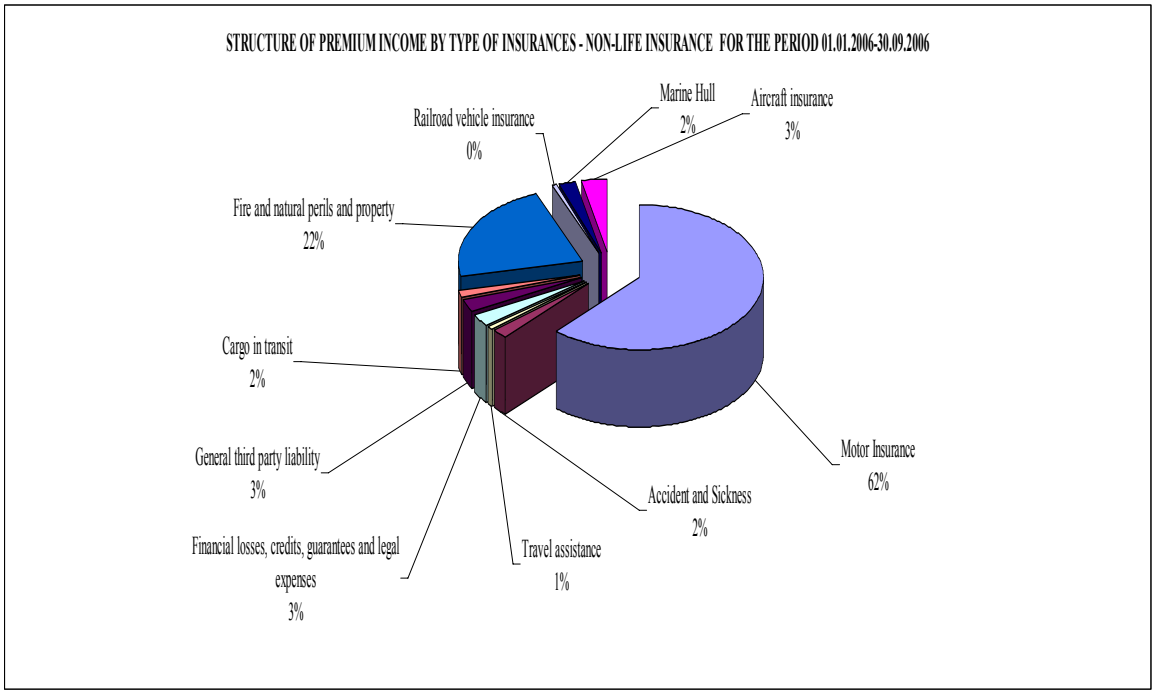
A number of insurers belong to insurance or financial services groups, which typically include a bank or a leasing company, a life insurer, a pension company or a health insurance fund. The Vienna Insurance Group, for instance, owns Bulgarski Imoti Life and a 40 percent shareholding in Kardan Financial Services.

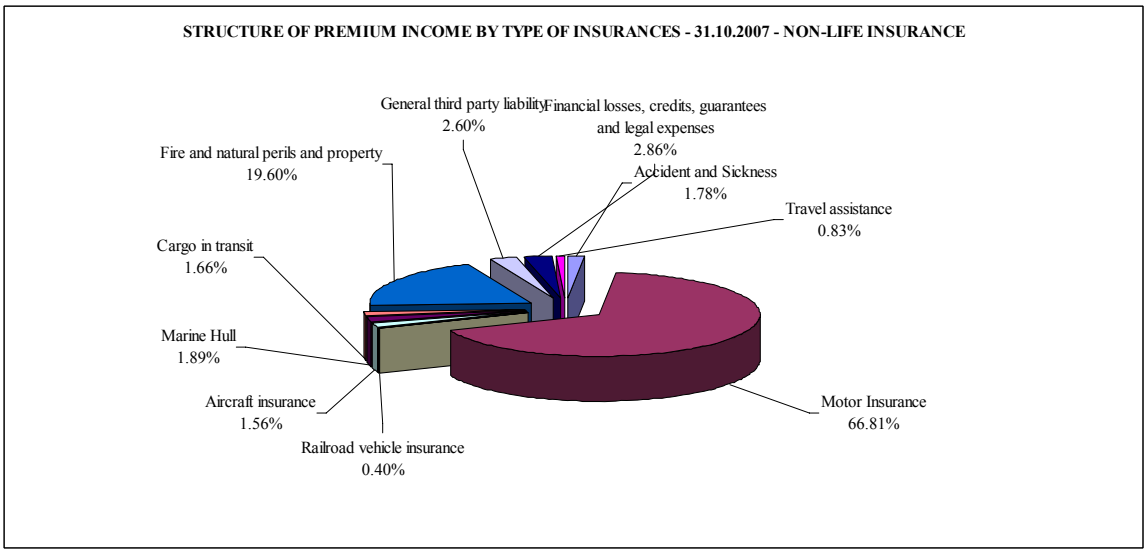
In 2005 non-life insurers made a post-tax profit of USD 44.18 million which represents 7.6 percent of the gross premium written. The overall profitability of the insurance market has been hampered by the high and rising expense ratio mainly due to brokers forcing up commission levels. Acquisition costs for MTPL, for example, can be as high as 50% when commissions, marketing expenses and free gifts to policyholders are taken into account. In addition, due to the growing competition for the MTPL business which in 2007 accounted for almost 70 percent of the premium written, the loss ratio for this line of business has been approaching, and for some companies, exceeding 100 percent. This rapidly deteriorating performance of the MTPL account has led to the increased loss ratio for the whole market from 36 percent in 2006 to 39 percent in 2007. Nevertheless, the

[1] The figures for 2007 do no account for GWP during the last 2 months of the year.

market by and large remains profitable due to exceptional performance of other non-life lines of business.

Figure 1. The structural composition of Gross Premium Written by Line of Business





At the time of the survey, the Bulgarian insurance market consisted of 19 non-life companies. Accession to the EU and recent improvements in Bulgaria's supervisory regime have led to a major expansion of foreign insurance companies: in the last 18 months the Vienna Insurance Group and UNIQA have taken over Bulstrad and Vitosha, respectively. Generali has taken over Orel, Hungary's OTP Garancia has set up DSK and

AIG has established a bank assurance entity while DZI, the former largest state insurer, has been bought out by the Belguim's KBC.

Property insurance

In 2005, property insurance generated BGN 184.1 mn (USD 116.96mn) of premium, an equivalent of 20 percent of the total non-life market premium; out of which BGN 149.7mn (USD 95.11mn) came from fire and natural perils covers. There are no statistics to show the division between household and industrial business, though the former account is believed to be rather small.

Only a small fraction of residences – about 9 percent - are insured against conventional (FLEXA) type perils. According to the recent survey conducted by the Insurance Regulator, even fewer, about 6 percent, are insured against catastrophic perils.

The property portfolios of local insurers mainly comprise multinational investments, which are often subject to fronting arrangements, and state-owned industrial assets. Low loss ratios, of the order of 30 percent, have encouraged a tradition of low rates.

Overall, the insurance industry is still in a nascent stage of development. This is particularly the case for insurance of catastrophic perils. However, since 1989, the Bulgarian insurance industry has undergone dramatic changes. Until then the industry was entirely owned by the state. With the 1990s came privatization and the entrance of international insurers into the Bulgarian insurance market. Currently four insurance companies dominate the market, accounting for over 70 percent of the market share

Catastrophe risk and insurance

Bulgaria has a history of large earthquakes dating from the beginning of recorded history. Moreover, given that the country is located in the most earthquake prone region of Europe, it has been fortunate to experience only moderate earthquakes and damage over the past 75 years. Major earthquakes struck the country in 1901 (with a Richter Magnitude of 7.2 or M7.2), 1904 (M7.3 and M7.8), 1913 (M7.0) and 1928 (M6.8, M7.1). The 1904 earthquake sequence with M7.3 and M7.8 includes the largest earthquake to strike continental Europe in the 20th century; the other events were among the largest earthquakes of the century on the continent. The country also experienced its first significant flood losses for 50 years in 2005 and 2006, with overall losses estimated to be around USD 700 million.

Coverage for most natural perils can be obtained through additional endorsements to the basic homeowners policy[2].

As mentioned, earthquake is an optional peril under a homeowners policy, but since penetration levels are low the risk accumulations are negligible. Usually, earthquake

[2] These include storm; hail; torrential rain, flood (high water), snow pressure, falling rocks, land slide, subsidence, earthquake, and in some cases frost.

coverage is offered as an optional extension to a fire policy with the slightly lower sum insured. Policies typically cover up to 85 percent of the sum insured.

As deductibles are not very popular with individuals and corporations they rarely exceed 2 percent of sum insured for earthquake coverage. Some companies however cover earthquake without any deductibles. For other natural catastrophe perils deductibles are not typical. In the absence of an explicit agreement to the contrary, underinsurance penalty (averaging) must be applied by law.

Local insurers are willing to provide earthquake cover on buildings and contents. Companies however are quite selective in providing earthquake coverage offering it on only pre-screened buildings. The insurers look carefully at construction, age and earthquake zone before offering a quotation. Coverage for business interruption can be obtained for only large companies.

An average Bulgarian household spends about 50 EUR per year on its homeowners policy. The cost of an additional cover for natural disasters is about 20 EUR.

Indemnification is typically done on the market value basis. However, foreign companies tend to settle claims on the new replacement value basis. This approach is now gaining popularity also among the local insurers. Loss adjustment is carried out by the insurance company experts. External (independent) loss adjusters are not common.

In the case of personal lines the main distribution channels used by companies to sell insurance products are own sales force, agents, banks, and retail brokers; for commercial and industrial lines– brokers and own sales force tend to be most common.

Risk Management

Companies monitor their earthquake accumulations by earthquake zones, often using the current Munich Re or Swiss Re natural hazards map or other similar zoning approaches. However, there are no known developed probabilistic models of the earthquake risk in Bulgaria; certainly no sophisticated models are known to be used in the insurance industry. Since probabilistic analysis of earthquake risk is still an undeveloped science in Bulgaria, local insurance companies have only a limited understanding of their earthquake risk exposures.

The lack of robust quantification approaches to earthquake risk can be seen in the wide spread of insurance rates offered in Bulgaria for the same risk. Table 1 shows the rates offered for earthquake insurance by a few companies for the four zones in accordance with the Munich Re natural hazards map. Zone IV is the highest risk zone. Rating levels vary significantly from insurer to insurer; they mainly range from a minimum of 0.1% to a maximum of 0.35%. Other insurers divide the country into three rating zones (A, B, C) in accordance with the Swiss Re natural hazards map and charge rates between 0.015% and 0.4 percent. The Swiss Re rating approach also envisages additional surcharges on the basis rate depending upon the height and age of buildings. For instance, for buildings

higher than 6 stories there is additional 10% premium increase; while owners of buildings older than 20 and 40 years must pay an extra 10% and 20% respectively.

There are local insurance companies that use an average rate of 0.14 percent across the whole country or add a 20 percent extra premium to the fire premium. The tariffs for other natural perils are flat, but some companies use premium loadings depending on flood maps or proximity to rivers and other water basins.

Table 1. Earthquake insurance rates for buildings

INSURER	EQ ZONE I Rate (%)	EQ ZONE II Rate (%)	EQ ZONE III Rate (%)	EQ ZONE IV Rate (%)	Deductibles	Sublimits
BULSTRAD	0,0290	0,0850	0,2800	0,7470	no	No
DZI	0,0360	0,1080	0,3290	0,9860	2%	85%
Allianz	0,0150	0,0450	0,1350	0,4000	no	no
Vitosha	0,2200	0,2200	0,2200	0,2200	no	No
Armeec	0,0102	0,0141	0,0225	0,0324	2%	85%
Viktoria	0,0100	0,0360	0,1000	0,300	no	No

Foreign companies, like AIG, Allianz, Vienna Insurance Group and QBE, have catastrophe excess-of-loss protection. Other companies have found that the minimum and deposit premiums quoted for X/L (excess of loss) contracts exceed their direct earthquake premium income, which leaves them with no choice but to scale down the volume of catastrophe risk premium written.

Catastrophe retentions of local companies are quite small, around 3 percent of the premium, with the rest of risk (and premium) ceded to international reinsurers. Companies track their risk accumulations by cresta zones and zip codes. The return periods used for accumulation control purposes vary from 250 to 450 years depending on the company. While the companies do not have their own risk models for accumulation control and pricing, they rely on those provided by large reinsurance brokers such as AON and Benfield.

Chapter II
Catastrophe Insurance for Bulgaria: Program Design Options

What would be the best design features for the Bulgarian catastrophe insurance pool and how such a program can be organized? What roles should be played by the government and the private insurance industry? This Chapter aims to shed light on these important questions first by drawing on the vast international experience in catastrophe risk transfer at the country level and then by providing an in-depth overview of the three existing proposals on the organization of the Bulgarian catastrophe insurance program. The Chapter then provides specific recommendations to the government and the insurance industry on the optimal design of the national catastrophe risk transfer program in light of international experience and the specific catastrophe insurance needs of Bulgaria.

Section I reviews international experience in designing national catastrophe insurance schemes. Section II presents three different approaches to the development of catastrophe insurance market in Bulgaria – the first one developed by the Bulgarian Catastrophe Insurance Initiative (an NGO comprising representatives of the insurance industry), the second one advocated by the Allianz Group, and the third proposed by the World Bank. The later introduces the regional approach to catastrophe risk insurance in Bulgaria, through the creation of the regional catastrophe insurance facility for 10 countries of South East Europe, which Bulgaria can join as a member. Section III provides a comparative analysis of all three proposals and points out their key strengths and weaknesses. Section IV concludes with recommendations on the optimal design of a Bulgarian catastrophe insurance scheme.

Section I. International experience in catastrophe risk pooling – major design options

Government policy-makers around the world are increasingly reaching a consensus that government has a legitimate role to play in providing insurance coverage against natural catastrophes. While this need has been generally recognized, there is however no one model of government intervention for catastrophe insurance that serves all needs - no single "one-size-fits-all" model. Each country has its own unique approach to providing financial protection against natural disasters, which varies from explicit government obligations to draw on budget revenues to fully compensate homeowners for damages wrought by natural calamities (e.g., Italy), to a situation where government has completely withdrawn from this field, leaving the provision of catastrophe insurance to the private insurance market (e.g., the UK). Many OECD countries have opted for intermediate solutions, whereby governments support national catastrophe insurance programs that often, but not always, have a significant element of private sector participation.

Due to the growing frequency and severity of natural disasters, caused by the increasing concentration of assets in disaster prone areas of the world and exacerbated by climate change, many more sovereign and sub-national governments have been in the process of identifying ways by which the fiscal burden of the state arising from natural disasters can at least partially be shared with the private reinsurance industry and capital markets through the creation of national or regional catastrophe risk transfer mechanisms.

Unfortunately, for a variety of reasons, many of these government-supported catastrophe insurance programs have not led to the desired policy outcomes. In fact, some of these programs have achieved just the opposite effect – for example, increased disaster vulnerability of homeowners and businesses, and reduced availability of private insurance coverage – and have resulted in considerably increased government fiscal exposure to natural catastrophes. *So what went wrong? Can one learn from these mistakes and design better disaster insurance programs?*

The purpose of this Section is to provide an overview of the existing most notable national or regional catastrophe insurance programs around the world with the view of drawing some conclusions and offering policy recommendations on the optimal design of a public-private partnership in catastrophe risk transfer for Bulgaria.

Rationale for State-Mandated Catastrophe Pools

Rapid onset natural disasters can cause extremely large losses to national or regional economies and the costs may be well in excess of what government resources can finance. Potentially huge losses are difficult to diversify within one, even a large-size economy, which necessitates risk transfer to the global reinsurance market through the establishment of national risk aggregating mechanisms. Traditionally, this risk aggregating function has been performed by the local insurance industry which has used reinsurance for a long time as a way to protect itself against catastrophic losses in excess of the desired risk retention.

However, even in wealthy countries with well developed insurance markets the loss potential can be so large that the insurance markets are unable to provide sufficient capacity at acceptable prices. Following a major loss, reinsurers often require substantially higher premiums to cover the same risk, in essence reducing or withdrawing cover through price increases. This effect, combined with the cyclical provision of capacity found in reinsurance markets, translates into highly volatile pricing for catastrophe risk which acts as a deterrent for many individual buyers of catastrophe insurance protection. This pricing volatility stems from a very significant risk transfer from primary insurers that originate the risk to the reinsurance market – the ultimate taker of this risk. According to some estimates, well over 50 percent of catastrophe risk is typically transferred by primary insurers to the reinsurance market, which makes the pricing of primary insurance policies highly dependent upon reinsurance rates prevailing in the market at the time of annual renewal of reinsurance treaties.

As a result, most national catastrophe insurance programs have thus emerged in the aftermath of major natural disasters in response to real or perceived market failure, in order to provide affordable insurance coverage. These disasters revealed, at least for a short period of time, the shortcomings of pure market solutions. Among the most common market failures have been frequent and well-documented insurance market break-downs in the aftermath of major catastrophic events. For instance, in the case of the Northridge, California earthquake in 1994, most non-life insurers stopped providing residential earthquake insurance coverage. A similar effect could be observed in the aftermath of the 2005 US "KRW hurricanes" (Katrina, Rita and Wilma) which resulted in

a shortage of available catastrophe insurance coverage. In the last three years, more than three million homeowners in the East coast of the US west of the Appalachian Trail have received cancellation letters from their insurance companies, which are determined to avoid yet another $40 billion Katrina bill.

Experience with State-Mandated Catastrophe Pools and Reserve Funds

As shown in Table 1, to date 14 national catastrophe risk management programs have been established and operate successfully in 26 countries, once 16 countries of the Caribbean region participating in the CCRIF are taken into consideration. Each of these catastrophe insurance programs emerged following highly devastating natural disasters to address the subsequent inability of the local insurance market to provide affordable catastrophe insurance coverage for a specific peril. Most of the programs:

- Provide country or state-wide coverage for dwellings and contents against specific natural hazards,
- Charge premium rates reflecting in one way or another the characteristics of the risk, but often with a significant element of solidarity involved; and generally do not receive direct government subsidies, instead relying on contingent government commitment to finance risk in case of a shortfall in claims paying capacity caused by a major catastrophic event.
- Address mitigation by encouraging retrofitting and safer construction practices through premium discounts or lower deductibles.
- Carry out sales and servicing of policies through the established distribution networks of private primary insurance companies and their agents.

Table 1. Specialized catastrophe insurance pools world-wide, 2008.

Country	Institution	Cover	Type
Algeria	CCR	EQ	PPP
France	NatCat/CCR	EQ/FL/WS/LS/S	PPP
Caribbean region	CCRIF	EQ/WS	PPP
Indonesia	Maipark	EQ	Private
Japan	JERe	EQ	PPP
New Zealand	EQC	EQ	PPP
Norway	Norsk Naturskedepool	WS/FL	PPP
Spain	Consorcio	EQ/FL/WS/LS	PPP
Taiwan	TREIP	EQ	PPP
Turkey	TCIP	EQ	PPP
US (CA)	CEA	EQ	PPP
US	FEMA	FL	PPP
US (FL)	Citizens	WS/FL	Public
US (FL)	FHCF	WS	Public

Notes: EQ-earthquake; FL- flood; WS – windstorm; LS – landslide; S – subsidence; PPP – public private partnership.

These programs also help alleviate political pressure, both from homeowners and mortgage lenders, for allocation of substantial government resources in the aftermath of natural disasters for reconstruction of private housing.

The role played by government typically involves the provision of additional risk financing capacity, either directly or indirectly. In the latter case, the government becomes the reinsurer of last resort by default, to be called upon in case of highly catastrophic events for additional claims paying capacity. The challenge in the latter ad hoc model is not to create sufficient moral hazard to undermine the whole risk management effort.

The government also provides regulatory oversight to ensure that catastrophe insurance pools are managed responsibly, with high quality underwriting, proper investment of capital reserves and sufficient solvency margin. The goal is to create a pool that sells an insurance product that is highly likely to pay out in the event of a catastrophe.

Ideally, a state-mandated or sponsored catastrophe insurance pool should increase the country's catastrophe risk absorption capacity, without competing with the existing markets. The objective of such programs is typically to supplement the coverage offered by the existing market.

Design of Catastrophe Insurance Pools

The design of catastrophe insurance pools typically aims at achieving affordable catastrophe coverage of acceptable credit quality and increasing the overall insurance penetration in the local market. These objectives are often met by having the government to provide claims paying capacity for highly unlikely catastrophic events while relying on the existing risk transfer market mechanisms to ensure that claims are paid in all but most catastrophic of the events. Governments are also quite instrumental to creating the regulatory environment conducive for the operation of such national catastrophe insurance schemes which, inter alia, involves introduction of some sort of compulsion or regulatory inducement or at least strong economic incentives for private citizens to buy catastrophe insurance products. To ensure availability of reliable and affordable insurance coverage, national catastrophe insurance programs often rely on the already existing infrastructure of the private insurance industry for the purposes of distribution and claims settlement.

While the design of national insurance programs involves a broad range of issues, in general they can be divided into five major categories:

- Design of insurance coverage**.** Design of an affordable insurance coverage starts with the identification of perils and exposures to be included in the coverage. The process considers the affordability constraints of the target population, the allowed variation of premiums by risk (the level of solidarity in the premium structure); the level of participation in the program (compulsory vs. voluntary); and other issues of policy design, including acceptable deductibles, limits, extent of coverage, and applicability of co-insurance and underinsurance penalties.

- Institutional structure**.** The design of the institutional structure entails the determination of the role of government, domestic private insurance companies and international reinsurers in the operation of the program; the establishment of its governance and management structures, as well as the distribution and claims administration mechanisms.

- Legal framework**.** The legal basis for a catastrophe insurance pool should be put in place to provide the incentives for purchasing insurance and undertaking mitigation activities by homeowners and businesses at risk.

- Risk financing and transfer strategy**.** Decisions will have to be reached on the initial pool capitalization requirements and its claims paying capacity; retention of risk by the pool vs. reliance on reinsurance and capital markets; the use of contingent credit arrangements to boost its claims paying capacity and promote survivability; asset management, and the role of the government as a reinsurer/guarantor.

- Mitigation incentives**.** The two key insurance related mitigation incentives are a credible statement from the authorities that they will only provide modest support to the better off (e.g. focusing the compensation effort on the poor) after a disaster occurs and the linking of insurance availability, or insurance payout, to planning and implementation of risk reduction measures.

The design process will invariably require iteration among these five sets of issues in order to develop an internally consistent and optimal model for the particular circumstances of the country and risks to be covered. A more detailed discussion of the four above mentioned steps in the program design process follows.

Insurance Product Design

Perils**.** The initial decision to be made in designing a catastrophe insurance pool is to choose the perils to be covered. This decision can present a challenge in an environment in which there is more than one serious natural disaster risk. Initially, the viability of an insurance coverage for each of the risks should be evaluated separately. Then it can be determined whether to start with one risk and add others later, or to issue a single policy covering several perils.

Exposures**.** The second key decision is to identify which exposures are to be covered, such as damage to structures (e.g. homes, businesses, offices), content or losses due business interruption.

Premiums and deductibles**.** The next step in the product design process is the determination of the premium rate structure. Initially, as a reference point this exercise should start with calculating the actuarial risk premium for a model policy (the features of which should be determined in advance), which should include the cost of annual

expected plus the cost of capital needed to support the volatility of annual technical results as well as the administrative costs and a profit margin. However, in practice, it is usually the case that the public is not willing to pay the full market value premium for a model policy that offers the most optimal insurance protection possible. Instead, the starting point is normally to estimate an affordable premium level, with the view of adjusting the policy coverage downward accordingly. Another challenge is to decide the extent to which premiums will vary by risk, which requires a more complex set of underlying data on the underlying hazard and vulnerability of the insured risks. Policymakers will also have to determine the degree of solidarity to be embedded in the premium structure, while ensuring that owners of expensive properties pay a fair premium. One tool to avoid moral hazard is to subject claims payments to a deductible or "an averaging clause," a form of co-payment for underinsured properties. Homeowners desiring a higher level of coverage can often purchase it through the private insurance market, which tends to cater to more affluent segments of population in developing and transition markets.

Participation incentives**.** An important issue is whether the insurance program will be compulsory or voluntary for homeowners. A compulsory program may be warranted where there is little awareness about insurance and mitigation on the part of the public, where there is a risk of adverse selection or where high enrollment is needed to bring the level of penetration high enough for the pool to be financially viable. Voluntary programs require active public education and mass marketing campaigns to succeed. A key consideration is the tradeoff between achieving wide penetration through a compulsory program and creating a negative perception of catastrophe insurance as a tax.

Coverage**.** The extent of coverage will then have to be determined taking into account the premium levels, administrative costs and calculations of the costs of adding capacity to the pool through reinsurance and the capital markets (risk financing and transfer strategy). Coverage can be adjusted to market clearing levels through deductibles, limits and maximum payouts. For example, the TCIP policies have a deductible of 2%, exclude indirect losses and damages to movable property, and the maximum insured limit of $60,000. These provisions also introduce an element of co-insurance into the equation so that homeowners share some of the risk and potential rebuilding costs. A determination will have to be made whether the coverage should be issued as a stand-alone policy or as an add-on to existing homeowners policies, taking into account the objectives of achieving effective distribution and wide penetration by keeping the costs of catastrophe coverage affordable.

Risk underwriting**.** The insurance pool manager should ideally have a mandate to deny catastrophe insurance coverage to buildings that are not compliant with the building code or were built illegally. It is also essential that the programs have enough leeway to adjust premium rates based on the latest available data on the nature of insured risks, such as, for instance, new scientific research underlying insured hazards or buildings vulnerabilities.

Legal Framework

If the government is to play a formal role in a catastrophe insurance pool then it will have to establish a legal basis for this activity. All but 2 of the above mentioned 14 existing catastrophe insurance schemes were established through enactment of the appropriate legislation. Relying on the underlying technical feasibility work, the legal framework typically spells out the institutional structure of a pool, including the governance and management arrangements; incentives to encourage purchase of catastrophe insurance product where appropriate; provisions for risk based premiums and coverage, and provisions to encourage safer construction practices and better risk mitigation through the use of insurance.

Ideally, such legislation should encourage widespread participation in the program, including if necessary, a legal requirement of compulsory insurance for those who can afford it. To create economic incentives for homeowners to undertake mitigation measures government should consider discontinuing government financed housing reconstruction programs for homeowners with access to insurance markets (whether private of government sponsored). This policy stance ideally should be combined with the introduction of risk based premiums and policy coverage limits that would allocate some of repair and reconstruction costs to the insured.

Building Strategic Partnerships among Key Stakeholders

A key design challenge is to determine the respective roles of government, domestic insurance companies and international reinsurers in the operation, financing, management and governance of a catastrophe pool. How these are determined will depend on circumstances in a specific insurance market, including the strength of the domestic insurance industry as well as the government's fiscal position. The government has a significant role to play in governance and regulatory oversight of such insurance entities once they are operational to ensure their financial soundness and fulfillment of social objectives.

The selection of the pool manager is a critical decision that should be taken at an early stage in the design process. This decision will have to be made at the front end so that the managing entity can work with the government team to develop the systems and business relationships that will be needed to launch such a program. The normal candidates for this role would be major domestic and international insurance and reinsurance companies.

In most developed and some transition countries, private insurers are able to provide some catastrophic insurance cover and the government supplements this by providing additional claims paying capacity in the form of backstop facilities. However, in developing countries it is usually the case that the domestic private insurance industry is undercapitalized and unable to retain any significant part of catastrophic risk. In this environment, the appropriate role for most domestic insurers is the distribution of policies and management of claims. Part of the design process will entail structuring the business relationships and processes between the pool manager and the firms that distribute

policies and manage claims in a way that would secure companies' commitment to the program and thus would ensure its success.

The role of international reinsurers is particularly critical to successful design of a risk aggregating mechanism such as a catastrophe pool. The government will have to work with the international reinsurance market at an early stage in the design process in order to assess the terms on which international reinsurers will be willing to accept the risk ceded by the pool. This assessment will be a significant factor in determining the viability of the future enterprise. A broad consultation process involving key reinsurance players will help facilitate a broad consensus on the structure of the national risk aggregator, so that reinsurers will be willing to commit capacity when the program becomes operational.

Governance arrangements for a catastrophe pool should focus on ensuring independence for the board of directors and professional management so that the business viability of the pool is not compromised by political interventions and the pool is well-protected from misuse or confiscation of funds. The composition of the board of directors should represent the interests of the government, the insurance industry and policyholders. The underlying legislation should establish the board's responsibility for setting up the strategy and policies of the pool and for overseeing the performance of management. The Board should be required to disclose information about the pool to the public in order to generate public trust and confidence.

Risk Financing and Transfer Strategy

The risk financing and risk transfer strategy of a catastrophe insurance pool has to optimize the relationship between premium levels, policy coverage and the pool's creditworthiness. The normal yardstick for creditworthiness is that the pool should be able to cover between one in 150 and one in 250 year events (i.e. probability of occurrence in a given year of between 0.67% and 0.4%) without becoming insolvent. As coverage levels increase for a given amount of premium and reserves, the creditworthiness of the pool may deteriorate. However, if coverage levels are set too low in relation to premiums then it will be difficult to achieve sufficient market penetration for the pool to be successful due to the unattractive terms of the coverage offered. The level of coverage in relation to premiums is driven by the pricing dynamics of the global reinsurance industry, as well as by the pool's overheads, its own risk retention levels and the targeted level of its creditworthiness.

A fundamental issue that pool managers must address is the sourcing of capacity for the pool. The pool sponsor will normally be expected to provide some initial capacity and working capital: and will have to determine how much risk the pool should retain and how much should be ceded to the reinsurance market. Initially, most of the claims paying capacity is likely to come from the international reinsurance market, particularly as the number of participants in the pool is still uncertain and on the rise. To maintain the adequate creditworthiness of the pool and ensure the affordability of premiums the government may play a role of reinsurer of last resort by providing additional capacity to the pool on less than market terms; alternatively, it may decide to stay completely out of

the program which can be achieved by having the pool pro-rate claims on a pro rata basis after an extreme (say one in 500 years) event. The latter approach however is likely to be politically unpopular with insured.

Catastrophe insurance pools face a particular challenge during the initial years when faced with claims from a major catastrophe before sufficient reserves have been accumulated. An explicit strategy has to be developed to avoid insolvency of the pool in this transition period, including the decision on the optimal amount of risk to be retained. At this point in time a pool needs more reinsurance capacity relative to its own reserves. One useful tool for enhancing the capacity of a pool to withstand an early disaster is a contingent credit arrangement.Till recently, for instance, the TCIP relied on a contingent credit provided by the World Bank, which helped it quickly accumulate its own surplus funds. The investment strategy for the pool's reserves is also intrinsically tied to the pool's survivability. For emerging markets, particularly smaller size economies, it is prudent for the bulk of the reserves to be invested outside the country to avoid extensive losses on both the liability and asset sides of the balance sheet in case of a large disaster.

Section II: Catastrophe Insurance Pool in Bulgaria – different design options

As could be seen from Section I, the design of a national catastrophe risk pooling scheme can take on different forms depending upon the unique combination of key features chosen by the architects of such a program. In the Section below we review three existing proposals that outline the design features and institutional arrangements for the Bulgarian catastrophe insurance program, e.g. those by BCII, by Allianz and the World Bank. Although all three proposals are still being in the process of further conceptualization, the broad contours have emerged that allow for their comparison.

Proposal by the Bulgarian Catastrophe Insurance Initiative (BCII)

The proposal advocated by the BCII closely follows the hybrid features of the Romanian and the Turkish catastrophe insurance schemes which results in an interesting hybrid approach.

Participation. The cornerstone of the BCII proposal is that catastrophe insurance should be made compulsory by law for owners of residential, municipal and government properties to avoid moral hazard and adverse selection problems by ensuring massive public participation. This feature of the program resembles both the Romanian and Turkish pool examples. To enforce the compulsion, BCII advocates the introduction of monetary fines and proposes to outlaw post-disaster government financial assistance for reconstruction of damaged or destroyed properties for homeowners without catastrophe insurance.

In addition, very similar to the Romanian model, to ensure the compulsion, local authorities are required to share the property ownership records with the insurance pool which will then contact property owners about the need to buy catastrophe insurance.

Property owners that do not buy the suggested insurance coverage become disqualified from any government post-disaster aid. Uninsured homeowners will also be subject to a fine in the amount of 100-500 leva.

Risks covered. Similar to the Romanian catastrophe pool, the risks to be covered under the BCII proposal include earthquake, flood and landslide.

Policy terms and conditions. The BCII proposal suggests coverage of damage to residential dwellings, but not contents, caused by the above mentioned perils up to a maximum insured limit of 40000-60000 leva. The policy will have a small deductible expressed either as a percentage of the limit or an absolute monetary amount.

The compulsory catastrophe insurance policy will be structured as the "first loss policy," e.g. the policy will pay claims up to the full policy limit net of a deductible w/o applying an underinsurance penalty.

For properties with values exceeding 40000 - 60000 leva, additional coverage could be obtained on a voluntary basis from the Bulgarian insurance market.

Risk rating. Following the Romanian model, the BCII proposal does not envisage a risk-based pricing approach to the risk, relying rather on the principle of solidarity among insured in the pool. The proposal however envisages two groups of dwellings for rating purposes – the first one includes buildings made of reinforced concrete and the second, consisting of dwellings made of materials that have not been subjected to either thermal or chemical processing. The proposed insured limits for the first and second groups are 40000 and 60000 leva, respectively. As mentioned, premium rates do not account for either size, height, location, or age of dwellings. The proposed premium rates for both classes of policies for all three hazards are 1 per mill (e.g. 0.001), which may or may not be sufficient to cover the actuarial and capital costs of the program.

Incentives for risk mitigation. Under the BCII's proposal, following the practice set by the Turkish TCIP the pool shall not insure illegally built dwellings or dwellings altered by subsequent construction without a valid building permit.

Risk underwriting. The compulsory insurance policies will be issued and backed by the national Bulgarian catastrophe insurance pool (BCIP), a special insurance entity established for the purpose of underwriting residential catastrophe insurance risk in the country. The pool will act as a national aggregator of catastrophe risk acquired from the sales of compulsory residential insurance policies. To ensure its solvency, the pool will maintain adequate claims paying capacity that will comprise a combination of its own surplus and reinsurance.

Distribution of insurance policies. Although domestic insurance companies can participate in the distribution of BCIP's catastrophe insurance products, under the program they will retain no catastrophe risk. Instead, they will pass on the risk acquired

from the sale of BCIP policies along with the insurance premium (net of distribution commission) to the pool.

To ensure the brand recognition and avoid the reputation risk the BCIP's policies will be issued on a separate policy form carrying an official BCIP's letterhead.

Claims settlement. The claims will be settled and paid by insurance companies participating in the program. The companies will be then reimbursed for these expenses by the pool.

For properties that will have both compulsory and voluntary policies, the later will pay claims based on the first loss basis as well up to the full insured limit with the deductible equal to the limit of the underlying compulsory policy.

For instance, consider a property with a replacement cost of 100000 leva is insured under both compulsory and voluntary policies, the limit of the first policy is 40000 leva and of the second is 60,000 leva. Assuming that the property is a complete loss, the first policy will pay 40,000 leva minus the deductible, while the second policy will pay the remaining 60,000 leva.

Ownership and Governance. Envisaged as a public-private partnership, the BCIP's Board will have representatives from the public and the private sector. The proposed composition of the Board will be as follows: one director will come from the Parliament, one from the Bulgarian Catastrophe Insurance Initiative, one from the Ministry of Finance; three members of the Board will come from insurance companies participating in the program and one from the management of the BCIP.

The original BCIP's capital will amount to 20 million leva. The subscription capital of the facility will be comprised of equity contributions by the insurance companies participating in the program. No shareholder will hold more than 10 percent of the pool's equity capital.

The role of government. Under the BCII's proposal, the government plays a rather prominent role in the scheme. The key elements of government participation include introduction of special catastrophe insurance legislation in the Parliament, enforcement of the compulsory insurance requirement as well as provision of a backstop contingent capital facility to the program to ensure its solvency in case of highly catastrophic events.

Risk financing. The pool's claims paying capacity will be comprised of a combination of the pool's own surplus, reinsurance and a government backstop facility.

Proposal by Allianz Bulgaria

Although less developed in terms of the level of detail, the proposal by Allianz Bulgaria sets itself apart from the BCII's proposal by the relative simplicity of implementation

which is likely to translate into considerable monetary savings due to reduced program operational costs.

Participation. Similar to the BCII proposal, catastrophe insurance under the Allianz proposal will be compulsory for every homeowner. This requirement will be enforced by adding a surcharge to the existing property tax. The property tax is currently levied on the estimated 3.8 million dwellings in Bulgaria, out of which 1.4 million are in the villages and 2.4 million in the cities. These additional revenues from the "catastrophe insurance" surcharge will be collected along with property taxes by local authorities and passed on to the catastrophe insurance pool. Homeowners that fail to pay the surcharge will be considered in arrears on the local property tax obligations, with all the corresponding remedies envisaged by the law.

Risks covered. Another important distinction of the Allianz proposal is that initially it envisages providing earthquake coverage only, with the flood risk sub-limit to be added at a later stage when the flood risk maps become available. The policy will not cover the risk of landslides.

Policy terms and conditions. Although there will be no insurance policy per se, under the Allianz proposal homeowners will be entitled to collect up to the full amount of the assessed property tax value upon presenting their property tax payment records for the last calendar year. The main drawback of this proposal is that property tax assessments on average account for only 20% of the current market value. The proposal however foresees that overtime this gap will considerably narrow down. The policy will have no deductible, and will pay up to the full limit (e.g. the full tax assessment of the property value) on the first loss basis.

Risk rating. Similar to the BCII's proposal, the Allianz proposal does not envisage any risk-based ratings either, instead opting for a flat surcharge (equal to 0.1 percent of the current property tax assessment) on the existing property tax. Since the amount of property tax to a large extent depends on the location and the size of dwellings, owners of larger houses in urban areas will end up paying more for their "catastrophe insurance coverage."

Claims settlement. To assess property damages in the aftermath of natural disasters and to ensure consistency in loss assessments, the pool will retain independent loss adjusters which will receive special training. Payment of claims will be contingent upon loss adjuster's damage report, along with the proof of property ownership and the receipt of paid property tax for the current tax year.

Risk underwriting. To administer the catastrophe insurance scheme, the government jointly with private insurers will set up a special insurance facility. All aspects of the pool's insurance operations will be outsourced to the private sector. The pool will be managed by an independent pool management company owned by the Bulgarian insurance industry.

Ownership and governance. Reflecting the public-private nature of the program, its Board of Directors will consist of representatives from both the government and the private sector, with the latter having a one vote majority. The facility will be capitalized and owned on a 50/50 basis by the government and the participating insurers.

Incentives for risk mitigation. One of the key drawbacks of the Allianz proposal is that it envisages no incentives for reducing the physical vulnerability of the existing and future housing stock to natural disasters.

Role of government. Under the Allianz proposal, the role of government is limited to introducing the legislation on compulsory insurance, as well as actively enforcing it at the local level through the property tax system.

Risk financing. Similar to the BCII's proposal, to pay claims the pool will heavily rely on reinsurance and its own reserves, which will be built over time from the pool's own earnings. Initially, the pool will have a risk capital of 20 million euro which will be used to finance its risk retention.

The World Bank Initiative for the Regional Catastrophe Insurance Facility

Yet another approach to dealing with the rather low catastrophe insurance coverage for private dwellings in Bulgaria would be to have it join the regional catastrophe insurance program which is currently being prepared by the World Bank for 10 countries of South Eastern Europe. The attractiveness of the World Bank facility stems from its superior ability to diversify catastrophe risk at the regional level as well as considerably reduce the start up and operational costs of the program by sharing them among a larger pool of insured clients as well as attracting donor funds.

While the objectives of the SEE Catastrophe Risk Insurance Facility (CRIF) partially overlap with those set out by both the BCII and Allianz Group proposals, they are more ambitious and broader in their scope. One of the distinct features of the World Bank proposal is that the CRIF explicitly aims to create economic incentives for homeowners and SMEs to reduce their physical vulnerability to natural disasters. Below we present the key features of the CRIF proposal.

Participation. Although the facility does not call for the introduction of compulsory catastrophe insurance in participating member countries, it will expect member governments to play an active role in raising the visibility of the facility's products. In addition, falling short of making catastrophe insurance mandatory, governments will be expected to take policy actions leading to a considerably increase in demand for catastrophe insurance in their home markets. These actions may include but not limited to:

(i) requesting mortgage lenders (through appropriate regulatory requirements) to require catastrophe insurance from borrowers for the full value of financed properties in disaster prone areas for the duration of the loans;

(ii) insuring with the facility all government owned housing stock against the risk of natural disasters;

(iii) limiting the amount of post-disaster aid to a small fraction of the average insured limit of SEERCIF insurance policy in the domestic market;

(iv) making availability of post-disaster aid contingent upon availability of CRIF insurance;

(v) investing in domestic public information campaigns to raise the disaster risk awareness among the population and explain the benefits of catastrophe insurance.

Hence, countries' membership in the facility will be contingent upon their commitment to adopt a policy framework conducive for the operation of CRIF in each respective market.

Risks covered. The facility will offer a stand-alone catastrophe insurance cover for the risks of earthquake, landslide and flood. However, similar to the Allianz proposal, the facility will start off by offering coverage for the risk of earthquake first, and will then add on the risks of flood and landslide as risk mapping and risk models for these perils become available.

Policy terms and conditions. The facility will offer innovative low cost catastrophe insurance products to homeowners and SMEs, which currently do not exist in the traditional insurance market. These products will include:

(i) a stand-alone catastrophe insurance cover for property and contents, which could be bought separately from a homeowners policy;

(ii) a stand-alone catastrophe insurance coverage for financial losses sustained by small and medium size businesses due to (i) business interruption; (ii) damages to business equipment and (iii) damage to owned business premises as a result of earthquake, flood and landslides.

(iii) parametric catastrophe insurance contracts for the above mentioned perils with payouts linked to occurrence of defined catastrophe events (such as quakes and floods of certain severity in a specified area), where appropriate. Parametric insurance products will be very much akin to financial derivatives, which would make them more suitable for distribution through alternative to insurance distribution channels such as local banks, post-offices and mobile telephone operators. As no loss assessment will be required for parametric products, following a natural disaster the facility will be in the position to make payments in a matter of days.

The above described CRIF indemnity type products will have a small deductible (of the order of 2-7 percent) that will be set as a percentage of insured limit. The maximum insured limits will vary from country to country based on the replacement cost of a median price dwelling in the country capital city. Similar to the other two proposals, the facility's policies will be structured on the first-loss basis.

Risk rating. Compared to the first two proposals, the insurance products provided by the facility will be actuarially priced, e.g. will closely reflect the true risk characteristics of insured properties. The premium rates charged by the facility will vary based on the location of insured risks and their vulnerability to natural disasters, which in turn depends on the age, height and construction quality of buildings. It is envisaged that due to its ability to diversify risk regionally, realize economies of scale and due to cost efficient organization of its operations, the insurance products offered by the facility will be priced competitively.

Incentives for risk mitigation. The program will help create strong incentives for businesses and individuals to engage in proactive mitigation and risk reduction efforts through the introduction of risk-based insurance pricing, and insurance deductibles. These efforts will be reinforced by commitments of SEE member states to engage in pro-active disaster risk management programs. In addition, the Facility will act as a powerful enforcement mechanism for the existing building codes and zoning regulations by being able to deny insurance coverage to non-compliant buildings, which overtime will considerably reduce the physical vulnerability of housing stock to earthquakes and floods. To ensure the continuity of proper disaster risk management in its member states, the Facility will contribute a part of its earnings toward raising public risk awareness and supporting other regional initiatives in disaster risk management.

Risk underwriting. The facility will be organized as a special purpose monoline insurance company offering stand-alone property and business interruption catastrophe insurance coverage for the risks of earthquake, flood, and landslides in SEE countries. To reduce the administrative burden arising out of multi-country registration requirements, the facility will be organized as an EU-chartered reinsurer and will seek admission to the SEE markets for its unique products through agreements with local insurance regulatory bodies and financial sector regulators.

The facility will not have public sector employees as the day-to-day operational management will be contracted out through an open tender process to a reputable private sector insurance or insurance services company.

The Facility will act as an aggregator of regional catastrophe risk. It will diversify its risk geographically and across different risks and product lines. The diversification benefits will be passed on to the SEE policyholders.

To manage its risk accumulations, the Facility will transfer its peak risks to the global reinsurance and capital markets.

Distribution of insurance policies. To distribute its insurance policies, it will rely on local insurers in Bulgaria. In addition, it will distribute its products through several of large European insurance companies with major presence in the SEE countries.

Claims settlement. The facility will administer claims by relying on the combination of loss adjustors from domestic insurers participating in the distribution of its products and a cadre of independent loss adjusters in member states. The regional nature of the program will enable it to quickly mobilize and allocate large numbers of loss adjusters from across the region to member countries affected by natural disasters.

Ownership and Governance. It will be owned and governed by SEE countries. The original capital contributions by the Facility's member governments will be used to satisfy the minimum capital and solvency margin requirements for reinsurance companies domiciled in Switzerland. It is envisaged that governments' equity participation in the program will be fully phased out after the first 5 years of the Facility's operations through a sale of government shares to private investors. The estimated size of the Facility's equity capital is $20 million.

The facility's Board will consist of the representatives of the member countries.

The role of government. The SEE countries will be the main owners as well as the major beneficiaries of the proposed catastrophe insurance program. The success of the Facility will depend on countries' willingness and ability to:

- create the enabling regulatory and legal framework for the operation of the program;
- carry out extensive public information and awareness campaigns about the availability and benefits of catastrophe insurance products;

Risk financing The claims paying capacity of the facility will consist of the initial paid-in capital of the country shareholders (around 20-30 million euros) as well as the reinsurance, premium and contingent capital facilities that may be provided to the program (through its member countries) by the World Bank. Contingent capital will be used as quasi equity and would enable it to accumulate reserves and pay for reinsurance premium during the first 5-10 years of its operations. It is envisaged that from the outset the facility will be in the position to cover losses from catastrophic events with a return period of up to 1 in 200 years.

Section III. Comparison of Three Different Approaches to Risk Transfer for Bulgaria

As has been shown in the previous section, each of three proposals is unique and has its own merits and short-comings. The objective of this Section is to provide an analytical comparison of these proposals with the view of determining the most optimal design features for the Bulgarian catastrophe insurance program.

We begin by providing the readers with a schematic comparison of all three schemes in a table format, see Table 2 below.

Table 2. Comparison of main program design variables

Design variables	BCII Proposal	Allianz Group	WB Regional Facility
Participation	Compulsory	Compulsory	Semi-compulsory
Risks covered	EQ, FL, LS	EQ, FL	EQ, FL, LS*
Policy limit	40000/60000 leva	Tax assessed value	Median property value in capital city
Deductible	TBD	None	TBD
Underinsurance penalty	None	None	None
Coverage	Property damage	Property damage	Property damage, contents and BI
Risk underwriter	National cat pool	National cat pool	Regional cat pool
Distribution of policies	Insurers/agents	NA	Insurers/agents
Claims settlement	Insurers' loss adjustors	Insurers' and independent loss adjustors	Insurance companies' and independent adjustors
Risk rating	Two ratings categories – solidarity based	One rate for all dwellings – solidarity-based	Risk based rates based on risk characteristics
Risk financing	Own reserves and reinsurance, backstop facility	Own reserves and reinsurance	Own reserves, reinsurance and contingent debt
Ownership	Government	Government/private insurers – 50/50	Member governments
Governance	Governed by public-private Board	Governed by public-private Board	Government by member governments
Management	Local insurers	Local insurers	Regional/global insurer
Role of government	Premium subsidies/legislation and its enforcement	Legislation and its enforcement	Policy actions conducive for business
Incentives for risk reduction	None	None	Yes

Notes: *The coverage of flood and LS will be phased in over time;

Participation. While the two proposals from Bulgaria are similar in their view of compulsory public participation in the program, the World Bank proposal assumes a much softer stance on this highly politically sensitive issue by calling for active government policy action in support of the program. The main advantages of the compulsory approach are of course the reduced adverse selection of insured risk and hence a much better quality of the insurer's portfolio in the end. The later typically

translates into lower premium rates for all participants in the pool. The disadvantage of the compulsory approach is that it is likely to be perceived as a tax, which may ignite strong political opposition to the proposal. But even if catastrophe insurance has been made compulsory by law, the weak enforcement of the requirement may eventually undermine the original intention of the program architects. The problem of enforcement is best dealt with in the Allianz proposal, which calls for adding a catastrophe premium surcharge to the property tax. Such an approach also implies much lower administrative costs of the program due to reduced expenses on marketing and distribution of insurance policies. Following the Romanian pool model, to ensure the enforcement the BCII proposal calls for assistance of local governments (that will monitor compliance) and will have the right to impose considerable fines on those homeowners which do not comply with the requirement. Due to its regional nature, the World Bank insurance facility can considerably mitigate the problem of adverse selection, which allows it to rely on only partial semi-compulsory approach to public participation. Nevertheless, the facility envisages governments introducing a compulsory catastrophe insurance requirement for mortgage borrowers in disaster prone areas in participating countries and limiting post-disaster assistance to a fraction of the insured limit.

- To summarize, in our view the Allianz proposal scores best in terms of ensuring the broadest public participation in the program, assuming the proposal can overcome political resistance to a new tax.

- Less onerous in terms of the envisaged enforcement mechanisms, the BCII proposal is also likely to experience considerable political resistance but, as opposed to the Allianz proposal, it is going to be less effectual in ensuring the compliance with the requirement of compulsory participation.

- The World Bank proposal, on the one hand, is likely to encounter much less political resistance in terms of implementation but, on the other, is unlikely to achieve the level of insurance penetration country-wide expected under the property tax scheme.

Risks covered. All three schemes will cover the risks of earthquake and flood, and two – the Allianz and the World Bank proposals – will also cover the risk of landslides. The fundamental difference between the proposals appears to be in the sequencing of the risk coverage. While the BCII proposal advocates the coverage of all risks from the start, the World Bank and Allianz proposals intend to phase in coverage for more complex risks (such as flood) over time, as risks models and risk maps for these risks become available.

To summarize, in our view, given Bulgaria's relatively low exposure to floods, and the modeling complexity of the flood risk, it may be advisable to adopt a gradual phase in approach, where the risk of earthquake is covered first and where the coverage for the risks flood and landslides is added later on once the data and models for the risk become available.

Insured policy limit. The amount of insured damages – the insured limit – constitutes one of the main differences between three proposals. The World Bank regional facility would offer the highest amount of coverage, amounting to the replacement cost of a median value home in the capital city of participating countries, which in the case of Bulgaria would be in excess of 100000 leva. The BCII scheme suggests a limit of up to 60000 leva which is likely to be sufficient for most residencies in Bulgaria except for those in Sofia. Finally, under the Allianz proposal, the insured limit will amount to the tax assessed value of the properties, which currently amounts to about 20 percent of the replacement cost of the property. One should point out that since most losses from the risks of earthquake and flood fall in the category of small or partial losses and no underinsurance penalty is envisaged under either the BCII or Allianz proposals, the expected annual losses (expressed as a percentage of insured limit) are likely to be considerably higher, which should be accounted for in setting the premium rates.

Deductible. While the Allianz proposal does not envisage introduction of an insurance deductible due to the tax driven nature of the scheme, the other two proposals do. In insurance, deductibles serve two important functions. First of all, they help aligning the incentives of insured with those of insurers and hence can work as a powerful countermeasure to the adverse selection and moral hazard problems. Frequently they also provide strong incentives for insured to proactively manage their risk exposures. Secondly, by shifting a significant percentage of losses to insured, deductibles reduce the overall amount of claims to be paid by insurers and hence result in lower premium rates.

In this context, out of the three proposals, the one by Allianz scores least favorably as it will provide no incentives for future buyers of protection to engage in proactive risk management. If actuarially priced, the proposal is also going to be more costly for insured in terms of premium rates (relative to sums insured) charged.

Underinsurance penalty. Also known as "averaging" in the insurance parlor, the underinsurance penalty aims to penalize homeowners which underinsure their properties, or buy less coverage than the estimated replacement cost of their dwelling. In cases when this happens, most insurers would prorate claims by multiplying the amount of claimed damage by the ratio of insured limit to the estimated replacement cost of a dwelling. While none of the three proposals contemplate the introduction of the averaging, the World Bank facility appears to be best equipped to deal with the consequences of underinsurance as compared to the other two.

Coverage. The coverage offered by the BCII and Allianz proposals is limited only to property damage incurred by insured properties as a consequence of an earthquake. The World Bank proposal offers a more comprehensive coverage offering a sub-limit for loss or damage to contents along with coverage for property damages. In addition, the WB facility plans to offer coverage for business interruption to small and medium size enterprises.

Risk underwriter. To provide the above-described catastrophe insurance coverage, all three proposals advocate the creation of a specialized catastrophe insurance company.

However, while the BCII and Allianz proposals call for the creation of a national Bulgaria specific pool, the World Bank proposal suggests the creation of a regional catastrophe insurance program that would offer catastrophe insurance coverage in 10 different countries of South Eastern Europe. To achieve a meaningful diversification effect within the national pool, country-wide pools in smaller size economies must ensure truly massive participation, which in turn rests on the creation of a truly compulsory (and effectively enforced) national insurance schemes. In the case of regional entity, due to a larger size of its portfolio and a more geographically diversified portfolio of risk, the mandatory participation of homeowners in the program may not be necessary. Instead, governments may need to focus on a softer set of policy measures to promote the catastrophe insurance products in their respective markets.

Distribution of insurance policies. Under the BCII and the WB proposals, insurance companies and their agents will act as a major distribution channel for insurance policies issued by the national/regional insurance pools. Under the Allianz proposal, the distribution function is not needed due to the property-tax linked nature of the program. By eliminating the distribution function, the Allianz program is likely to realize cost savings of up to 15 percent of the insurance premium which in turn will translate into increased affordability of insurance coverage.

Claims settlement. All three programs contemplate to use loss adjustors of insurance companies to settle claims in the event of a disaster. However, the Allianz and the WB proposals also envisage the use of independent loss adjustors, which will be trained by and affiliated with the national/regional programs. Such a two-tiered approach is likely to be more effective in the case of a major natural disaster as it would enable to considerably expand the number of loss adjusters the programs can rely on during the hour of need.

Risk rating. Following the Romanian model, both the BCII and Allianz proposals call for essentially a flat premium rate for all insured regardless of location and risk characteristics of insured dwellings. Such an approach implies major cross-subsidies from “good” risks to “bad” risks which is likely to result in adverse selection (unless the compulsory requirement is effectively enforced). In addition, a solidarity based approach to risk rating creates no incentives for insured to engage in proactive risk management and reduce the physical vulnerabilities of their dwellings to natural disasters. On the contrary, the WB proposal advocates risk-based premium rates which will vary based on risk characteristics of insured dwellings, which will include location, age, type and height of dwellings. Although, in our view, the risk-based rating of the risk is preferred to a solidarity-type pricing, we must caution against introducing too many risk rating categories to avoid unnecessary technical complexity in the administration of the scheme. In addition, a small element of solidarity (e.g. cross-subsidies) may still be necessary to ensure enrollment of homeowners in the higher risk rating categories.

Risk financing. All three programs will rely on reinsurance, own surplus and premium income to pay claims. The WB however also includes contingent capital as a potential source of risk funding that can be extended to the facility by participating member

countries or the World Bank Group itself. Similarly, the BCII proposal envisages the use of a government backstop facility to cover claims from highly catastrophic and rare events. While the Allianz proposal does not envisage capital participation of the government in the facility, due to the tax-driven nature of the program, it would be difficult for the government to refrain from providing financing support to the program in case of a major catastrophic event. Hence, we envisage that this feature of the program is likely to be added to the Allianz proposal at a later stage.

Ownership. All three proposals see governments as key shareholders in the proposed programs. However, the extent of government participation varies from 100 percent (the BCII proposal) to 50 percent (with the rest to be owned by private insurers) under the Allianz proposal. Under the WB facility, although governments will fully own the facility in the first 5 years, once the facility becomes fully operational and financially sustainable, they can sell their stakes to private investors. The rationale for heavy government participation has to do with the crucial role of the government regulatory powers which can influence the take up rate for the catastrophe insurance products and hence address the problem of adverse selection.

While the benefits of government ownership of such programs are obvious, one has also to be aware of the downsides, which can be addressed through the appropriate governance structure. First, governments typically do not have the expertise to adequately supervise the actions of the management. Hence, management has to be given clearly verifiable performance benchmarks as well as strong economic incentives to perform independently. For instance, one can consider linking management's compensation to the level of insurance penetration achieved during a specific period of time. Secondly, governments often tend to put the social objectives of such programs ahead of operational and financial goals. This problem can be addressed by limiting the Board's influence on the program to the matters of overall strategy, transparency and overall management accountability.

Governance. Reflecting the nature of the ownership, under all three proposals government will be well represented on the Board. Under the BCII and Allianz proposals however program Boards will also include representatives from the insurance industry, management board and academia. This diverse representation will help achieving a more balanced decision making process and minimize the potential political influences on the operational management of the program. In the case of the WB facility, to ensure its immunity from political influences, the Board will not have a say in the operational decisions of the company, limiting its decisions to the matters of overall strategy and governance.

Management. Under all three proposals, the pool will be managed by the insurance industry. The BCII's proposal envisages the creation of the pool management company owned by the insurance industry, where as the Allianz proposal is somewhat more vague about the exact form of private sector participation in the management. The World Bank facility will be managed by a private insurance services company to be selected through a competitive tender.

Role of government. While all three proposals envisage a major role for government in the creation and governance of the catastrophe risk pooling programs, the extent of suggested government participation varies a good deal. The Allianz proposal is perhaps the most interventionist as it makes the program possible only because of the introduction of mandatory catastrophe insurance requirement and its enforcement through the collection of property taxes by local authorities. In addition to the introduction of compulsory requirement and its enforcement the BCII"s proposal sees government providing premium subsidies as well. The least level of government participation can be seen in the WB facility, which neither requires the introduction of compulsory insurance requirement in participating countries, nor does it envisage premium subsidies (as the insurance products provided by the facility will be actuarially priced). We must point out that despite being less effective in terms of accomplishing a considerable increase in insurance penetration in participating countries, the World Bank proposal is likely to be the least contentious as it expects governments to facilitate the process rather than taking upon themselves politically unpopular commitments (such as introducing a new tax).

Incentives for risk reduction. Due to the solidarity-based risk fixed premium rates and uniform deductibles, neither of the two Bulgarian proposals provide incentives to homeowners for reducing the physical vulnerability of their dwellings or moving to safer buildings. The BCII proposal provides for the possibility of declining insurance coverage to buildings built without a construction permit. The World Bank proposal on the other hand is more conducive for mitigation activities as premium rates will vary significantly based upon the true risk characteristics of dwellings thus revealing the true cost of risk. Similar to the BCII's proposal the WB facility will also refrain from providing coverage to illegally built dwellings.

Section III. Designing an Optimal Risk Transfer Program for Bulgaria

The objective of this section is to outline an optimal, from the author's point of view, institutional design of the Bulgarian catastrophe insurance scheme. The suggestions on the design features proposed in this section are based on the existing international experience in building catastrophe risk transfer programs as well as on the analysis of the above presented proposals on the design of a catastrophe risk transfer scheme for Bulgaria. The Section advances two potential types of risk transfer solutions for Bulgaria – (i) the regional insurance scheme combined with the government regulatory support for its products and the (ii) Bulgaria specific insurance scheme. A summary of the main design features of the two proposed programs is presented in Table 3.

Table 3. Designing Catastrophe Insurance Solutions for Bulgaria

Design variables	Option I: Joining Regional Facility	Option II: Bulgaria cat pool
Participation	Compulsory or semi-compulsory	Compulsory – enforced by local governments

Risks covered	EQ, FL, LS*	EQ, FL, LS*
Policy limit	Up to median housing value in Sofia	Tax assessed value plus optional extra cover for extra premium
Deductible	TBD	None
Underinsurance penalty	None	None
Coverage	Property damage	Property damage, contents
Risk underwriter	Regional cat pool	National cat pool
Distribution of policies	By local insurance companies	NA
Claims settlement	Insurers' and independent loss adjustors	Insurers' and independent loss adjustors
Risk rating	Risk-based rating	Risk-based rating with strong element of solidarity
Risk financing	Own reserves and reinsurance, backstop facility	Own reserves and reinsurance, backstop facility
Ownership	Governments initially; private sector at a later stage	Government/private insurers – 50/50
Governance	Member governments	Governed by public-private Board,
Management	Regional/global insurer	Local insurers
Role of government	Legislation and its enforcement	Legislation and its enforcement
Incentives for risk reduction	Reduced premium for mitigation	Reduced premium for mitigation

Regional Insurance Program

In our view the most optimal catastrophe insurance solution for Bulgaria can be achieved by combining the design features of the regional risk diversification (envisaged under the World Bank regional insurance facility) with the mandatory nature of the scheme contemplated under both the BCII and Allianz proposals. By joining the World Bank facility as a founding member and enacting the corresponding legislation that would make catastrophe insurance compulsory in Bulgaria, the government can achieve lower premium rates for the Bulgarian homeowners, accumulate catastrophe reserves at a much faster pace, and reduce the probability of the pool's call on government budget in case of a major catastrophic event. In addition, the government would benefit from much lower start up costs involved in setting up a national catastrophe insurance pool, as most of these costs will be covered by donor funding.

The cover offered by the Regional insurance facility will include earthquake, flood and landslides. However, the coverage will be phased in over time with the risk of earthquake to be covered first. As the relevant data and risk pricing models become available for other perils, they will be included in the coverage as well.

Following the BCII proposal, the pool will sell its policies through local insurance companies and their agents participating in the program.

The coverage offered by the pool will have an insured limit up to the median housing value in Sofia and a deductible of 2-10 percent. The size of the deductible will be decided considering the tradeoff between the affordability of premium and the comprehensiveness of coverage.

Similar to the Regional facility, the premium levels (e.g. property tax surcharges) would vary with the risk characteristics of insured dwellings.

To settle claims, the Regional facility will rely on loss adjustors from local insurance companies as well as on loss adjustors from the neighboring countries. Each local insurance company will be assigned an area of the market where it would have the responsibility for carrying out the loss assessment services. If necessary, its own force of loss adjustors will be supplemented by those from other companies.

The overall operational management of the Regional facility will be carried out by an experienced insurance services company selected through a competitive open tender.

As has been discussed earlier, the governance of the facility will be entrusted to the member governments, one of which will be Bulgaria.

Bulgaria Insurance Pool

The country specific catastrophe risk pooling proposal would be organized similarly to the Regional Facility, except that it would be established in Bulgaria and would provide coverage only for the Bulgarian market.

To reduce the cost of coverage for homeowners even further we propose to adopt the design feature of the Allianz proposal – by using the existing property taxation mechanism. However, here we would propose introducing several important modifications.

First, as opposed to the flat premium rate (which translates into a flat property tax surcharge across the board), we propose to introduce a *variable* property surcharge which will be reflective of the true risk characteristics of insured dwellings and homeowners risk reduction efforts. For instance, homeowners that can demonstrate that the vulnerability of their dwellings has been significantly reduced through retrofitting efforts would be eligible to receive reduced premium rate. While it may not be practical to have too many risk rating categories, one can envisage at least 12-15 risk surcharge classes which would account for the location of the property and its physical vulnerability characteristics.

Second, under our proposal the limit of the coverage will be equal to the assessed property value for a basic coverage and for up to the full replacement cost for an extra

premium. Homeowners interested in obtaining extra coverage would have to contact the Regional Facility with a request for extra coverage. The facility will then contact the local government administering the insurance surcharge with the new insurance surcharge to be added to the local property tax.

The property risk surcharge will be then collected by local governments and transferred to the Regional Insurance Facility net of a small service fee.

The claims will be managed by insurance companies own loss adjustors and the cadre of independent loss adjustors to be contracted by the Pool.

While the diversification benefits realized by the program would not be that significant, it would nevertheless be an economical solution due to considerable economies of scale the program will be able to realize relative to private insurance companies that may offer catastrophe coverage.

Another important distinction with the Regional approach is that the pool would be managed by the pool management company set up and managed by the local insurance industry (as opposed to a competitively selected international insurance services firm). Also, the Bulgarian pool would be governed by the Board consisting of the representatives of the government and the private sector, with the later having a one vote majority.

Chapter III
Proposed Organizational and Operational Design for BCIP

The purpose of this Chapter is to outline the possible organizational and operational setup for the BCIP with a view of providing a clear blueprint for the Bulgarian policy-makers and the insurance industry interested in establishing such a program in the future. Following up on the two Bulgaria-specific catastrophe risk pooling approaches presented in the previous section of the report, this chapter attempts to spell out the key building blocks necessary for their successful implementation.

The structure of the Chapter is as follows. Section I lays out the model regulatory framework – the cornerstone for a national catastrophe insurance program. Section II describes the possible corporate governance and pool management arrangements, which inter alia outline the role to be played by the government, the program's Board of Directors and the Pool Management Company. Section III covers the main areas of the program's operational performance including the description of the insurance policy to be offered by the program, the proposed product distribution and claims handling mechanisms, the program's financial and risk management operations and IT. Section IV outlines potential approaches to boosting the demand for the program's insurance coverage in Bulgaria.

I. Legal Framework

Enactment of the appropriate legal framework is the key precondition for the successful operation of the national Bulgarian insurance program. One of the main objectives of such disaster insurance legislation would be to (i) limit government fiscal outlays on reconstruction of private dwellings in the aftermath of natural disasters and (ii) reduce the financial vulnerability of the Bulgarian homeowners to natural disasters by providing them with access to affordably priced insurance coverage. These objectives can be achieved by means of (i) increasing the level of catastrophe insurance penetration among the Bulgarian homeowners; (ii) transferring the risk of natural disasters to the private insurance and reinsurance markets.

Similar to many other country level disaster insurance programs, in the case of a country-specific program, the BCIP must be established as a discrete legal entity charged with the task of providing earthquake insurance to the Bulgarian homeowners, and, possibly, SMEs. To deal with the moral hazard problem and ensure the economic viability of BCIP, the coverage must be made either compulsory or semi-compulsory to ensure massive participation in the program.

To avoid competition for the same type of coverage from the private market that may result in the adverse selection against the pool (also known as "cherry-picking"), the law must also specify that the BCIP would be made the sole-source provider of catastrophe insurance coverage up to a certain limit.

In addition, to provide the right incentives for the Bulgarian homeowners to buy catastrophe insurance coverage, the legislation may consider explicitly eliminating any government obligations to provide post-disaster aid to those without insurance or, at least, limiting the amount of aid to a small fraction of the average insured limit envisaged under the BCIP's insurance policy.

To prevent potential misuse of funds, the legislation must also specify that the BCIP resources may only be used to cover costs incurred in connection with settling claims, paying reinsurance premium and administrative costs, including the commission to the company acting as the pool administrator, as well as covering scientific studies, consultants on relevant areas of pool administration, costs of public relations, or repayment of State funds (if those were provided) to the Pool. It is also essential that the BCIP's funds are legally safeguarded from any political influences and are invested in accordance with the Asset Management Guidelines approved by the Board.

The law must also contain a provision that would clearly describe the government obligations in case of an unlikely eventuality of the pool's claims exceeding its claim paying capacity. International experience shows that to reduce the cost burden on the program and hence make the coverage more affordable without jeopardizing its financial sustainability governments often opt for providing contingent liquidity facilities to such programs to cover residual claims in case of catastrophic events with an annual probability of less than 0.5 percent. As the program builds its own surplus funds over time, the probability of a call on government funds becomes even more remote.

To ensure that the program has a proper risk transfer program in place, the law must also spell out the minimum financial survivability requirements for such an insurance program. One way to proceed would be to set forth a regulatory requirement for the program's risk-based solvency margin to be determined based on the size and risk characteristics of its insurance portfolio. To this end, a special internal solvency model may need to be developed for the BCIP's portfolio and approved by the Insurance Regulator to ensure the program's compliance with the risk-based solvency margin requirements.

II. BCIP's Governance

The BCIP's governance should be shaped by the interests of multiple stakeholders involved in the creation and operation of the program. These should include the Bulgarian government, the local insurance industry, the scientific community, local consumer organizations and the Office of Insurance Supervisor.

If the program is to be managed by the local insurance industry whether through a special pool Management Company created by the industry or by an individual insurer selected through a tender, the pool manager should also play a prominent role in the operation of the program.

The Board must consist of an odd number of members, with one of them being the chairman of the Board. Typically, the number of the Board members in similar organizations is 5-7. The term to be served by Board members must be limited to 2-3 years as well as the number of terms they can serve. The law should specify the exact composition of the Board, and the minimum required qualifications of Board members. To ensure a diverse and capable Board, the law may also consider opting for an optimal mix of representatives from the public and private sector as well as academia.

Role of the Insurance Supervisor

Although it is expected that the Disaster Insurance Law should stipulate the main principles of the insurance coverage such as actuarial soundness of insurance premiums charged, limits of coverage, and deductibles, the role of the Insurance Supervisor would still be quite considerable. For instance, the Insurance Supervisor may be given the responsibility for defining the exact terms and conditions for insurance coverage to be provided by the BCIP as well as for administering future changes in coverage such as premium increases or increases in insured limits. It may be also advisable to stipulate in the law that any increase in the BCIP premium rates in excess of that indicated by the annual official construction cost index should also be approved the Insurance Regulator.

In setting the terms of insurance coverage, premium rates and commissions the Insurance regulator should aim to realize the following objectives:

- Maintain the financial viability of the BCIP;
- Increase the size of the fund over time so as to reduce the reliance of the BCIP on protection purchased from third parties (e.g., reinsurance);
- Encourage risk management and the mitigation of earthquake risk in Bulgaria through the adoption of improved standards of construction for domestic dwellings;
- Recognize variations in expected earthquake severity and frequency in different areas in Bulgaria and in different types of housing construction by varying premium rates commensurately;
- Encourage Bulgarian homeowners to purchase the BCIP policies through attractive pricing and increasing public awareness of the benefits of catastrophe insurance.

Premium rates and commissions should be set within the parameters established by the law, and subject to the BCIP underwriting guidelines and the necessary regulatory approvals.

The Insurance Regulator should also set the guidelines for the selection of insurance companies qualified for selling the BCIP's policies and settling its claims. This responsibility however should not detract from the ability of the BCIP to cancel the agreement with authorized insurers immediately should they fail to fulfill their obligations under the program.

The Insurance Regulator should be also responsible for holding the BCIP transparent and accountable to its policyholders by supervising the regular auditing of its books (to be carried out by an independent auditor), records and procedures, as well as ensuring the accuracy of its annual financial statements.

Role of the Board

The main role of the BCIP's Board is to determine the broad goals of the program as well as to monitor the performance of the Pool Manager and hold it accountable in case of its weak performance. This function is distinctly different from the operational objectives of the BCIP Manager.
The Board should be also responsible for ensuring that the BCIP has sufficient financial and human resources to carry out its functions and meet its objectives.

The Board should also have the authority to appoint those individuals and/or companies that are authorized to adjust claims presented to BCIP by its policyholders.

Another important responsibility of the Board is to agree on a budget and cash flow projections that would enable the BCIP to implement its operational strategy and achieve its operational objectives as envisaged in the business plan for that financial period while sustaining its ability to meet claims.

In consultation with the Insurance Regulator, the Board should also approve the BCIP's asset management strategy which is essential to the success of the program. Such a strategy combined with the purchase of adequate protection (e.g., reinsurance, contingent debt) aims at bolstering the BCIP's claims paying capacity in the face of its insurance obligations in a "worst event scenario." The Board has also the authority to appoint Asset managers to manage the funds accumulated by the program.

One of the main responsibilities of the Board is to develop and maintain a positive reputation of the program in the eyes of the Bulgarian public. A public relation consultant needs to be appointed to assist with such public relations exercises on behalf of BCIP. It may be advisable to create a special public relations committee of the Board that would comprise of several Board members and the CEO of the Operational Manager.

Role of the Operational Manager

To ensure the maximum cost-efficiency of the program, it may be best to outsource all operational tasks to the private insurance providers. The first step in this direction would be the retention of the Operational Manager which will be handling all technical and administrative tasks arising from the day-to-day operations of the BCIP.

Two options may be considered in this regard. The first option is to leave the selection of the BCIP manager to the local competition for the most qualified insurance company to

manage the program. The selection process can then be repeated every 3- 5 years to ensure the robust performance by the incumbent managing company. The second option implies the creation of the pool management company owned by the Bulgarian insurance industry, where the shares and influence exercised by different insurers will depend on their market share of sold BCIP insurance policies issued by the Pool.

In general, the main responsibilities of the Operational Manager can be defined as follows:

- Facilitate active sales of the BCIP policies through the available distribution channels;
- Manage the portfolio of policies written and monitor the receipt of premium by BCIP;
- Ensure adequate and cost-efficient reinsurance protection for the program;
- Manage loss adjustment and claims settlement processes in a way that ensures the expedient payment of claims in case of an earthquake;
- Maintain an IT database with the BCIP's policies and claims and all supporting accounting and accumulation control information;
- Manage BCIP's business relationships with insurance companies, agents, service providers and consultants;
- Provide management information as and when instructed by the Board;
- Operate BCIP in a secure and cost efficient manner;
- Make suggestions to the Board on how to improve the effectiveness and efficiency of the BCIP;
- Maintain a "Hot line" to respond to daily queries from insurance agents and homeowners regarding the BCIP policy sales.

For providing the above mentioned services, the Pool Manager will receive a management fee which will be proportional to the volume of insurance premium written by the program, and its ability to meet its operational targets. These typically include the volume of gross premium written, policy renewal ratios, underwriting ratios, costs and expenses, claims handling capacity and response times, and marketing effectiveness.
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III. Insurance Operations

An important step in institutionalizing the operational practices of BCIP is to prepare its operational guidelines. The guidelines set out the standards of operational performance for the Operational Manager and the BCIP's service providers in such key areas of the day-to-day operations as well as the terms and conditions of the BCIP earthquake insurance policy, the risk underwriting process, sales of BCIP policies, claims handling process, financial management, and the IT system. Each of these segments is described in more detail below.

BCIP Insurance Policy

To minimize fraud and differentiate BCIP from other insurance entities operating in the Bulgarian market, the program's insurance policies should be assigned unique policy numbers and printed off the BCIP's website on its letterhead by the authorized insurance companies and their agents throughout the country.

The perils to be covered under the BCIP policy should include earthquake, landslides and floods. However, it may be prudent to phase in the coverage of flood over time as flood risk models become available. Therefore, from now on we would refer to the BCIP's coverage as simply earthquake coverage.

The typical period of the BCIP policy should not exceed one year. The cover should commence and terminate at 12:00 noon in Bulgaria on the commencement and termination dates written on the policy, unless otherwise specified.

Buildings/units subject to BCIP insurance should be as follows:

- Detached or semi-detached residential dwellings in private ownership;
- Buildings constructed as dwellings on lands subject to private ownership and registered in the deed;
- Independent units within these buildings used for residential or office purposes by households or small and medium size enterprises;
- Dwellings constructed by the State and/or with credits provided by the State after natural disasters.

To avoid competition with the private sector and avoid taking excessive underwriting risks, the following buildings should be excluded from the scope of the compulsory disaster insurance:

- Buildings used entirely for commercial and industrial purposes;
- Buildings constructed without a valid construction license granted within the framework of relevant regulations.

To encourage better mitigation and safer construction practices throughout the country, buildings that do not comply with building codes should not be insured by the BCIP.

Under the earthquake insurance program, all material damage in the insured buildings (including those to the foundations, main walls, combined walls which separate independent units, ceilings and floors, stairs, landings/platforms, corridors, roofs and chimneys) caused directly by the earthquake (including fire, explosion and landslide following an earthquake) should be covered up to the insured value by the BCIP. The following risks should be excluded from the cover:

- Cost of debris removal, loss of profit, business interruption, deprivation of rent, alternative expenses of residence and business office, third party liabilities and the like and any other indirect losses which may be claimed,
- All kinds of movables, goods and the like,

- All bodily damages including death,

After the event causing the loss BCIP may also want to have the right of recourse against those insured whose declarations turned out to be contrary to the reality (i) for the whole of the paid and/or to be paid indemnity, in cases where the unrealistic declaration is made intentionally, (ii) for the amount of the indemnity exceeding the percentage between the premium already collected and the premium still to be collected in cases where the unrealistic declaration is not made intentionally.

Risk pricing and underwriting

The BCIP premium ratings should be set in an actuarially sound way to ensure the long-term financial sustainability of the program. The rates should account for the expected annual loss, the deviation of results from the mean, as well as the cost overheads and a modest profit margin. The premium ratings should be initially prepared by the Pool Manager and approved by the Insurance Regulator. Although it is advisable to differentiate between different buildings based on their unique risk characteristics, such as their location and vulnerability to risks, one should refrain from introducing an infinite number of rating categories as it may considerably complicate the administration of the program. Below, we present a rating approach that may be considered by the BCIP, which in our view is a good example of a sensible compromise between risk differentiation and administrative simplicity. The proposed tariff is built upon four components:

- Type of building/unit. Buildings can be classified under 4 vulnerability categories[3]:

    D. Steel reinforced concrete carcass: these are the buildings which have steel or reinforced concrete carcass carriers with high level of earthquake resistance, or masonry buildings with reinforced or confined concrete; or steel made structures or timber structures.
    C. Masonry buildings build out of massive stone; unreinforced masonry buildings with reinforced concrete floors; buildings out reinforced concrete with a frame or walls without earthquake-resistant design (ERD);
    B. Masonry buildings made out of simple stone or unreinforced masonry buildings made out of manufactured stone units;
    A. The least earthquake-resistant masonry buildings made out of rubble stone, fieldstone or adobe (earth brick).

A more detailed description of the building vulnerability categories can be found in the Study's Actuarial Report, Table 3.2.

- Earthquake intensity zone. Four different earthquake intensity zones should be considered based on the Bulgarian map of earthquake zones. This map divides

[3] Grunthal, G. (Ed.), European Macroseismic Scale 1998 (EMS-98). European Seismological Commission, Luxemburg, 1998.

Bulgaria into zones with potential hazards ranging from level 1 (highest) to level 5 (lowest) reflecting an evaluation of seismic activity, faults and earthquake history. These zones are not related to any administrative divisions or geographical characteristics.

- Sum insured. The sum insured under the BCIP policy may be set equal to the square meter of the dwelling multiplied by the square-meter value (per given class of construction) indicated in the national annual construction statistics report. These figures must be adjusted annually to reflect the latest changes in the current construction (replacement) costs. The maximum amount of cover to be offered by the BCIP should not exceed an annual median value of a dwelling in Sofia, which is currently of the order of 65,000 euro.

- Deductible. The premium rate for a given amount of coverage is greatly influenced by the level of selected insurance deductible. The program may consider offering coverage with a standard 5 percent level of deductible, which could be reduced further for an extra premium. The effect of insurance deductibles on the selected premium rates is fully examined in the Actuarial Report of the study.

As a result of above described approach, the program will have 16 rating categories for a standard level of deductible of 5 percent, as determined by 4 types of construction and 4 earthquake zones. Rates to be applied to the sum insured are detailed in the Annexes of the Actuarial Report of this study.

As a part of project preparation work, it would be useful to carry out a national building engineering survey which could lay the groundwork for the GIS based database for the BCIP's underwriting systems.

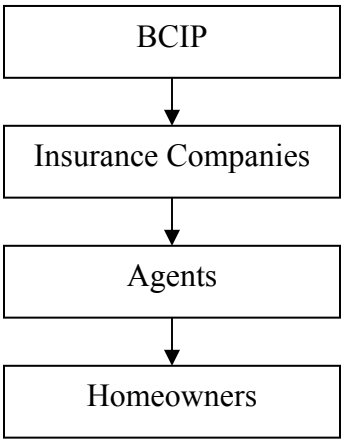
It is proposed that the BCIP policy should be structured as a "first loss" policy, i.e., losses are to be paid after applying a 5 percent deductible but without any underinsurance penalties up to the sum insured. Losses occurring within consecutive 72 hours should be attributed to a single event.

Sales of the Policies

Due to the catastrophic nature of earthquake and flood risk, and the inherent difficulties involved in diversifying it at an individual company level, it is proposed that insurance companies and their agents do not assume any risk under the BCIP program, instead passing it on fully to the pool. Under this proposal, domestic insurers and their agents will act as intermediaries in the sale of BCIP policies throughout the country. Although not risk takers under the program, insurance companies and their agents will play a critical role in the program as they will directly influence the volume of BCIP's policy sales and the public perception of the program. Figure 1 summarizes the marketing process.

It is envisaged that all licensed insurance companies in the Bulgarian insurance market that would agree to abide by the rules set out by the program would be able to sell insurance policies on its behalf to homeowners and SMEs. The companies can either sell policies through their own sales force or through affiliated agents. However, to eliminate the credit risk (also known as "counterparty risk") for the pool from doing business with numerous frequently unrated insurance entities, the companies will be required to post collateral with the program for the amount of their expected monthly premium writings. The collateral will be then used by BCIP to guarantee the timely payment of premium collected by insurers or its agents to the program.

Figure 1. BCIP marketing process



To facilitate the sales of policies, insurers will receive commissions on the sale of each and every policy. While the exact geographic distribution of the BCIP portfolio is difficult to predict at this stage, we envisage that most policies will be sold in the main 7 cities, with Sofia clearly being the most active regional sub-market.

To ensure the quality underwriting, authorized insurance companies will be requested to have policyholders fill in all the relevant policy information and transmit it in real time to the BCIP server (on line transfer).

As has been described in the legal framework section, under the program private insurers would not be able to offer their own earthquake insurance in lieu of the cover provided by the BCIP for housing units with the insured limits below the amount to be stipulated in the law. However, private earthquake insurance can be written for the part exceeding the sum insured under the BCIP policy, provided that the BCIP policy has already been purchased.

It is envisaged that when the program IT systems will have been installed, BCIP policies can be printed by the qualified insurance companies and insurance brokers from the program server once all the required information about the insured risk has been entered. To prevent fraud and ensure long-term credibility of the program, each policy will carry

its unique identification number and a logo of the BCIP program. Once printed and signed by the client, the policy will be activated for one year as long as the annual insurance premium has been collected upfront. The policy number can also be seen as a dwelling's ID number since it will remain the same through the year. Accounting settlements will also be based on the data transferred to the BCIP's central IT system.

The authorized insurers will be expected to demonstrate diligence in ensuring a successful renewal of their BCIP policies. They would be required to advise each policyholder at least one month before the policy expiration that it is about to expire and that it is necessary to renew it. The IT system should provide for an easy renewal of the existing policies by enabling agents to effortlessly retrieve the existing policy details of the insured from the previous years. In renewing a BCIP policy, all the information about the insured and the insured housing unit could be easily retrieved from the BCIP's database and would not have to be entered again by the agent. The renewing agent would only need to use the policy number to retrieve the policy record from the BCIP System and enter any additional changes on the risk, if needed.

Claims handling

This section outlines the claims adjustment processes that are likely to be followed by the BCIP if it were to become a well-functioning national insurance program. A lot of the suggestions provided in this section rely on the international experience in the field.

As mentioned, for the BCIP to quickly gain the national recognition and credibility, it is important that it has the necessary capabilities to pay claims quickly and in full. Claims under the BCIP policy will be managed by the Pool Manager. The later would also be required to render all necessary support and assistance to insurance companies involved in claims settlement whenever needed to ensure the prompt loss adjustment and settlement.

When an earthquake occurs, several factors will influence the claims management by the BCIP such as distance of the earthquake to the Operational Manager's headquarters, means and time of access to the earthquake area, weather conditions in the disaster area; number of insured units in the disaster area and the level of damage inflicted on the insured housing stock by a disaster. International experience suggests that the following tasks are likely to be performed by the BCIP as soon as an earthquake occurs:

- Officers of the BCIP Operational Manager arrive at Claims Management Center;
- The Claims Management Center staff is reinforced, if necessary, by transferring previously trained staff from other departments;
- Information on insured units in the earthquake area is retrieved from the computer database;
- Channels for claim notification are announced through mass media, posters displaying these numbers are faxed to agents of the insurance companies located within the earthquake area.

- Insurance companies responsible for settling claims in disaster prone areas are contacted to confirm their ability to perform.
- Additional loss adjustors are mobilized, if needed, to perform the claim settlement services in disaster prone areas.

Affected homeowners should be given various channels to notify BCIP of their claims, including ordinary mail, facsimile, direct phone lines, electronic mails, and a call center. A call center should be set up in the offices of the BCIP Operational Manager. Staffs from different departments should be trained to receive claim notices and enter them into the computer records in case of a large catastrophic event.

Loss adjustment will be one of the most critical aspects in the relationship between the BCIP and its clients. Speed, consistency and homogeneity in loss adjustment are the most important concepts to inspire sustained public confidence in BCIP. The basic task of a BCIP loss adjuster would be to determine the cost of compensating affected homeowners for the amount of loss. The simplest task is to recruit loss adjusters already employed by the insurance industry for the purposes of settling its claims. The program may be able to recruit more loss adjusters from the neighbouring countries who have the technical knowledge and experience needed for adjusting earthquake losses. In addition, the BCIP can also expand the cadre of its loss adjusters by training and consequently mobilizing those who are not professional loss adjusters but possess the needed technical knowledge and experience so as to ensure fast and fair loss adjustment after an earthquake. To expand the numbers of available loss adjustors, a special training programme sponsored by the BCIP should be established.

In general, once claims are reported, they should be assigned to loss adjusters in a manner which will ensure loss adjustment in an economic and efficient manner. The claims settlement stations in the disaster area must be in constant contact with loss adjusters in the area and additional loss assessments may be requested from a loss adjuster as claim notices are received at a later time.

The indemnity amount could be based on the construction replacement cost of the building on the date and at the place where the loss occurred subject to a cap equal to the insured amount.

The BCIP will have to inform the insured of the loss and indemnity amount determined after completing investigations within the shortest possible period following the submission of the documents on the loss amount to the pool.

The loss adjuster who has investigated the damaged building would have to fill in a loss adjustment report. Once the agreement is reached between the insured and the BCIP, the full amount of indemnity should be paid with 30 days. Since compulsory earthquake insurance should provide a minimal form of cover, it may be beneficial to enable partial prepayments of the claims that can be later deducted from the full indemnity, as part of the strategy to win public support.

Indemnity or advance payments should then be remitted by the fastest form of bank transfer to a bank branch in the earthquake area which can be easily reached by the insured. Upon receiving his/her indemnity payment the insured should be asked to sign a letter of discharge.

The Terms and Conditions of the BCIP policy should also specify obligations of insured in the aftermath of an earthquake, which should include the follows:

- Inform the BCIP and/or the insurance company which executed the insurance contract on behalf and account of the BCIP at the latest within 15 working days following the date when the insured becomes aware of the damage;
- Give permission to the officials and/or authorized bodies of the BCIP to enter into the damaged buildings with reasonable means and ways and to take any measures likely to reduce the loss;
- Submit without delay to the BCIP, upon their request, all the necessary information and documents which may be provided by the insured and which are useful in determining the loss amount;
- Submit a written note indicating the estimated loss amount with a reasonable and suitable period of time to the BCIP and/or to their authorized bodies;
- Inform the BCIP in cases where there is other earthquake coverage other than the compulsory one for the insured dwelling.

The cause, characteristics and amount of loss occurred in the buildings insured under the BCIP policies should be fixed by agreement between the insured and BCIP in accordance with the findings of authorized loss retained and working on its behalf. In case the parties do not come to an agreement in respect of the loss amount, the determination of the loss should be made by the arbitrators.

To prevent illegal improvements of insured properties, the BCIP should have the right to cancel an insurance policy in cases where the insured makes alterations in the insured dwelling without a valid construction permit.

In the case where the loss occurred is a total loss, the insurance expires by the payment of indemnity. In the case of a partial loss, the sum insured decreases as much as the indemnity amount paid as of the date of risk occurrence.

BCIP's Financial Management

The BCIP's income will comprise insurance premiums, income from its financial assets, and reinsurance recoveries. The expenses will include claims payments, claims handling expenses, reinsurance premiums, commissions paid to insurance companies and their agents, Operational Manager's fee, cost of advertising and public relation campaigns, general expenses for administration and operation of the BCIP, debt service, if any, on any debt that may be provided to it by the government or commercial lenders. One important observation to make here is that the legislation establishing the program should

make a provision for exempting the program from any taxes, duties, and charges to ensure rapid accumulation of catastrophe reserves.

Hence, the BCIP will require sensitive financial management in its early stages, with the key elements of it being (i) actuarially sound pricing of the risk (see the Actuarial Report); (ii) cost-effectiveness; (iii) adequate claims paying capacity; and (iv) prudent asset management.

Asset management. The management of BCIP assets should be done in accordance with the Investment Guidelines that would need to be developed by the Pool Manager and then approved the Board and the Insurance Regulator. Once assets reach a certain threshold, say $20 million, it may be advisable to retain a professional investment advisor to manage the pool's surplus funds in accordance with the investment guidelines approved for the program. The composition of the BCIP's investment portfolio will be crucial for its ability to pay claims quickly and in full. Hence, its investments of choice should be immune to a loss in value in case of a large earthquake – the time when the BCIP would be selling assets to meet its claims. Hence, investments should be chosen based on their ability to meet the liquidity, preservation of principal, and rate of return requirements. They must be diversified and must be spread across a wide range of instruments and securities so that the greater part of the portfolio can be converted into cash without loss in real value when needed on a very short notice. The presence of double exposure on both the asset and the liability sides of the balance-sheet necessitates the importance of investing a significant percentage of BCIP's funds in liquid foreign assets (such as EU government bonds or euro-denominated CDs of large highly rated international banks).

Other common investment guiding principles for similar institutions commonly require that investment instruments must be of highest investment grade available in the country. Total investment exposure to one single issuer must not exceed 5-10 percent of total portfolio assets (except for treasury bonds). Except for domestic or foreign treasury/government bonds, the maturity of investment instruments should be rather short – similar to that of money market type investment instruments.

The annual accounts of BCIP should be regularly audited by an independent auditor to be appointed by the BCIP's Board.

Reinsurance Before deciding on a risk transfer strategy for the program, premium projections regarding the volume and the spatial composition of the BCIP's first year premium (percentage of premium written in zones 1-4) had to be made by the Pool Manager. Table 1B below presents our calculations of probable maximum loss for events with different return periods and the overall amount of reinsurance coverage required in the first year of the program's operations. These calculations are based on certain assumptions with regard to the level of insurance penetration in different risk zones, risk retention by the pool, the average insurance limits and deductibles (see Table 4).

Table 4. Assumptions for Portfolio Risk Management Model

Penetration	60% in Sofia and 50% in 6 other major cities

Deductibles	0, 2%, 4%, 5%, 7%, 10%
Protection threshold (return period)	1 in 160, 200 or 250 year events
Coverage	EQ
Insured limit	Vary (up to 65,000 euro)
Pool's risk retention	5% of claims paying capacity on first-loss basis

As can be seen from the Table 5, the amount of reinsurance coverage required for the program is highly sensitive to assumptions about, the level of insurance deductibles chosen and the severity of loss threshold selected (also known as the event return period). For instance, if the program is to protect itself against one in 160 year event the amount of reinsurance it would have to buy from the market will be directly linked to the size of the insurance deductible under its policies – if it were to issue policies with 0% deductible it would have to buy US$640 mm of reinsurance whereas if the deductibles are raised to 10% of sum insured the amount of reinsurance needed drops to US$356 mm. Obviously, policies with higher deductibles require much less reinsurance premium to be paid to paid to reinsurers and hence are more affordable for the consumers.

Table 5. Required BCIP reinsurance coverage

Return period (years)	0%	2%	4%	5%	7%	10%
160	640,311	577,486	522,178	494,523	438,264	356,258
200	998,875	945,405	899,483	876,521	830,598	761,714
250	1,739,226	1,652,455	1,564,438	1,520,430	1,383,317	1,103,599

While the exact structure of the reinsurance program is to be defined by the program manager jointly with its reinsurance advisor, given the start-up nature of the placement one may foresee the following program features:

- Although the reinsurance program will be intended for one year, the Operational Manager should have the right to cancel the cover at the end of the first six months, taking into account the penetration and the exposure experience of the insurance program;
- Another approach would be to have the first few layers of coverage attached at the beginning and ran for 12 months, while the remaining top 3 layers of coverage could be attached quarterly and ran for 9, 6 and 3 months respectively.
- To reduce unnecessary expense on reinsurance, premium adjustment could be made annually based on the BCIP's average aggregate premium written at the end of the period;
- To compensate reinsurers for uncertainty with regard to the utilization of their reinsurance capacity, the facility may want to pay them an option fee;
- BCIP's coverage should be placed with highly rated reinsurers, with credit ratings of at least A.

One issue that has to be addressed from the outset of the program is how to finance the costs of reinsurance premium in the first few years of the pool's operations at a time when the pool does not have enough surplus of its own. To commence the operations of the program, a reinsurance cover will have to put in place from day one, even though the amount of premium collected by then is likely to be insufficient to support the cost of reinsurance. To address this problem the designers of the BCIP may consider two possible approaches. Under the first approach, the BCIP will have to negotiate a special agreement with its reinsurers permitting it to pay the reinsurance premium at the end of the coverage term (which will be at odds with the existing industry practice). The loss of financial income to reinsurers on the uncollected premium may be compensated by a higher overall reinsurance premium rate. The other approach would be to secure a short-term loan facility from either the government or commercial lenders that will be used to cover the costs of reinsurance in the first and possibly second year of the BCIP's operations.

Besides reinsurance, another form of debt that may be considered by the BCIP for its risk financing program is contingent debt. The advantages of contingent debt have been well proven by the example of the Turkish Catastrophe Insurance Pool (TCIP) and the UK Pool Re. By substituting a percentage of reinsurance with contingent debt, these programs achieved significant premium savings and accelerated accumulation of their reserves. Contingent lines of credit can be secured from either commercial or developmental lenders (such as IFC/World Bank) or government for the purposes of paying claims in case of an insured catastrophic event. Dynamic financial analysis should be used to determine the most optimal slot for contingent debt in the overall risk financing structure of the program.

IT systems

To considerably increase insurance penetration, ensure secure and timely payment of premiums, improve the quality of risk management and financial reporting, and accomplish prompt settlement of assessed claims from securely invested and adequate funds the BCIP will need to implement a wide-ranging and efficient information system.

For instance, one of the immediate IT goals of the BCIP would be to establish an internet-based central policy production center that can provide flexible, scalable, secure, and controllable services. The primary objective of the system would be to enable effective tracking of all insurance policies sold from a single center as well as to provide effective claims management when necessary. To meet such specifications the system is likely to be (i) a Java-based, high performance application designed to operate through the internet; (ii) have a high performance central database; and (iii) an open, scalable, and fault tolerant IT infrastructure; (iv) have a high performance, expandable, and reliable LAN and WAN structure. In addition, given the critical nature of such an IT system for the operation of the whole program, we would strongly recommend the establishment of a backup system.

The implementation of the system will allow the Pool Manager to securely manage BCIP data from a single center through access to a real-time accurate and reliable insured database. The insurance sector will also benefit from a high performance working and reliable BCIP IT infrastructure which will provide a new and secure sales channel in a user friendly and easily accessible environment and the effective and rapid claims management capabilities.

The implementation of the above proposed IT system will also allow the BCIP to deal directly with insurance agents in writing of and renewing of business as well as ensuring a timely remittance of insurance premiums by agents and insurance companies. The system can also be used for direct online sales to individuals.

In addition, one can consider incorporating in the system the real-time data transfer function which can be used by large insurance companies who have already invested in their own IT systems and hence may want to use their internal systems for the sale of BCIP policies. Insurance companies whose agencies would be using their corporate systems to sell BCIP policies would have to connect to the BCIP central system to receive a policy number in real-time for each newly created policy. The operating system should be able to support both modes of operation.

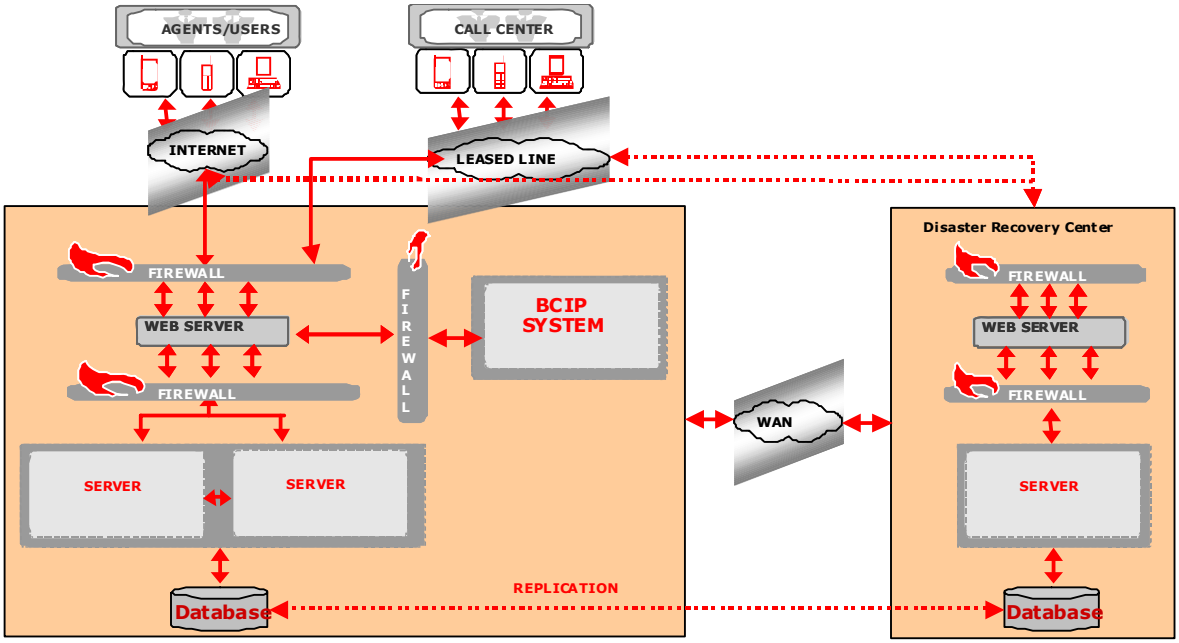
Once implemented the system should provide for the production of insurance policies, claims management, financial management, reporting, as well as other management support functions. Furthermore, as information is central to minimizing costs and reducing adverse selection, BCIP's IT system should be designed to collect essential statistical data that takes into account location of the policyholder (earthquake zones, urban, rural, etc.) and the building being insured (type, number of stories, age, etc.). Quick and accurate access and analysis of this data will be essential to the optimal portfolio management of the BCIP and thereby its ultimate success.

The system should be able to support the web access for the distribution network and produce policies in real time through the central database and application software after receiving the central approval using interactive SSL (secured socket layer) techniques. Under the SSL, to access a general policy screen a predefined user (an authorized insurance company or agent) would use a username and password which then would enable him to accurately enter the necessary policy information.

The system should also be able to process claims received through several communication channels – a call center, the internet, or directly through insurance agents. The call center should be set up within the BCIP Operational Manager's offices to provide homeowners with general information, claims advice and policy activation services. Additionally, the call center should also provide IT information and support to the users or agents selling the policies. Besides the internet and call center, the BCIP can take advantage of the SMS (short message service) technology, within the GSM (global system for mobile) framework for policy renewals and claims advice.

Finally, to secure against a loss of the database in the case of a major earthquake, a disaster recovery center must be set up outside of Sofia to act as a "backup system" to the main system situated at the headquarters of the Operational Manager in Sofia. This center should provide such functions as replication, analysis and inquiries, while acting as a "mirror site" providing backup in the case of extraordinary or catastrophic circumstances to ensure the continuity and performance of the BCIP. A schematic illustration of the proposed BCIP system is provided in Figure 1.

Figure 2. Proposed BCIP's IT System



V. The Consumer Demand for Earthquake Insurance

Gaining the consumer confidence in the BCIP would be key to its success. In the light of the government intention to make the program compulsory, the public perception of the BCIP is likely to be rather negative from the outset. Prejudice and misunderstandings about the compulsory nature of the program, the amount of premiums to be paid, the way the collected funds will be used, and the operation of the pool are all likely to be subject to public scrutiny. Hence, winning the confidence of the consumers should be viewed as the main priority of the program. To overcome the low earthquake risk awareness and little trust in the insurance industry from the outset the BCIP would have to invest heavily in public education and marketing campaigns to gain consumer confidence.

These public information campaigns should be carried out by a professional public relations firm via a range of different media channels (ranging from television to public radio, internet and newspapers). The main focus of these campaigns should be to address the lack of confidence in the program and its insurance products among the Bulgarian consumers. Among the pertinent questions that may need to be addressed by the

campaign are the ability of the program to survive a large catastrophic event, speed of claim settlement, the procedure to be followed in settling claims, and available venues for buying an earthquake policy.

The ability of the BCIP to considerably increase catastrophe insurance penetration will also depend on the policy support from the government. Falling short of making the BCIP insurance policies compulsory, the government will then have to adopt a policy framework conducive for the operation of the program. While the exact list of required policy actions will depend on the concrete circumstances of the BCIP's launch, the key policy measures to be adopted by the government may include, but not limited to:

(vi) requesting mortgage lenders (through appropriate regulatory requirements) to require catastrophe insurance from borrowers for the full value of financed properties in disaster prone areas for the duration of the loans;

(vii) insuring with the facility all government owned housing stock against the risk of natural disasters;

(viii) limiting the amount of post-disaster aid to a small fraction of the average insured limit of BCIP insurance policy in the domestic market;

(ix) making availability of post-disaster aid contingent upon availability of BCIP insurance;

(x) investing in domestic public information campaigns to raise the disaster risk awareness among the population and explain the benefits of catastrophe insurance.

Chapter IV. Insurance Product Design and Pricing

Technical feasibility of catastrophe insurance is predicated on its proper pricing. Proper pricing shall take into account the expected costs of covering the underlying risk exposure, targeted return on equity as well as administrative and management expenses, and costs of risk capital.

In this Chapter, based on the case study of seven Bulgarian cities, we develop a risk pricing methodology that would enable the BCIP to offer catastrophe insurance products on the terms which will make it financially sustainable. The cities covered in the study are Sofia, Plovdiv, Varna, Rousse, Pazardzhik, Blagoevgrad and Veliko Tarnovo.

The Chapter is organized as follows. In Section I we provide description of earthquake residential insurance products which we have chosen for pricing purposes. We differentiate between indemnity based and parametric trigger products and consider different sub-limits and deductibles. Section 2 provides a detailed explanation of the pricing methodology which we applied for both indemnity based and parametric trigger products. In Section 3, we describe the uncertainty factors that may have influenced the computed product prices and provide recommendations for the future research. Finally, in Appendix C, we present individual policy pricing results for each policy type, each building type for each of seven Bulgarian cities under consideration.

I. Possible Product Portfolio

This section we describe different possible insurance products that can be offered to homeowners and SMEs in Bulgaria for the risk of earthquake. These include both indemnity based and parametric trigger products. From the outset, it is worth mentioning that these two groups of products are rather different. Whereas an indemnity based product indemnifies a policyholder based on the actual loss to the policyholder's insured property, a parametric trigger product pays out a pre-agreed amount of money if the chosen trigger has been met independently from the actual loss to the insured property.

Indemnity Based Products

We consider two classes of indemnity based products – products with sub-limits (indemnification is limited by the chosen sub-limit) and products without sub-limits. Four different sub-limits – EUR 10,000, 15,000, 20,000 and 25,000 – were taken into consideration. For the product without sub-limits, we assumed that the Total Sum Insured of the policies in each city is equal to the average dwelling price in this city. Furthermore, for both policy types with and without sub-limit, we considered six different values of deductible – 0%, 2%, 4%, 5%, 7% and 10%.

Based on different combinations of sub-limits and deductibles we obtained 30 different designs for indemnity type products. These 30 designs are summarized in Table 2.1 below. We have assigned self-explanatory names to each policy type based on the specific combination of sub-limit and deductible (See Table 6 below).

Table 6. Policy types, indemnity based products

Sub-limit / Deduct.	nil	€10,000	€15,000	€20,000	€25,000
0%	NoSLD0	SL10D0	SL15D0	SL20D0	SL25D0
2%	NoSLD2	SL10D2	SL15D2	SL20D2	SL25D2
4%	NoSLD4	SL10D4	SL15D4	SL20D4	SL25D4
5%	NoSLD5	SL10D5	SL15D5	SL20D5	SL25D5
7%	NoSLD7	SL10D7	SL15D7	SL20D7	SL25D7
10%	NoSLD10	SL10D10	SL15D10	SL20D10	SL25D10

The payout patterns of indemnity based products can be illustrated by the following example. Let us consider the product SL20D10, i.e. indemnity based product with the sub-limit of EUR 20,000 and the deductible of 10%. Table 7 below shows the policy payouts for different values of the loss to the property insured.

Table 7. Payout pattern, indemnity based product SL20D10

Loss to Property	Payout Insurance
EUR 1,000	none
EUR 10,000	EUR 8,000
EUR 30,000	EUR 18,000

With the sub-limit of EUR 20,000, deductible of 10% translates into EUR 2,000. With this result, we can easily understand why there is no insurance payout in case of a loss to the insured property of EUR 1,000 – this loss falls under the policy deductible. However, for the loss of EUR 10,000, the insured will receive a payout of EUR 8,000, e.g. the original insured loss minus the deductible of 10 percent applied to the insured sublimit of EUR 20,000. In case of an insured loss of EUR 30,000, first, the sub-limit is applied, which reduces the covered loss to EUR 20,000. Then, applying the deductible of EUR 2,000 translates into the policy payout of EUR 18,000.

Parametric Trigger Products

The trigger for the suggested parametric products is based on earthquake magnitude. In case of an earthquake, the policy pays the chosen maximum amount as long as the magnitude of the event is above the chosen upper threshold. The policy does not pay anything if the magnitude is below the chosen lower threshold. For the lower magnitude threshold, we considered three alternatives: 6, 7 and 7.5. The upper magnitude threshold was set at 9. For magnitudes between the lower and the upper magnitude thresholds, policies pay partial amounts of maximum payouts proportionally to the magnitude.

For the policy maximum payout, we chose four different values: EUR 5,000, 10,000, 15,000 and 20,000. Therefore, we obtained 12 alterative product designs with three different lower thresholds and four different maximum payouts. These 12 designs are summarized in Table 8 below. We have assigned a self-explanatory name to each specific type of policies based on its sub-limit and deductible. The product names are provided in Table 8.

Table 8. Policy types, parametric trigger products

Max payout / Thresholds	€5,000	€10,000	€15,000	€20,000
lower 6, upper 9	T6to9MP5	T6to9MP10	T6to9MP15	T6to9MP20
lower 7, upper 9	T7to9MP5	T7to9MP10	T7to9MP15	T7to9MP20
lower 7.5, upper 9	T7.5to9MP5	T7.5to9MP10	T7.5to9MP15	T7.5to9MP20

To illustrate the payout patterns of a parametric insurance policy let us consider an example. Let us consider the product T6to9MP20, i.e. the parametric trigger product with the lower magnitude threshold 6, upper magnitude threshold 9 and a maximum payout of EUR 20,000. Table 9 below shows the policy payouts for different values of the earthquake's magnitude.

Table 9. Payout pattern, parametric trigger product T6to9MP20

Magnitude	Payout
5.5	none
7.5	EUR 10,000
9.5	EUR 20,000

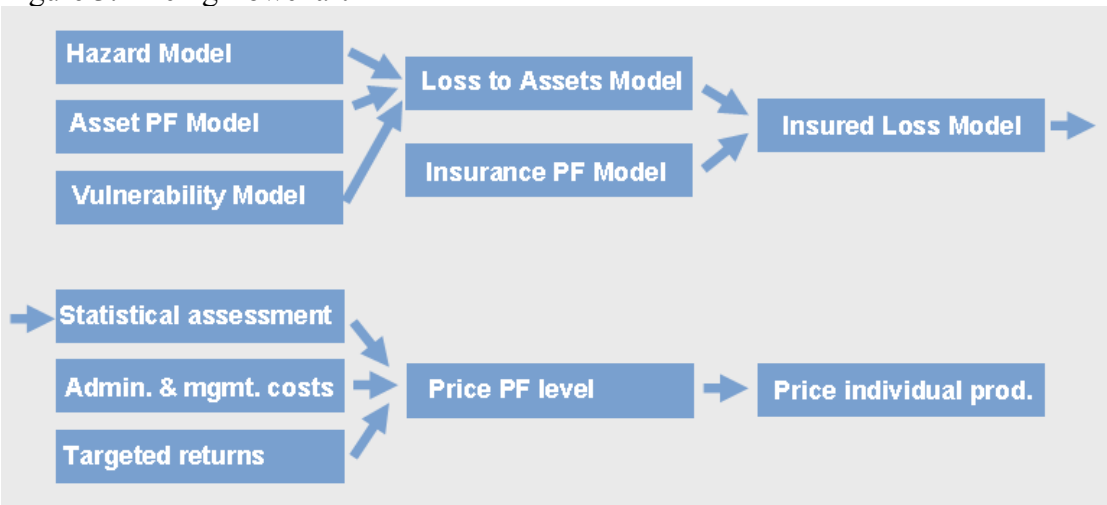
In case of an earthquake event with the magnitude of 5.5, the policy does not make any payout as the actual magnitude of the event falls below the chosen product trigger for the magnitude threshold. However, in case of an event with magnitude of 9.5 the policy pays the maximum payout of EUR 20,000 as the actual size of the event is well above the chosen upper payment trigger. Finally, for the magnitude of 7.5, the policy pays 50 percent of the maximum payout as the magnitude of 7.5 falls exactly in-between the

lower threshold of 6 and the upper threshold of 9. Thus, as specified above, the policy pays only a partial amount of the maximum limit proportionally to the magnitude.

II. PRICING

In this section, we present the developed pricing methodology which can be applied to both indemnity based and parametric trigger products. This methodology can be illustrated by the flowchart shown in Figure 3 below.

Figure 3. Pricing flowchart



As can be seen from the flowchart, in the first step, the Hazard Model, the Assets-At-Risk Portfolio Model and the Vulnerability Model have to be specified. The Hazard Model captures different physical characteristics of the hazard to be covered, the risk of earthquake in our case. In brief, the Hazard Model specifies the probabilistic distribution of earthquake magnitude and earthquake intensities (or other measures of the earthquake strength) at each geographic location of interest, in our case for seven Bulgarian cities included in the case study (Sofia, Plovdiv, Varna, Rousse, Pazardzhik, Blagoevgrad and Veliko Tarnovo). The objective of the Assets-At-Risk Portfolio Model is to specify all different characteristics of the assets at risk, in our case a portfolio of residential dwellings in seven Bulgarian cities, which are relevant for the insurance coverage. Finally, the Vulnerability Model specifies the range of potential damage to the Assets-at-Risk portfolio from each of the modeled earthquake events.

By superimposing the Hazard, Assets-At-Risk and the Vulnerability Models, we can then obtain a Loss-to-Assets Model. In our case, this model specifies the losses to the portfolio of residential buildings in each of seven Bulgarian cities arising out of earthquake events. However, to complete the next step, the Insurance Portfolio Model is required. This model describes the characteristics of the portfolio of all insurance products which are in place for the covered hazard and assets at risk. By superimposing the Loss-to-Assets Model and the Insurance Portfolio Model we then in the next step can estimate what portion of the loss to assets (specified by the Loss-to-Assets Model) is covered by

insurance. This brings us directly to the Insured Loss Model. In our case, this model specifies the probabilistic distribution of insured losses to the residential portfolio from seismic events in each of seven Bulgarian cities considered in this study.

In the next step, statistical assessment of the probabilistic Insured Loss Model has to be carried out. The resulting parameters of the probabilistic distribution (such as expected loss, standard deviation, quintiles) together with all involved costs and targeted returns on equity constitute the basis for calculating the price of the insurance coverage at the portfolio level. Finally, this portfolio price is translated into the individual policy prices.

Below, we provide some more details on each part of the pricing methodology.

The Hazard Model

As mentioned above, the Hazard Model specifies the probabilistic distribution of earthquake magnitude at earthquake origin and earthquake intensities (or other metrics for the earthquake strength) at each geographic location of interest, in our case for seven Bulgarian cities. This is often done by specifying a stochastically generated set of earthquake events with sufficient many events for generating a reliable probabilistic distribution. Our pricing was based on the set of 18,000 earthquake events in the following format, see Table 10.

Table 10 Stochastic set of earthquake events

Event id	Freq., 10^-4	Seism. Reg.	Magnitude	Peak Ground Acceleration (PGA), [g]						
				Sofia	Plovdiv	Varna	Rousse	Pazardz.	Bl.Grad	V. Tarn.
...	...	...	...	...	...	...	...	...	...	...
1123	0.201	Reg. A	7.3824	0	0	0.13	0.05	0	0	0.05
1124	0.201	Reg. A	6.3448	0	0	0.10	0.18	0	0	0.07
1125	0.201	Reg. B	6.3876	0.11	0.05	0	0	0.12	0.17	0
...	...	...	...	...	...	...	...	...	...	...

In this format, not the earthquake intensity but the value of another metrics for the earthquake strength – Peak Ground Acceleration (PGA) – is specified for each event and each city. Usually, such event sets can be provided by such modelling agencies as EQECat, RMS, AIR, etc.

The Assets-At-Risk Portfolio Model

The objective of the Assets-At-Risk Portfolio Model is to specify all different characteristics of the assets at risk portfolio which are relevant for the insurance coverage. For the portfolio of residential buildings, this mainly includes clustering dwellings into vulnerability groups with unique earthquake vulnerability characteristics within each group, estimating number of dwellings in each group and specifying the distribution of dwelling prices (total sum insured) in each group. As estimating the distribution of dwelling prices was difficult in our case, we worked instead with average dwelling prices for each city.

We considered four dwelling vulnerability groups according to the following four different construction types:
Type T1: Newer reinforced concrete precast-large panel buildings,
Type T2: Diverse reinforced concrete buildings,
Type T3: Masonry buildings with rigid floors,
Type T4: Masonry buildings with deformable floors (wood or still beams) as well as stone, wood and adobe buildings (the latter three account for a very small percentage of the total).

Further detail on the above construction types can be found in [1], pp. 30 ff.

From the available statistical data, [1], Bulgarian National Statistic Institute, www.bns.bg, we calculated number of dwellings in each vulnerability group and average dwelling prices in each city. Dwelling numbers are given in Table 11 and average dwelling prices in Table 12 below.

Table 11. Dwelling numbers in each vulnerability group and each city

	Total number of dwellings	no dwellings in buildings of Type T1	no dwellings in buildings of Type T2	no dwellings in buildings of Type T3	no dwellings in buildings of Type T4
Sofia	513,725	58,973	99,569	224,791	130,392
Plovdiv	149,667	21,354	21,922	46,700	59,691
Varna	163,135	12,590	17,430	77,171	55,944
Rousse	78,332	7,471	6,428	31,018	33,414
Pazardzhik	33,490	5,510	3,598	7,685	16,698
Blagoevgrad	28,832	3,601	10,139	9,723	5,368
Veliko_tarnovo	30,292	2,970	5,966	9,994	11,361

Table 12. Average dwelling prices in each city

	Average price per sq.m. (Levs), III Quart 2007	Average price per sq.m. (EUR'000)	Average floor space per dwelling, sq.m.	Average dwelling price (EUR'000)
Sofia	2,112.00	1.07881	62.91	67.87
Plovdiv	1,256.50	0.64182	65.24	41.87
Varna	1,940.83	0.99138	64.08	63.53
Rousse	1,496.83	0.76458	61.60	47.10
Pazardzhik	758.83	0.38761	65.09	25.23
Blagoevgrad	1,134.00	0.57925	68.73	39.81
Veliko Tarnovo	1,051.67	0.53719	65.59	35.23

Vulnerability Model

The vulnerability model we used is based on Modified Mercalli Intensities (MMI) whereas our Hazard Model provides the PGA values, see Table 10. Therefore, we had to translate PGA values into MMI values. We did this with the help of the following converter of MMI values into PGA as it is provided in [3], see Table 13 for the results.

Table 13 Converter of PGA into MMI values

Modified Mercalli Intensity (MMI) and PGA Equivalents			
MMI	PGA (%g)	Perceived Shaking	Potential Damage
I	< 0.17%	Not Felt	None
II	0.17% - 1.4%	Weak	None
III	0.17% - 1.4%	Weak	None
IV	1.4% - 3.9%	Light	None
V	3.9% - 9.2%	Moderate	Very Light
VI	9.2% - 18%	Strong	Light
VII	18% - 34%	Very Strong	Moderate
VIII	34% - 65%	Severe	Moderate to Heavy
IX	65% - 124%	Violent	Heavy
X	>124%	Extreme	Very Heavy
XI	>124%	Extreme	Very Heavy
XII	>124%	Extreme	Very Heavy

To assess damage to buildings and dwellings, we used Damage Probability Matrices as provided in [5] for vulnerability classes A, B, C and D of EMS-98 [4]. Even though, the classes T1, T2, T3 and T4 which we introduced above do not exactly match the classes A, B, C and D of EMS-98, we used the damage probability matrices as proxies provided in [5] for our classes T1, T2, T3 and T4.

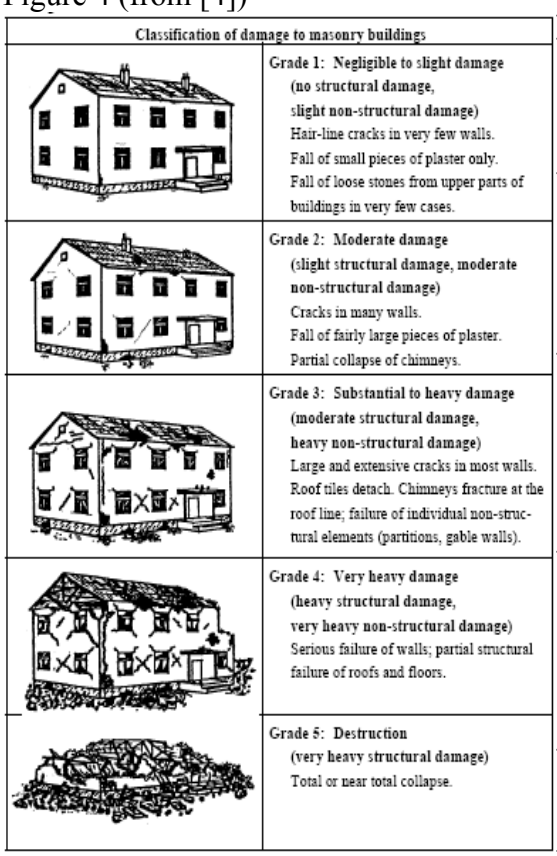
Below, the damage probability matrix is shown which was used for the vulnerability class T1.

Damage Probability Matrix for building class **T1** (we assume T1 = D from EMS-98)							
			Seismic intensity and % of buildings in each damage class				
Damage grade	Damage ratio	CDF	intensity 5	intensity 6	intensity 7	intensity 8	intensity 9
0	0%	0.00%	100.0%	100.0%	92.5%	50.0%	7.5%
1	0%-1%	0.50%	0.0%	0.0%	7.5%	42.5%	42.5%
2	1%-20%	10.00%	0.0%	0.0%	0.0%	7.5%	42.5%
3	20%-60%	40.00%	0.0%	0.0%	0.0%	0.0%	7.5%
4	60%-100%	80.00%	0.0%	0.0%	0.0%	0.0%	0.0%
5	100%	100.00%	0.0%	0.0%	0.0%	0.0%	0.0%
	Mean Damage Ratio		0.00%	0.00%	0.04%	0.96%	7.46%

For each earthquake intensity the damage probability matrix provides the estimated distribution of different damage grades in the building portfolio. For example, for the intensity 8, 7.5% of buildings are estimated to be destroyed according to the damage grade 2 (damage ratio 1-20%), 42.5% of buildings according to the damage grade 1 (damage ratio 0-1%) and finally 50% are estimated not to be damaged at all which corresponds to the damage grade 0 (damage ratio 0%).

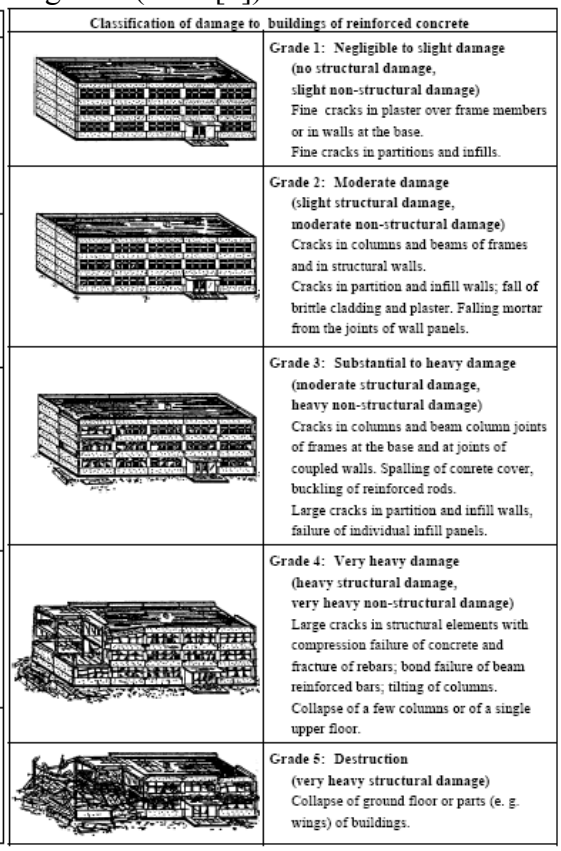
Figures 4 and 5 below illustrate the five damage grades according to EMS-98 [4] which the damage probability matrices we used are based upon for both masonry and reinforced concrete buildings.

Figure 4 (from [4])



Classification of damage to masonry buildings	
	Grade 1: Negligible to slight damage (no structural damage, slight non-structural damage) Hair-line cracks in very few walls. Fall of small pieces of plaster only. Fall of loose stones from upper parts of buildings in very few cases.
	Grade 2: Moderate damage (slight structural damage, moderate non-structural damage) Cracks in many walls. Fall of fairly large pieces of plaster. Partial collapse of chimneys.
	Grade 3: Substantial to heavy damage (moderate structural damage, heavy non-structural damage) Large and extensive cracks in most walls. Roof tiles detach. Chimneys fracture at the roof line; failure of individual non-structural elements (partitions, gable walls).
	Grade 4: Very heavy damage (heavy structural damage, very heavy non-structural damage) Serious failure of walls; partial structural failure of roofs and floors.
	Grade 5: Destruction (very heavy structural damage) Total or near total collapse.

Figure 5 (from [4])



Classification of damage to buildings of reinforced concrete	
	Grade 1: Negligible to slight damage (no structural damage, slight non-structural damage) Fine cracks in plaster over frame members or in walls at the base. Fine cracks in partitions and infills.
	Grade 2: Moderate damage (slight structural damage, moderate non-structural damage) Cracks in columns and beams of frames and in structural walls. Cracks in partition and infill walls; fall of brittle cladding and plaster. Falling mortar from the joints of wall panels.
	Grade 3: Substantial to heavy damage (moderate structural damage, heavy non-structural damage) Cracks in columns and beam column joints of frames at the base and at joints of coupled walls. Spalling of conrete cover, buckling of reinforced rods. Large cracks in partition and infill walls, failure of individual infill panels.
	Grade 4: Very heavy damage (heavy structural damage, very heavy non-structural damage) Large cracks in structural elements with compression failure of concrete and fracture of rebars; bond failure of beam reinforced bars; tilting of columns. Collapse of a few columns or of a single upper floor.
	Grade 5: Destruction (very heavy structural damage) Collapse of ground floor or parts (e. g. wings) of buildings.

Loss-to-Assets Model

For each earthquake event provided by the Hazard Model, the Vulnerability Model provides the distribution of damage ratios for each dwelling vulnerability group in each city; whereas the Asset-At-Risk Model provides numbers of dwellings in each dwelling vulnerability group and dwelling prices (total sum insured) in each city. Thus, by superimposing the two models for each earthquake event, we can estimate losses to assets in each dwelling vulnerability group and each city.

Insurance Portfolio Model

The objective of the Insurance Portfolio Model is to specify all relevant characteristics of the portfolio of all different insurance products which cover the assets at risk for a specific hazard. For our case study, this means specifying the numbers of insurance policies of different types in each city and each dwelling vulnerability group. In order to obtain these estimates, one first has to make certain assumptions about the level of insurance penetration and the percentage of each type of insurance product in each city and each dwelling vulnerability group. Based on these assumptions and knowing the numbers of dwellings in each city and each dwelling vulnerability group, which were provided by the Asset-at-Risk Model, the estimated numbers of policies of each type can then be calculated for each city and each dwelling vulnerability group.

For the portfolio of indemnity based products, we assumed that 60 percent of dwellings will have the earthquake cover in Sofia and 50 percent in all other cities. For the portfolio of indemnity based products, 10 percent for Sofia and 5 percent for all other cities. Table 14 and Table 15 summarize the percentages of indemnity based products with different sub-limits in the overall portfolio of indemnity based products (Table 14) and shares of parametric trigger products with different maximum payouts in the portfolio of parametric trigger products (Table 15).

Table 14. Composition PF of indemnity based products with different sub-limits

Policy type	Share in the PF
SL10D*	30%
SL15D*	25%
SL20D*	25%
SL25D*	20%

Table 15. Composition PF of parametric trigger products with different max payouts

Policy type	Share in the PF
T*MP5	30%
T*MP10	25%
T*MP15	25%
T*MP20	20%

Insured Loss Model

As has been described above, with help of the Hazard Model, the Asset-at-Risk Portfolio Model and the Vulnerability Model, one can obtain the Loss-to-Assets Model which estimates losses to assets for each earthquake event generated by the Hazard Model. By applying the Insurance Portfolio Model we can then estimate the insured loss for each earthquake event. Therefore, we obtain the Insured Loss Model as a stochastic set of insured loss values, each of them corresponding to an earthquake event generated by the Hazard Model. The resulting probabilistic Insured Loss Model can be described in the following format, see Table 16.

Table 16. Stochastic set of insured loss values

Event id	Freq., 10^-4	Seism. Reg.	Magnitude	Insured Loss, EUR'000,000						
				Sofia	Plovdiv	Varna	Rousse	Pazardz.	Bl.Grad	V. Tarn.
...	...	...	...	...	...	...	...	...	...	...
1123	0.201	Reg. A	7.3824	0	0	43.8	20.0	0	0	12.6
1124	0.201	Reg. A	6.3448	0	0	36.2	33.9	0	0	13.4
1125	0.201	Reg. B	6.3876	65.4	17.5	0	0	18.7	21.5	0
...	...	...	...	...	...	...	...	...	...	...

Statistical Assessment of Insured Loss Model

From the statistical evaluation of the resulting probabilistic Insured Loss Model, the following usual characteristics of the underlying insured loss exposure can be obtained: expected annual insured loss, standard deviation of the annual insured loss, Value-at-Risk and expected shortfall for different chosen confidence levels, and portfolio PMLs for different return periods. Together with costs involved and targeted returns, these characteristics of the covered exposure provide the basis for the portfolio pricing, as will be discussed in the following sub-section.

Portfolio Price, Admin & Mgmt. Costs, Target Returns

The insurance pricing logic dictates that an adequate annual portfolio price should cover the total of the expected annual insured loss, administrative costs loading and the fluctuation loading, with the latter covering the risk of fluctuation, i.e. the risk that the actual annual insured loss will deviate positively from its expected value. This leads us to the following calculation formula for the portfolio price:

Portfolio Price = Annual Expect. Loss + Admin Costs Loading + Fluctuation Loading

Usually, an administrative cost loading is calculated as a percentage of portfolio price:

*Admin Costs Loading = ACL Factor * Portfolio Price*

For our test case study, we chose *ACL Factor* of 20%.

There are two alternative approaches to calculating the fluctuation loading. According to the first approach, fluctuation loading is calculated proportionally to the standard deviation of the annual insured loss, according to the formula below:

*Fluctuation Loading = FL Factor * Standard Deviation of Annual Insured Loss*

This approach is based on the assumption that the fluctuation risk exposure is proportional to the standard deviation of the annual insured loss.

The second possible approach (we used this approach for our test case study) calculates the fluctuation loading based on the required risk capital and return on equity (RoE). The required risk capital needs to be held by an insurance company to cover the risk of fluctuation. Typically contributed by shareholders, this risk capital is not without a price as the shareholders expect some return on their investment. We call this return – the RoE (Return on Equity), which has to be earned on the held amount of risk capital. In this context, the RoE represents the costs of risk capital. The fluctuation loading, which by its very definition covers the risk of fluctuation, then can be assumed to be equal to the cost of risk capital defined as determined by the required amount of risk capital and RoE in the formula below.

*Fluctuation Loading = Target RoE * Required Risk Capital*

For our test case study, we chose the *Target RoE* of 8%.

For calculating the required risk capital, we assumed that with the held risk capital, insurance company should be able to absorb a loss from a catastrophe event with a 1-in-150 years return period. Therefore, the required amount of risk capital calculates as a 150-year portfolio PML minus the expected annual insured loss, as per the formula below.

Required Risk Capital = Portfolio PML return per. 150 yrs – Annual Expected Loss

We deduct the expected loss as the expected loss is already covered from the insurance premium.

Individual Policy Prices

In this step, the calculated price for the total insurance portfolio has to be allocated to each individual insurance policy in each city for each dwelling vulnerability class. This allocation has to account for the differences between cities and vulnerability classes. Obviously, policy prices should be higher in the cities which are more exposed to the earthquake risk than those that less exposed. The same approach holds for dwelling vulnerability classes – policies for dwellings from the higher vulnerability classes should cost more than polices for dwellings from lower vulnerability classes.

An allocation which satisfies these requirements can be obtained via the following two-step procedure. In the first step, the price of the total insurance portfolio is allocated to prices of individual sub-portfolios, with each individual sub-portfolio including only one type of policies for each city and a specific individual building type. For example, a sub-portfolio SL15D4-Sofia-Building-TypeT1 includes indemnity based policies of type SL15D4 (sub-limit EUR 15,000, deductible 4%) in Sofia for the dwellings from the building type T1. For each similar sub-portfolio, the expected annual insured loss and the standard deviation of the annual insured loss can be obtained from the Insured Loss Model. Based on these expected values and standard deviations, the allocation of the total insurance portfolio price to the prices of the individual sub-portfolios can be easily completed. The allocation of the risk capital costs (the fluctuation loading) is done proportionally to the sub-portfolio's standard deviation – the larger the standard deviation the higher is the sub-portfolio's fluctuation risk and hence the share of the total portfolio risk capital costs allocated to this sub-portfolio. With the help of the resulting sub-portfolio prices and knowing the numbers of policies in each sub-portfolio (they are available from the Insurance Portfolio Model), in the second step we calculate the individual policy prices by dividing the sup-portfolio prices by the number of policies in corresponding sub-portfolios. For example, for the price of policy SL15D4 in Sofia for dwellings in buildings of type T1 we obtain

Price of the policy SL15D4 in Sofia, Building-Type T1 =
Price of sub-pf SL15D4-Sofia-Building-TypeT1 / Number of policies in this sub-pf

Policy prices for all individual insurance products in each city and for each building type are given in Appendix II.

Discussion of pricing results

Below we present the portfolio PMLs for a 150 year return period as well as the annual expected losses for two portfolios of indemnity based products – one with and the other one without sub-limits. See Figures 5 and 6.

Figure 5

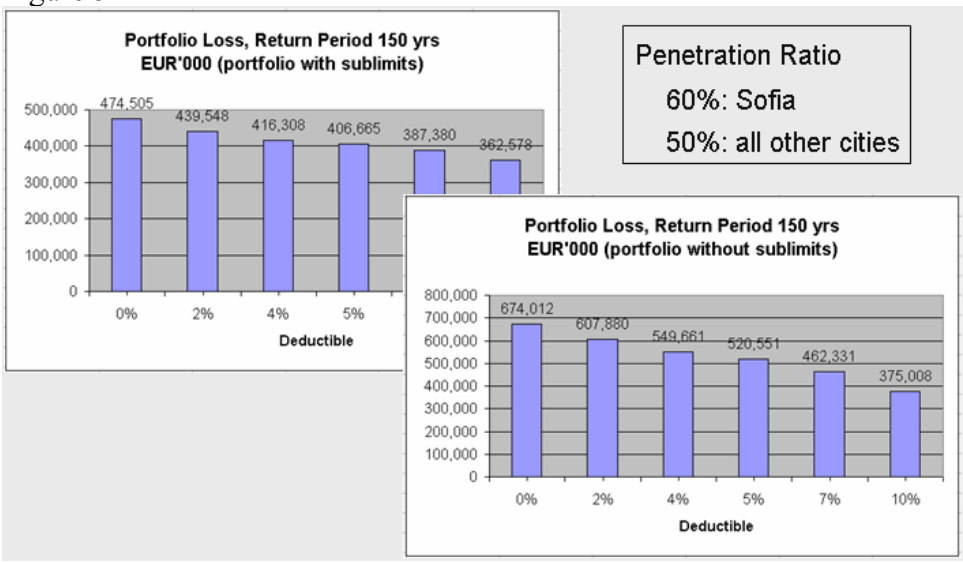
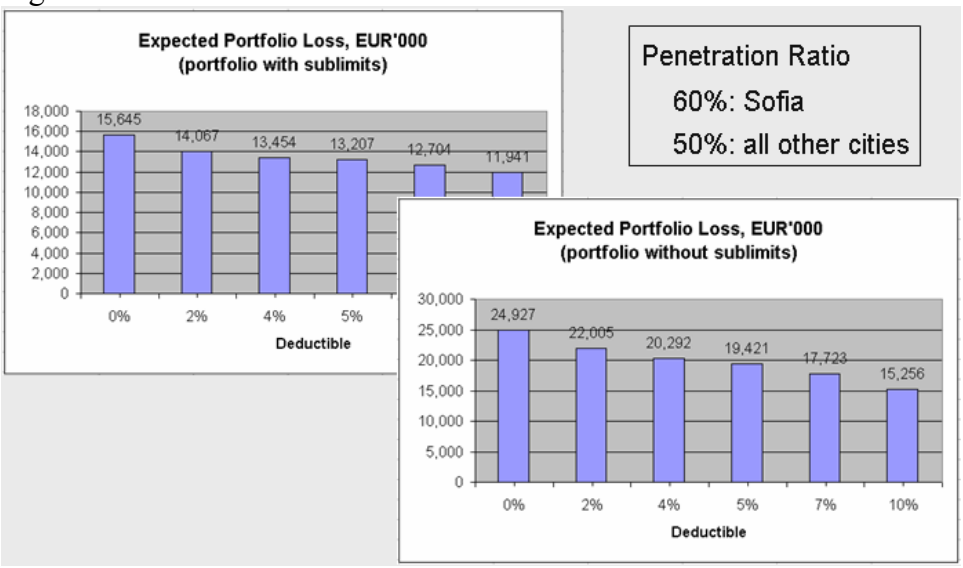


Figure 6



As can be seen from the Figures, the portfolio PMLs and expected losses are higher for the portfolios of products without a sub-limit. This result is in-line with expectations as in the case of insurance policies with sub-limits, insurance coverage is limited by the chosen sub-limits whereas for the products without sub-limits it is not.

Indicative insurance rates for policies in Sofia for the building class T2 are shown in Figure 7 below. The upper part of the Figure shows the prices for indemnity based

products with different sub-limits and a deductible of 5 percent. The lower part summarizes the prices for the policies without sub-limits and with different deductibles.

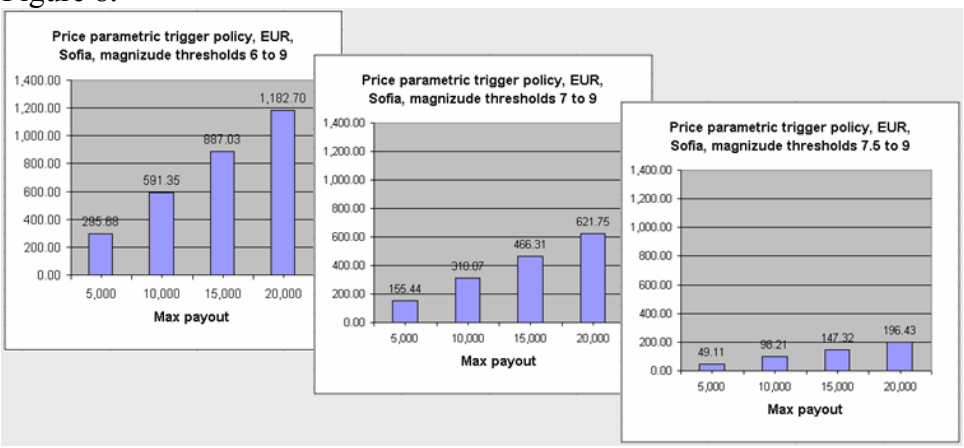
Figure 7.

Obviously, higher deductibles lead to a substantial price reduction and higher sub-limits to a price increase. We notice that for sub-limits of EUR 10,000 and EUR 15,000 the prices of the policies (EUR 40.72 and EUR 50.60) are cheaper than the price of the policy without a sub-limit (EUR 53.81). However, in the case of policies with sub-limits of EUR 20,000 and EUR 25,000 the prices (EUR 60.65 and EUR 70.79) are higher than the price of the policy without a sub-limit. At first, this latter observation seems to be counter-intuitive as the policy without sub-limit provides more coverage than policies with sub-limits. Why then the policies with the sub-limits are more expensive? This question can be answered by looking at the policy deductibles. Both policies with and without sub-limits have a deductible of 5 percent. However, for the policies with a sub-limit, the deductible is calculated based on that sub-limit and for a policy without a sub-limit it is based on the total sum insured. As explained above, we have assumed that total sum insured is equal to the average dwelling price in each city, e.g. for Sofia it is EUR 70,000. By applying the deductibles, we discover that a deductible of 5 percent translates into a deductible of EUR 1,000 for the policy with a sub-limit of EUR 20,000, a deductible of EUR 1,250 for the policy with a sub-limit of EUR 25,000 and deductible of EUR 3,500 for the policy without a sub-limit. Hence, the same deductible of 5 percent translates into higher absolute deductibles for the policy without a sub-limit. This higher deductible is the reason why the policy without sub-limits is cheaper than that with sub-limits. Based on these observations, we can conclude that higher deductibles have a more profound impact on the price of an individual insurance policy than the lower coverage limits.

Let us know examine policy prices for three different parametric trigger products and different maximum payouts (see Figure 8 below). On the left hand side the Figure shows the prices for the parametric trigger product with a lowr magnitude threshold of 6 MMI, in the middle one can see the product with a higher magnitude threshold of 7 MMI and

on the right hand side is the product with yet an even higher magnitude threshold of 7.5 MMI. The upper magnitude threshold is set at 9 MMI for all three parametric products.

Figure 8.



The three diagrams show that by increasing the magnitude attachment point (the lower magnitude threshold) one can substantially reduce the price of parametric trigger products. Furthermore, we notice that parametric trigger products are expensive compared to indemnity based products. This reflects the fact that the payout of parametric trigger products is detached from the actual loss to the policyholder's property – by buying a parametric trigger insurance product, the policyholder also pays for the scenarios which do not lead to any loss to his property which makes the product more expensive.

Limitations and Recommendations of the Actuarial Results

The presented results of the actuarial research suffer from uncertainties that mainly originate from the weak quality of the underlying data in virtually every actuarial model developed for this study, e.g. the asset portfolio data, hazard data and vulnerability data. Faced with this data insufficiency, our approach was to deploy some reasonable approximations in each case of uncertainty. Therefore, our pricing results can only be understood as *indicative*. However, we have tried to compensate to the extent possible by applying a sound and reliable methodology at each step of the pricing procedure. Provided the identified data gaps will be closed in the future, the developed pricing methodology can be again one more time to arrive at more accurate results. Below we set forth the main uncertainties encountered during the research, methods used to address them and the limitations of these methods.

Uncertainties of Asset-at-Risk Portfolio Model

In our asset model, we considered four dwelling vulnerability groups corresponding to four construction classes - T1, T2, T3 and T4. In the process of vulnerability clustering we have not considered either the number of stories no the age of the residential buildings. We certainly recommend considering these and, possibly, other factors in the future work on the clustering of vulnerability groups.

As the statistical data on the number of dwellings in each vulnerability group was not available, we had to employ estimates using the available statistical data. In the future, we recommend collecting more accurate statistical data on the number of dwellings in each vulnerability class.

We assumed the same prices for all dwellings within each city. For each city, we calculated these prices from the available statistical data. For the future versions, we recommend to use more specific price distributions which take into account the construction type, location, and age of the buildings.

Uncertainties of Hazard Model

As a probabilistic set of corresponding PGA values for the provided MMI values in different cities was not available, we used economic losses to residential building stock for seven cities to arrive at the PGA values. This "indirect" way of determining PGA values represents a substantial drawback. In the future, we recommend to obtain a probabilistic set of PGA or MMI values from a professional risk modelling company. Furthermore, the future stochastic data sets from a modelling consultancy should specify the geographical location of each earthquake in a given seismic zone.

Uncertainties of Vulnerability Model

Our vulnerability model is based on the four Damage Probability Matrices provided for each building class T1, T2, T3 and T4. In this report, we used Damage Probability Matrices provided in the European Macroseismic Scale 98 publication [4] for building vulnerability classes D, C, B and A even though they do not exactly coincide with our classes T1, T2, T3 and T4. This approximation may have resulted in some inaccuracy in the final damage assessment. Furthermore, in all four matrices, percentages of buildings in each damage class only take values of 0%, 7.5, 42.5, 50, 92.5, and 100 percent. This rather coarse granularity represents a further substantial limitation for the model accuracy. For the future versions, we recommend to use more accurate and building class specific Damage Probability Matrices custom-tailored for Bulgaria.

Recommendations

For the future, we would like to recommend:

- To carry out further marketing studies in order to find out what product designs (deductibles, sub-limits, indemnity based / parametric trigger) are most suitable for residential earthquake insurance in Bulgaria.

- To close the modeling and data gaps and re-price the chosen products according to the methodology proposed in this report.

- To launch a residential earthquake insurance scheme with the chosen product designs at the calculated prices.

Annex I

Survey of Bulgarian Insurers

Allianz

Section I: Available catastrophe insurance products

1. Please, describe the main types of catastrophe insurance covers available in the market (i) homeowners; (ii) small businesses; (iii) farmers – for drought/flood; (iv) industrial and (v) commercial customers. Obtain a copy of policy document for each one. In particular, describe the following key features of each product:

- Perils covered
  - Storm
  - Hail;
  - Torrential rain;
  - Flood, High Water;
  - Snow pressure, falling rocks, land slide, subsidence;
  - Earthquake
  - Frost /some companies, cover this peril/

- What's the scope of coverage: property, BI, both, etc?
  - Mostly property, BI coverage can be agreed for large industrial companies.

- What's excluded?
  - Contents stored in open /for Flood and torrential rain/

- Stand alone cover or a rider
  - Nat cat coverage is not offered on stand alone basis

- Limits of coverage (average limit in the portfolio)
  - Some companies intend to limit their Earthquake coverage up to 85% of the Sum insured.
  - Limits on other Nat Cat perils are not typical for the market with exception of some large industrial risks.

- Rating (risk based or flat or tariff) – attach if available a rating table by risk zones?
  - Earthquake rating is depends mainly on EQ zone, construction code applied and soil conditions.
  - The tariffs for the other Nat Cat perils are flat, but some companies use loading depending of flood maps or proximity to rivers and other water basins.

- Minimum deductible
  - Minimum deductible which is accepted by the market is only for EQ and it is about 2% of the SI, but some companies intend to cover this peril without any deductibles. For the other Nat Cat perils deductibles are not typical.
- First loss or averaging
  - And both options are available, but first risk is typical only for household or some additional perils. If there are not any specific agreements average clause should be used by law.
- Indemnification basis: replacement cost, market value, fair value, agreed upon value, etc.
  - Most often indemnification basis is based on actual cash value or market value, New replacement value has been typical for foreign companies, but now it is gaining popularity also on the local market.
- Loss adjustment (describe how it is done).
  - The client informs insurance company by loss notification form /in written form/, afterwards the company send its loss adjustment employees on the with additional external experts and they measure the actual loss and require in written form all needed documents. The use of external loss adjustment companies is not typical, with exception of some large industrial claims or fronting risks.

- Describe the main distribution channels for the product: own sales force, agents, third parties (banks, post-office)
  - homeowners; small businesses - own sales force, agents, banks, retail brokers;
  - Commercial and industrial – brokers and own sales force.

2. Estimate the percentage of customers in your portfolio with homeowners or business policy but w/o catastrophe risk policy in percentage terms?
   - below 3%

3. What is the average costs of a homeowners policy and the average cost of catastrophe insurance cover?
   - 50 EUR - average costs of a homeowners policy, 20 EUR - average cost of catastrophe insurance cover

Section II: Catastrophe Risk Management by Insurance Companies

1. How much of catastrophe risk does you company retain as percentage of total risk written?
   - maximum 3%, but it depends on capital base
2. How the catastrophe risk is retained: quota share, XL, surplus treaties?
   - quota share and XL
3. Do you have a formal accumulation control procedure?
   - yes
4. How do you track your accumulations: cresta zone, zip codes, address?
   - cresta zone and zip codes
5. Do you use catastrophe risk models to determine the average annual loss and PML for the risk written? What kind?
   - we count on catastrophe risk models provided by our reinsurance brokers /Benfield and Aon/.
6. What return periods you use in setting up your PMLs for risk accumulation control purposes?
   - 250 years and 450 years
7. Please, describe your current reserving requirements for catastrophe risk retentions.
8. Please, describe your reinsurance program: how much is ceded to foreign reinsurers vs. a domestic reinsurer vs. a parent company (if applicable)?
   - 80% /reinsurers/ vs. 0% /domestic reinsurer vs. 20% /parent company/

9. Please, describe your current process for capital allocation for catastrophe risk retained.

Section III. Regulation of Catastrophe Risk Segment of P&C Market

1. What types of regulatory requirements guide the catastrophe risk segment of P&C business:
   a. Any specific solvency requirements?
   b. Any requirements for catastrophe or equalization reserves?
   c. Any requirements for pricing catastrophe risk (e.g. tariff)?
   d. Any reporting requirements (e.g. risk accumulations by cresta zone?)
   e. Any maximum/minimum requirements for risk retention? Please, explain.

f. Any special requirements for reinsurance, e.g. special cessions to domestic reinsure, etc.?

Survey of Catastrophe Insurance Markets in Bulgaria

Bulstrad

Section I: Available catastrophe insurance products

4. Please, describe the main types of catastrophe insurance covers available in the market
   a. homeowners;
   b. small businesses;
   c. industrial
   d. commercial customers.

   The policies are based on named perils. The earthquake covers in offered subject to payment of additional premium

   - Perils covered – FLEXA; landslide; malicious damages, impact with vehicles. Separates Clauses – flood and earthquake
   - What's the scope of coverage: property, BI, both, etc? In most of the cases Property only
   - What's excluded?
   - Stand alone cover or a rider – stand alone
   - Limits of coverage (average limit in the portfolio) – the Sum Insured, sub-limits are applied very rare
   - Rating (risk based or flat or tariff) – attach if available a rating table by risk zones? – tariff
   - Minimum deductible – in most of the cases there are no deductibles. For industrial property – as per the attached policy wording
   - First loss or averaging
   - Indemnification basis: replacement cost, market value, fair value, agreed upon value, etc. – depends on the basis chosen by the insured
   - Loss adjustment (describe how it is done)
   - Describe the main distribution channels for the product: own sales force, agents, third parties (banks, post-office)
     - brokers, agents , direct in the office of Bulstrad

5. Estimate the percentage of customers in your portfolio with homeowners or business policy but w/o catastrophe risk policy in percentage terms? – 5%

6. What is the average costs of a homeowners policy and the average cost of catastrophe insurance cover? – It depends on the Sum insured and the zone in which the property is located

Section II: Catastrophe Risk Management by Insurance Companies

10. How much of catastrophe risk does you company retain as percentage of total risk written? – EUR 300,000
11. How the catastrophe risk is retained: quota share, XL, surplus treaties? - XL
12. Do you have a formal accumulation control procedure? - Yes
13. How do you track your accumulations: cresta zone, zip codes, address? – Zip codes
14. Do you use catastrophe risk models to determine the average annual loss and PML for the risk written? What kind? – Not yet
15. What return periods you use in setting up your PMLs for risk accumulation control purposes?
16. Please, describe your current reserving requirements for catastrophe risk retentions.
17. Please, describe your reinsurance program: how much is ceded to foreign reinsurers vs. a domestic reinsurer vs. a parent company (if applicable)? – We place 100% in excess of EUR 300,000 under the NATCAT of VIG (Vienna Insurance Group)
18. Please, describe your current process for capital allocation for catastrophe risk retained.

Section III. Regulation of Catastrophe Risk Segment of P&C Market

2. What types of regulatory requirements guide the catastrophe risk segment of P&C business:
    a. Any specific solvency requirements? - No
    b. Any requirements for catastrophe or equalization reserves? - No
    c. Any requirements for pricing catastrophe risk (e.g. tariff)? - tariff
    d. Any reporting requirements (e.g. risk accumulations by cresta zone?)
    e. Any maximum/minimum requirements for risk retention? Please, explain. – No such requirements
    f. Any special requirements for reinsurance, e.g. special cessions to domestic reinsures, etc.? – Group cover with VIG

Section III. Regulation of Catastrophe Risk Segment of P&C Market

1. What types of regulatory requirements guide the catastrophe risk segment
of P&C business:

a. Any specific solvency requirements?
b. Any requirements for catastrophe or equalization reserves?
c. Any requirements for pricing catastrophe risk (e.g. tariff)?
d. Any reporting requirements (e.g. risk accumulations by cresta zone?)
e. Any maximum/minimum requirements for risk retention? Please, explain.
f. Any special requirements for reinsurance, e.g. special cessions to domestic reinsures, etc.?

Bulgaria is exposed to flood and earthquake, but the insurance against these risks is not compulsory by law. As a result of this, according to the statistics and some publications less than 5% of the population of Bulgaria is now insured against these risks.

Appendix II. Insurance Product Prices

A1. Indemnity Based Products with Sub-limits

Individual Policy Prices, EUR'000

	Deductible 0%				Deductible 2%				Deductible 4%			
	SL10D0	SL15D0	SL20D0	SL25D0	SL10D2	SL15D2	SL20D2	SL25D2	SL10D4	SL15D4	SL20D4	SL25D4
Sofia												
b.t. T1	0.01890	0.02066	0.02243	0.02420	0.01721	0.01840	0.01977	0.02124	0.01600	0.01721	0.01842	0.01963
b.t. T2	0.04768	0.05954	0.07157	0.08371	0.04413	0.05464	0.06560	0.07683	0.04155	0.05177	0.06216	0.07263
b.t. T3	0.10297	0.12945	0.15672	0.18439	0.09379	0.11646	0.14117	0.16701	0.08714	0.11042	0.13439	0.15870
b.t. T4	0.14165	0.19023	0.23923	0.28842	0.13127	0.17524	0.22071	0.26703	0.12368	0.16723	0.21112	0.25519
Plovdiv												
b.t. T1	0.01131	0.01284	0.01337	0.01337	0.01000	0.01125	0.01157	0.01136	0.00936	0.01040	0.01051	0.01010
b.t. T2	0.03420	0.04466	0.04930	0.05077	0.03111	0.04073	0.04475	0.04570	0.02948	0.03848	0.04195	0.04242
b.t. T3	0.08170	0.10599	0.12060	0.13004	0.07260	0.09499	0.10815	0.11628	0.06895	0.09006	0.10192	0.10889
b.t. T4	0.12644	0.17404	0.20469	0.22691	0.11590	0.16045	0.18873	0.20884	0.11072	0.15315	0.17944	0.19776
Varna												
b.t. T1	0.01320	0.01451	0.01582	0.01713	0.01198	0.01287	0.01393	0.01503	0.01115	0.01204	0.01294	0.01384
b.t. T2	0.03351	0.04227	0.05117	0.06013	0.03100	0.03882	0.04700	0.05528	0.02924	0.03679	0.04446	0.05220
b.t. T3	0.07034	0.08970	0.10960	0.12978	0.06348	0.07996	0.09831	0.11716	0.05890	0.07594	0.09347	0.11124
b.t. T4	0.09773	0.13248	0.16751	0.20268	0.08995	0.12122	0.15394	0.18701	0.08461	0.11571	0.14705	0.17850
Rousse												
b.t. T1	0.00968	0.01089	0.01182	0.01182	0.00863	0.00957	0.01031	0.01015	0.00806	0.00888	0.00944	0.00913
b.t. T2	0.02771	0.03589	0.04251	0.04366	0.02536	0.03281	0.03885	0.03960	0.02398	0.03101	0.03657	0.03695
b.t. T3	0.06346	0.08205	0.09830	0.10560	0.05640	0.07311	0.08814	0.09448	0.05315	0.06939	0.08337	0.08886
b.t. T4	0.09616	0.13193	0.16332	0.18006	0.08799	0.12104	0.15039	0.16557	0.08364	0.11552	0.14323	0.15708
Pazardzhik												
b.t. T1	0.01155	0.01159	0.01159	0.01159	0.01009	0.00983	0.00954	0.00924	0.00930	0.00875	0.00817	0.00759
b.t. T2	0.04227	0.04460	0.04671	0.04679	0.03860	0.04016	0.04150	0.04087	0.03644	0.03728	0.03791	0.03660
b.t. T3	0.10139	0.11529	0.12928	0.13164	0.09214	0.10410	0.11619	0.11691	0.08737	0.09756	0.10794	0.10713
b.t. T4	0.17612	0.20959	0.24391	0.25664	0.16417	0.19448	0.22566	0.23587	0.15690	0.18447	0.21299	0.22089
Blagoevgr.												
b.t. T1	0.01839	0.02091	0.02138	0.02138	0.01606	0.01816	0.01827	0.01792	0.01505	0.01677	0.01654	0.01586
b.t. T2	0.06106	0.07853	0.08375	0.08617	0.05480	0.07088	0.07506	0.07652	0.05203	0.06692	0.07014	0.07070
b.t. T3	0.16545	0.21098	0.23175	0.24725	0.14943	0.19147	0.20933	0.22209	0.14238	0.18135	0.19654	0.20677
b.t. T4	0.30238	0.41737	0.47112	0.51235	0.28259	0.39104	0.43970	0.47619	0.27120	0.37435	0.41857	0.45088
V. Tarnovo												
b.t. T1	0.01116	0.01255	0.01255	0.01255	0.00979	0.01090	0.01067	0.01044	0.00912	0.00999	0.00954	0.00909
b.t. T2	0.03676	0.04660	0.04822	0.04984	0.03334	0.04233	0.04335	0.04438	0.03156	0.03983	0.04028	0.04075
b.t. T3	0.09102	0.11618	0.12637	0.13691	0.08172	0.10492	0.11355	0.12255	0.07765	0.09912	0.10634	0.11395
b.t. T4	0.15889	0.21479	0.23989	0.26605	0.14729	0.19966	0.22211	0.24564	0.14089	0.19039	0.21054	0.23181

Individual Policy Prices, EUR'000

	Deductible 5%				Deductible 7%				Deductible 10%			
	SL10D5	SL15D5	SL20D5	SL25D5	SL10D7	SL15D7	SL20D7	SL25D7	SL10D10	SL15D10	SL20D10	SL25D10
Sofia												
b.t. T1	0.01565	0.01673	0.01781	0.01890	0.01494	0.01577	0.01661	0.01745	0.01401	0.01450	0.01498	0.01547
b.t. T2	0.04072	0.05060	0.06065	0.07079	0.03905	0.04826	0.05764	0.06711	0.03688	0.04517	0.05364	0.06222
b.t. T3	0.08552	0.10810	0.13139	0.15502	0.08228	0.10348	0.12539	0.14766	0.07797	0.09729	0.11735	0.13779
b.t. T4	0.12148	0.16403	0.20693	0.24999	0.11708	0.15762	0.19851	0.23958	0.11126	0.14911	0.18734	0.22573
Plovdiv												
b.t. T1	0.00908	0.01002	0.01002	0.00952	0.00854	0.00926	0.00906	0.00837	0.00780	0.00822	0.00774	0.00677
b.t. T2	0.02879	0.03749	0.04070	0.04094	0.02741	0.03551	0.03823	0.03802	0.02558	0.03288	0.03490	0.03404
b.t. T3	0.06742	0.08786	0.09912	0.10554	0.06437	0.08347	0.09355	0.09890	0.06025	0.07753	0.08598	0.08983
b.t. T4	0.10852	0.14993	0.17532	0.19281	0.10413	0.14348	0.16707	0.18294	0.09825	0.13485	0.15597	0.16958
Varna												
b.t. T1	0.01089	0.01169	0.01249	0.01330	0.01037	0.01099	0.01161	0.01223	0.00969	0.01005	0.01041	0.01078
b.t. T2	0.02863	0.03593	0.04336	0.05084	0.02741	0.03422	0.04115	0.04815	0.02582	0.03196	0.03823	0.04457
b.t. T3	0.05775	0.07431	0.09135	0.10863	0.05545	0.07103	0.08711	0.10343	0.05242	0.06669	0.08148	0.09653
b.t. T4	0.08304	0.11342	0.14405	0.17479	0.07989	0.10885	0.13805	0.16736	0.07578	0.10283	0.13014	0.15757
Rousse												
b.t. T1	0.00783	0.00857	0.00905	0.00866	0.00739	0.00796	0.00828	0.00773	0.00680	0.00713	0.00721	0.00645
b.t. T2	0.02343	0.03023	0.03556	0.03577	0.02233	0.02866	0.03356	0.03342	0.02088	0.02659	0.03090	0.03026
b.t. T3	0.05200	0.06775	0.08125	0.08634	0.04971	0.06446	0.07704	0.08135	0.04665	0.06008	0.07139	0.07461
b.t. T4	0.08199	0.11311	0.14009	0.15333	0.07868	0.10828	0.13381	0.14585	0.07431	0.10187	0.12545	0.13583
Pazardzhik												
b.t. T1	0.00894	0.00825	0.00753	0.00681	0.00822	0.00726	0.00627	0.00527	0.00724	0.00588	0.00448	0.00309
b.t. T2	0.03548	0.03597	0.03626	0.03463	0.03357	0.03338	0.03300	0.03074	0.03100	0.02983	0.02851	0.02535
b.t. T3	0.08522	0.09458	0.10416	0.10262	0.08092	0.08865	0.09667	0.09371	0.07507	0.08049	0.08634	0.08139
b.t. T4	0.15367	0.17996	0.20725	0.21405	0.14719	0.17096	0.19581	0.20048	0.13841	0.15864	0.18012	0.18177
Blagoevgr.												
b.t. T1	0.01461	0.01614	0.01574	0.01490	0.01371	0.01489	0.01417	0.01301	0.01250	0.01317	0.01197	0.01034
b.t. T2	0.05080	0.06515	0.06791	0.06803	0.04834	0.06162	0.06348	0.06275	0.04501	0.05682	0.05740	0.05544
b.t. T3	0.13918	0.17672	0.19065	0.19968	0.13276	0.16748	0.17893	0.18561	0.12391	0.15468	0.16260	0.16597
b.t. T4	0.26608	0.36680	0.40894	0.43927	0.25581	0.35170	0.38969	0.41612	0.24176	0.33097	0.36308	0.38394
V. Tarnovo												
b.t. T1	0.00883	0.00957	0.00902	0.00846	0.00824	0.00875	0.00798	0.00722	0.00744	0.00762	0.00654	0.00547
b.t. T2	0.03078	0.03872	0.03890	0.03910	0.02922	0.03650	0.03616	0.03584	0.02713	0.03351	0.03241	0.03136
b.t. T3	0.07583	0.09652	0.10306	0.11003	0.07218	0.09131	0.09655	0.10225	0.06723	0.08422	0.08762	0.09157
b.t. T4	0.13806	0.18626	0.20534	0.22556	0.13238	0.17800	0.19496	0.21312	0.12472	0.16683	0.18081	0.19610

A2. Indemnity Based Products without Sub-limits

Individual Policy Prices, EUR'000, limits equal to dwelling price						
	Deductible 0%	Deductible 2%	Deductible 4%	Deductible 5%	Deductible 7%	Deductible 10%
Sofia	NoSLD0	NoSLD2	NoSLD4	NoSLD5	NoSLD7	NoSLD10
b.t. T1	0.01905	0.01505	0.01206	0.01063	0.00789	0.00419
b.t. T2	0.07583	0.06583	0.05777	0.05381	0.04606	0.03494
b.t. T3	0.20800	0.18257	0.16465	0.15571	0.13785	0.11115
b.t. T4	0.38083	0.34626	0.31921	0.30557	0.27803	0.23598
Plovdiv						
b.t. T1	0.01014	0.00798	0.00639	0.00563	0.00417	0.00221
b.t. T2	0.04094	0.03527	0.03087	0.02871	0.02450	0.01846
b.t. T3	0.11870	0.10275	0.09195	0.08657	0.07587	0.05994
b.t. T4	0.22413	0.20233	0.18563	0.17724	0.16035	0.13471
Varna						
b.t. T1	0.01295	0.01022	0.00818	0.00720	0.00533	0.00282
b.t. T2	0.05102	0.04435	0.03887	0.03618	0.03092	0.02340
b.t. T3	0.13739	0.12013	0.10838	0.10251	0.09082	0.07333
b.t. T4	0.24943	0.22589	0.20790	0.19884	0.18052	0.15253
Rousse						
b.t. T1	0.00885	0.00697	0.00558	0.00490	0.00363	0.00192
b.t. T2	0.03531	0.03052	0.02669	0.02482	0.02116	0.01593
b.t. T3	0.09932	0.08597	0.07710	0.07269	0.06391	0.05085
b.t. T4	0.18617	0.16778	0.15386	0.14686	0.13276	0.11135
Pazardzhik						
b.t. T1	0.00886	0.00698	0.00560	0.00493	0.00367	0.00194
b.t. T2	0.03639	0.03135	0.02746	0.02555	0.02181	0.01643
b.t. T3	0.10629	0.09302	0.08345	0.07868	0.06920	0.05508
b.t. T4	0.20941	0.19079	0.17575	0.16819	0.15301	0.13000
Blagoevgr.						
b.t. T1	0.01672	0.01305	0.01048	0.00925	0.00688	0.00364
b.t. T2	0.07164	0.06090	0.05313	0.04931	0.04182	0.03101
b.t. T3	0.22772	0.19805	0.17621	0.16536	0.14382	0.11192
b.t. T4	0.50072	0.45684	0.42024	0.40192	0.36523	0.31005
V. Tarnovo						
b.t. T1	0.00956	0.00750	0.00601	0.00529	0.00392	0.00207
b.t. T2	0.03942	0.03382	0.02953	0.02743	0.02332	0.01743
b.t. T3	0.11734	0.10197	0.09108	0.08568	0.07494	0.05904
b.t. T4	0.24001	0.21776	0.19988	0.19093	0.17295	0.14582

A3. Parametric Trigger Products

Individual Policy Prices, EUR'000												
	Lower magnitude threshold 6 Upper magnitude threshold 9				Lower magnitude threshold 7 Upper magnitude threshold 9				Lower magnitude threshold 7.5 Upper magnitude threshold 9			
	T6to9MP5	T6to9MP10	T6to9MP15	T6to9MP20	T7to9MP5	T7to9MP10	T7to9MP15	T7to9MP20	T7.5to9MP5	T7.5to9MP10	T7.5to9MP15	T7.5to9MP20
Sofia												
	0.29568	0.59135	0.88703	1.18270	0.15544	0.31087	0.46631	0.62174	0.04911	0.09821	0.14732	0.19643
Plovdiv												
	0.29568	0.59135	0.88703	1.18270	0.15544	0.31087	0.46631	0.62174	0.04911	0.09821	0.14732	0.19643
Varna												
	0.15884	0.31767	0.47651	0.63535	0.06155	0.12310	0.18465	0.24620	0.01393	0.02785	0.04178	0.05571
Rousse												
	0.15884	0.31767	0.47651	0.63535	0.06155	0.12310	0.18465	0.24620	0.01393	0.02785	0.04178	0.05571
Pazardzhik												
	0.29568	0.59135	0.88703	1.18270	0.15544	0.31087	0.46631	0.62174	0.04911	0.09821	0.14732	0.19643
Blagoevgr.												
	0.29568	0.59135	0.88703	1.18270	0.15544	0.31087	0.46631	0.62174	0.04911	0.09821	0.14732	0.19643
V. Tarnovo												
	0.15884	0.31767	0.47651	0.63535	0.06155	0.12310	0.18465	0.24620	0.01393	0.02785	0.04178	0.05571

ANNEX III

Earthquake Insurance Policy Form – Homeowners

DECLARATIONS

Policy number:
Policy period: 12:01 am CET FROM: TO:

Name Insured and Mailing Address:

The residential property covered by this policy is located at the above address unless otherwise stated:

The coverage is provided at the indicated limits of insurance, subject to the applicable deductible:

COVERAGE	LIMIT OF INSURANCE	DEDUCTIBLE
A. Damage to owned dwelling		
B. Damage to contents		
C. Loss of Use		

Policy premium: $_____

IMPORTANT NOTICES

1. Deductible. No payment will be made for any loss to personal property until the deductible shown on the DECLARATIONS has been exceeded by the amount of covered loss to property that is covered under "Coverage A: Damage to Owned Dwellings" and "Coverage B: Damage to Contents." "Coverage C: Loss of Use" is not subject to any deductible. The deductible will be applied one time for each seismic event.

AGREEMENT

This policy is issued by the Bulgarian Catastrophe Insurance Pool (BCIP), established and authorized by law to transact insurance in Bulgaria as necessary to sell policies of basic residential earthquake insurance.

1. Covered Losses. This policy insures for accidental, direct physical loss to insured property (described under Coverages A and B) from a seismic event that occurs during the policy period as a result of a seismic event, subject to all the terms, limits of insurance, and conditions of this policy. In addition, as provided in COVERAGE D, we insure for loss of use of the insured private dwelling due to a seismic event that occurs during the policy period as a result of a seismic event, subject to all the terms, limits of insurance, and conditions of this policy.

2. Premium Payment. BCIP will provide the insurance described in this policy form in return for your payment of the premium and your compliance with all applicable provisions of this policy.

3. Policy period. The policy period as shown on the DECLARATIONS page will begin and end at 12:01 am CET.

4. Policy services. Policy services and claims adjusting will be provided by the participating insurer. All inquiries and correspondence regarding the policy should be directed to the participating insurer.

DEFINITIONS

Throughout the policy, the words “you” and “your” refer to the named insured shown in the DECLARATIONS and the named insured’s spouse if a resident of the same household. The words “we,” “us,” and “our” refer to the Bulgarian Catastrophe Insurance Pool. Additional words and phrases are defined as follows.

1. “Actual Cash Value” means the fair market value of the property at the time of a total loss, subject to the policy limit of insurance for that type of property. If fair market value cannot be determined or if there is a partial loss, actual cash value means replacement cost less depreciation, subject to the policy limit of insurance for that type of property.

2. Bulgarian Catastrophe Insurance Pool or “BCIP” means the insurance entity that issued the policy.

3. “Earthquake” means a vibration-generating rupture event caused by displacement within the earth’s crust through release of strain associated with tectonic processes and includes effects such as ground shaking, liquefaction, and

damaging amplification of ground motion. While land sliding, including seismically-induced land sliding, is not itself an earthquake, we cover, subject to "Losses Excluded" item 5 and subject to all other terms and conditions of this policy, loss to covered property arising out of seismically-induced landslide if that landslide would not have occurred in the absence of an earthquake that commences during the policy period as part of seismic event. Earthquake does not mean or include tsunami or volcanic eruption.

4. "Insured" means you and the following persons if they are permanent residents of your household:

    a. Your relatives, whether related by blood, marriage or adoption, and
    b. Anyone under the age of 21 who is in the care or custody of you or of any of your relatives who permanent residents of your household.

5. "Limit of insurance" means the most we will pay for covered loss arising from any seismic event.

6. "Nuclear hazard" means any nuclear reaction, radiation, or radioactive contamination or any consequence of any of these.

7. "Participating insurer" means the insurance company that issued the policy, meets the legal and regulatory requirements to offer residential earthquake coverage by participating in the BCIP, and provides claims and policyholder services for this policy on behalf of the CEA.

8. "Replacement cost" means the cost of replacement or the cost of reasonable repair, at the time of the loss, with like construction and use and using materials of like kind and quality, without deduction for depreciation, subject to the policy "limit of insurance" for that type of property.

9. "Residence employee" means an employee of any "insured" who performs duties at the "dwelling" location described in the DECLARATIONS in connection with the maintenance or use of the "dwelling," including household or domestic services, including health care services for the insured.

10. "Seismic event" means one or more earthquakes that occur within a 360-hour period. The seismic event commences upon the initial earthquake, and all earthquakes or aftershocks that occur within the 360 hours immediately following the initial earthquake are considered for purposes of this policy to be part of the same seismic event.

11. "Sublimit" means a dollar limit on coverage for a specific type of property within a category of property that is subject to a higher total limit of insurance. Payment under a sublimit will reduce the amount available under the total limit of insurance.

12. “Tectonic processes” means natural adjustments of the earth’s crust that are wholly in response to regional stress conditions caused by natural dynamic forces within the earth’s interior, and not initiated, in whole or in any part, by any human activity.

COVERAGES

COVERAGE A: DAMAGE TO OWNED DWELLING

Property Covered – Coverage A

Subject to the deductible and subject to the limit of insurance for "COVERAGE A: DAMAGE TO OWNED DWELLING", we insure against direct physical loss by or from earthquake to:

1. The dwelling owned by the insured at the location described in the DECLARATIONS of this policy.

2. Additions and extensions attached to and in contact with the dwelling by means of a rigid exterior wall, a solid load-bearing wall interior wall, a stairway, an elevated walkway, or a roof.

3. Plumbing pipes and utility service structures and equipment that are (i) enclosed in the wall, ceiling, or floor of the "dwelling" and (2) extend to the exterior surface of the "dwelling's" foundation wall.

4. Utility service structures and equipment that (a) are located outside of the foundation wall but within the property boundaries at the location on the DECLARATIONS page and 92) affect the habitability of the "dwelling," and (3) are among the following utility services: traffic, telephone, natural or bottled gas, heating oil, water, and septic sewer systems.

5. Bulkheads, piers, and retaining walls that are integral to the stability of the "dwelling" are covered parts of the "dwelling." Integral to the stability of the "dwelling" means that unless the affected item is repaired or restored immediately, the residential structure is or will become structurally unstable or unsteady.

6. The cost of land stabilization necessary for the habitability of the "dwelling," including the engineering costs of the stabilization. The cost of land stabilization is covered only when the land instability is directly and immediately caused by an "earthquake."

The amount available under the "limit of insurance" for your dwelling in coverage A, above, will be reduced to the extent that we make any payment for coverages B through C.

Covered damage to any of your property listed in coverages A through C are covered by Coverage A of this policy for purposes of meeting the deductible requirement.

COVERAGE B: DAMAGE TO CONTENTS

Subject to a total "limit of insurance" of ____ , we cover damage to contents of the insured dwelling owned or used by an "insured" while the contents are at the "dwelling." At your request, we will cover personal property owned by others while that property is on the part of the "dwelling" occupied by an "insured." In addition, at "your" request we will cover personal property owned by a guest or a "residence employee" while the personal property is on any part of the "dwelling" occupied by an "insured."

The amount available under the total "limit of insurance" for contents will be reduced to the extent that any payment is made for damage to or loss of personal property owned by others.

COVERAGE C: LOSS OF USE

Subject to a total "limit of insurance" of $_____ for additional living expenses and fair rental value combined:

1. If a covered loss makes that part of the "dwelling" you occupy unfit to live in, we cover:
    a. Additional Living Expenses – the necessary increase in living expenses you actually incur to maintain your normal standard of living. We will pay Additional Living Expenses for the shortest time reasonably needed to (i) repair or replace the parts of the dwelling you occupy that are unfit to live in, or (ii) for you to relocate permanently if you do not elect to repair or replace your dwelling.

2. If a covered loss makes that part of the dwelling rented to others or held for rental by you unfit to live in, we cover the fair rental value of that part of the dwelling that is rented to others or that you hold for rental, less any expenses that do not continue while the rental portion of the "dwelling" is unfit to live in. Fair rental value means the average rental amount immediately before the earthquake in your rental market for a residential unit similar to that covered under the policy. We will pay for the shortest time reasonably needed to repair or replace that part of the dwelling rented or held for rental. Your loss of rents due to cancellation of a lease or rental agreement is not covered.

3. If a civil authority prohibits you from occupying your dwelling because of direct damage to neighboring premises that would have been a covered loss under this policy had it occurred on the premises of the "dwelling," we cover the resulting Additional Living Expenses or fair rental value, subject to the Coverage C limit of insurance.

OTHER COVERAGES

If covered property is damaged by a "covered event" we will pay the reasonable expense you incur in removing debris of damaged covered property. This coverage provides up to 2% of the dwelling limit of insurance as additional insurance.

PROPERTY NOT COVERED

We do not cover:

1. Detached garages, outbuildings, other structures, fences, and masonry fences and walls that are not necessary for the structural integrity of the dwelling. Necessary for the structural integrity of the dwelling means that unless the affected item is repaired or restored immediately, the residential structure is or will become structurally unstable or unsteady.

2. Walkways, driveways, and patios.

3. Awnings and patio coverings.

4. Landscapes, trees, shrubs, lawns, or plants.

5. Exterior water supply systems.

6. Antennas and satellite dishes and any towers, brackets or attachments that support or secure them.

7. Any decorative or artistic features of the dwelling, including but not limited to works of art, fountains, aquariums, and their systems.

8. Bulkheads, piers, and retaining walls not integral to the stability of the dwelling.

9. Swimming pools, spas, and hot tubes.

10. Personal property separately insured for the earthquake peril under any other insurance policy.

11. Animals, birds, or fish.

12. Motor vehicles, lawn mowers, or any other motorized land conveyance equipment or any contents of this equipment.

13. Data stored in any form of media.

14. Artwork, including but not limited to paintings, drawings, framing, sculpture, photos, pottery, and ceramics.

15. Glassware, china and porcelain.

16. Watercraft.

17. Trailers.

EXCLUSIONS

We do not cover the following losses when caused directly or indirectly by, or which result from, contributed to, or are aggravated by an earthquake, or that were present at the time of an earthquake:

1. Loss or damage caused by (1) controlled or uncontrolled nuclear hazard or (2) any act or condition incident to any nuclear hazard, whether direct or indirect, proximate or remote, or in whole or in part caused by, contributed to or aggravated by an earthquake.

2. Your neglect to take all reasonable action to save and preserve covered property at and after a loss.

3. Intentional loss, meaning any loss arising out of an act committed:

    a. By or your direction, or at the direction of any insured or of any person named as additional insured; and

    b. With the intent to cause a loss.

4. Explosion.

DEDUCTIBLE CLAUSE

We will only pay that part of the loss that exceeds the deductible amount, but not more than the limit of insurance for the dwelling. The deductible percentage that applies to this policy is shown on the DECLARATIONS page.

The deductible will be applied one time for each covered event. Until the cost to repair or replace the dwelling damage exceeds the deductible, we will not pay for any coverage under this policy except for Loss of Use coverage, which is not subject to application of deductible.

Only dwelling damage that is covered by Coverage A of this policy, as limited by application of any sub-limits that apply to the loss, can be applied to meet the deductible requirement. After the deductible amount is calculated and applied, coverage sub-limits, if applicable, will be applied and may limit your recovery under the policy.

INSURED LIMIT CLAUSE

The insured limit will be calculated based on the construction costs index calculated per square meter specifically for the location and the construction quality of your insured property times its size subject to a maximum insured limit allowed under the BCIP program.

CONDITIONS

1. Concealment or Fraud. The entire policy will be void if, before or after a loss, you:
    a. Intentionally conceal or misrepresent any material fact or circumstance;
    b. Engage in fraudulent conduct; or
    c. Intentionally make false statements relating to this insurance.

2. Your duties after Loss. If a loss occurs to covered property, you must perform the following duties:
    a. Give written notice to the participating insurer without delay.

    b. Protect the property from further damage. Make any emergency repairs that are necessary and reasonable to protect the property from further damage.

    c. Make and keep a list of all damaged or destroyed personal property, showing in detail the quantity, description, and amount of covered loss. Keep all bills, receipts, and related records that support your figures.

    d. Send the participating insurer within 30 days from the date on which you have sustained a loss your signed statement (along with supporting documents) that sets forth to the best of your knowledge and belief:

        i. The time, date, and cause of loss;

        ii. Your interest and the interest of all others in the property that sustained a loss, and a detailed description of all liens or encumbrances on the property;

        iii. A signed by you copy of the claims adjustment report provided by a participating insurer.

iv. The list of damaged or destroyed personal property described above;

v. All receipts and records that support any claim for additional living expense or fair rental value.

3. **Loss Settlement**. Covered property losses are settled as follows:

   a. We will settle a loss to property described or covered, or both, under COVERAGE A at replacement cost for the amount to be incurred to repair or replace that property with like construction and use and with materials of like kind and quality, without deduction for depreciation, up to the applicable limit of insurance. This amount will be calculated as a percentage of insured limit proportional to **the level of property damage** described in the claims adjustment report for your insured property. Or, if the dwelling is rebuilt or placed at another location, we will settle a loss to the property at an amount no more than the cost to repair or replace the dwelling at the original dwelling location, up to the applicable limit of insurance. This policy does not provide full repair or replacement of your dwelling following an earthquake or covered event if the costs associated with the full repair or replacement exceed the dwelling limit of insurance shown in the DECLARATIONS.

4. We will settle losses to property described under COVERAGE B: DAMAGE TO CONTENTS at an actual cash value.

   a. Our liability for loss to any personal property insured under COVERAGE B will not exceed the smallest of the following:

      i. The cost of repair or restoration

      ii. The actual cash value

      iii. The sublimit of insurance for COVERAGE B specified in the DECLARATIONS.

5. **Resolution of Claims Disputes**. If you and we fail to agree on the extent of damage to your insured property, either of us may request an additional independent appraisal of the damage. In this event, each party will choose a licensed, competent and disinterested loss appraiser within 20 days after receiving a written request from the other. The two appraisers will choose an arbiter. If they cannot agree on an arbiter within 15 days, you or we may request that a judge of a Bulgarian court of competent jurisdiction in the area where the insured dwelling is located appoint an arbiter. The appraisers will separately appraise the amount of loss under this policy. If the appraisers submit an agreed written report to us, the amount they agree on will be the amount of loss under this policy. If they fail to

agree, they will submit their differences to the arbiter. A decision by the arbiter agreed to by any two of the three individuals (consisting of the two appraisers and the arbiter) will set the amount of loss under the policy.

Each party will:

a. pay its own appraiser, and

b. bear the other expenses of the appraisal and of the arbiter equally.

6. **Loss Payment.** We, through the participating insurer will adjust all losses and pay you unless some other person is legally entitled to receive payment. Losses will be payable within 30 days after we receive your proof of loss and:

   a. there is a filing of a final appraisal award with us;

   b. there is an entry of a final judgment on the amount of award in case a dispute.

7. **Mortgagee Clause.**

   a. The word mortgagee as used in this policy includes trustee.

   b. If a mortgagee is named as a loss payee in this policy and that mortgagee required you to purchase earthquake insurance that covers the dwelling as a condition for making a loan to you secured by the dwelling, any loss payable under Coverage A will be paid to the mortgagee, to the extent of its interest in the property, with the remaining balance of the indemnity payment to be paid to you.

8. Under this policy, a mortgagee is also entitled to submit a claim directly to us as long as:

   a. it notifies the participating insurer at the inception of this policy about its intention to be a loss payee;

   b. pays any premium due under this policy on demand within 15 days after it receives notice from us of your failure to do so;

   c. submits a signed, sworn statement of loss within 30 days after it receives notice from us of your failure to do so. Policy conditions relating to Appraisal and Loss Payment procedures apply to the mortgagee.

9. **Termination.** If we offer to renew your policy and we do not receive your required premium payment on or before the end of the then current policy period,

your policy will terminate automatically at the expiration of the then current policy period.

10. **Cancellation.**

    a. You may cancel this policy at any time by returning it to the participating insurer, which will issue you a policy cancellation receipt specifying the cancellation date and the premium due to you as a refund.

    b. We may cancel this policy only for the reasons stated in this condition by notifying you in writing of the date cancellation takes or took effect. The cancellation notice may be delivered to you or mailed to you at your mailing address shown in the DECLARATIONS. Proof of mailing will be sufficient proof of notice.

        i. When you have not paid the premium within 15 days from the date on which the policy has been issued, we may cancel at any time by notifying you at least 10 days before the cancellation takes effect.

        ii. When this policy has been in effect for less than 60 days and is not a renewal with us, we may cancel it if we discover that the risk does not meet our eligibility standards by letting you know at least 10 days before the date cancellation takes effect.

        iii. When the policy has been in effect for 60 days or more, or it at any time it is a renewal with us, we may cancel based on the occurrence of one or more of the following:

            1. our discovery of fraud or material misrepresentation by either the insured or the insured's representative in obtaining the insurance, or by you or your representative or in pursuing a claim under the policy; or

            2. our discovery of grossly negligent acts or omissions by the insured or his or her representative that have substantially increased any of the hazards insured against.

            We may cancel this policy during the policy term by notifying you at least 30 days before the date cancellation takes effect. We may cancel this policy at the policy renewal date by notifying you at least 45 days before the date cancellation takes effect.

    c. When this policy is cancelled, any premium paid for the period from the effective date of the cancellation to the expiration date will be refunded.

When the policy is cancelled, the return premium will be pro rata less the cancellation processing fee.

11. **Assignment**. Your assignment of this policy will not be valid unless we give written consent.

12. **Death**. If you die during the policy term, we insure:

    a. Your legal representatives, but only with respect to the property of the deceased covered under this policy at the time of your death; or

    b. Residents of your household who were insureds at the time of your death.

13. **Recovered Property.** If you or we recover any property for which we have made payment under this policy, you or we will notify the other of the recovery. At your option, the property will be returned to or retained by you or it will become our property. If the recovered property is returned to or retained by you, the loss payment will be adjusted based on the amount you received for the recovered property.

14. **Legal Jurisdiction for Disputes** In case of a dispute between the parties with reference to this insurance policy they will do their utmost to settle it amicably by agreement. Should that prove to be impossible, the parties shall refer the dispute to the respective Bulgarian Court of Justice for consideration

References

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[4] Grünthal, G. (Ed.), *European Macroseismic Scale 1998 (EMS-98).* European Seismological Commission, Luxemburg, 1998

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