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CATASTROPHIC RISK FROM PUBLIC FINANCE PERSPECTIVE

Introduction

Catastrophic risk becomes serious threat to national economies of almost all countries. Public sector, as one of main actors creating economic processes, participates in catastrophic risk management process. The aim of this article is to present the problem of catastrophic risk management from public finance perspective. This demands both: identifying domains of public sector responsibility for catastrophic risk management as well as demonstrating main problems of public sector engagement in catastrophic risk financing, which is crucial issue of this risk management.

1. Catastrophic risk impact on public sector

Catastrophic risk, from among other categories of risk, is distinguished by the character of its' consequences. Consequences of catastrophic risk realization are large and multiple losses, both: personal and material, cumulated in time and space. A cause of a catastrophe can be sudden (hurricanes, earthquake, nuclear reactor explosion) as well as relatively lingering or – using other words – taking a longer time (drought, war, economic crisis). Such understood catastrophic risk is a particular challenge for projecting economic processes, which – basing on limited resources – aim at filling unlimited needs of a mankind. This challenge is particular, because as a result of catastrophic risk realization multiple resources suffer, what in turn has following consequences:

- impossible is exploiting damaged resources and filling the everyday needs (i.e. water supply, food supply, transport),
- resources, that were not injured by a catastrophe, have to be engaged in process of restituting damaged resources, what limits possibilities of filling the everyday needs not related to catastrophic risk realization.

Catastrophic risk realization impact on public sector (and thus public finance) is characterized by a wider and – to a certain extent – specific only for a public sector, range of consequences. Those consequences appear as:

- losses in public property (especially infrastructure), which constrain filling social needs^{*},
- necessity of engaging public resources (including public monetary means)^{**} in process of restituting damaged public property, which also constrains filling social needs,
- emergence of a social need for providing safety and everything what is necessary to fill basic needs of people hurt by the catastrophe, what requires engaging public resources (including public monetary means),
- tax incomes lowering as a result of lowering tax bases of diverse taxes being a part of tax system, especially such bases as: people's incomes, corporate incomes, magnitude of domestic markets turnover and the real estate floor space.

First two of mentioned types of losses can be described as direct losses suffered by public sector due to catastrophe occurrence. Other two types can be described by indirect losses, because public sector experiences such losses due to this sector environment modification caused by a catastrophe occurrence.

Public sector engagement (and thus public finance engagement) in catastrophic risk management is thereof an indispensable condition of rational management within this sector. However such engagement is not demanded only due to negative consequences of catastrophe occurrence for public sector. The state – taking a responsibility for protecting their citizens right to live (*Konstytucja Rzeczypospolitej Polski z dnia 2 kwietnia 1997 r.*, 1997, art. 38) – is especially responsible for counteracting personal losses, and so – responsible for counteracting catastrophes. Thus it can be stated, that states engagement in catastrophic risk management is motivated not only by necessity for public resources protection, but also by the necessity for citizens and their property protection. This can be briefly expressed as the necessity for the national economy protection (or country protection).

2. Domains of states responsibility for catastrophic risk management

National economy exposition to catastrophic risk can be modified in order to lowering such exposition. Entirety of actions taken in order to lowering exposition to catastrophic risk, in procesual aspect, is called catastrophic risk mana-

^{*} Social needs can be defined as needs noticeable by members of society as a result of belonging to a certain society.

^{**} Public resources are understood as resources allocated in public sector (machines, labour, money etc.).

gement. Assuming that management is realized with the help of informative – decisive functions (Bieniok, 2006, p. 17), it should be stated, that in the process of catastrophic risk management it is necessary to gather appropriate information on this risk (what is called risk assessment and proceeds in certain phases) and then, basing on gathered information, taking actions oriented towards lowering countries exposition to catastrophic risk (what is called risk control)*.

Catastrophic risk assessment includes gathering information of this risk sources (what is called risk identification) and information on this risk severity (risk measurement). Catastrophic risk severity depends on both: risk realization frequency and the magnitude of losses being catastrophe occurrence consequences (Williams, Smith, Young, ..., p. 94-96).

Information on catastrophic risk should be gathered systematically, which means it should be sectioned according to risk categories, and gathered continuously (Tchankova, 2002). Catastrophic risk categories are types of this risk settled basing on properly selected risk features. The main criterion of catastrophic risk classification exploited in systematization of catastrophic risk identification is the criterion of risk sources. Basing on this criterion two categories of catastrophic risk are distinguished: natural catastrophes and man-made disasters (these categories can be further analyzed with at will particularity). Subdivision of catastrophic risk based on risk sources criterion allows identifying methods appropriate for risk control (i.e. risk prevention, which aims at counteracting catastrophe occurrence, is impossible to apply for earthquake risk control, however this method it very useful in terroristic attacks risk control).

Estimating catastrophe occurrence frequency and the magnitude of losses caused by such occurrence is called risk measurement. Risk measurement results also should be apprehended in scheme that facilitates risk control methods and tools selection. Such scheme is proposed by the World Bank (Figure 1).

Category	Probability of Event or Return Period	Damage as proportion of GDP
Group 1	5% or up to 20 years	Up to 3%
Group 2	3,33% or up to 20-30 years	Up to 5%
Group 3	1% or up to 30-100 years	Above 5%
Group 4	0,5% or up to 100-200 years	Above 5%
Group 5	Below 0,5% or above 200 years	Above 5%

Fig. 1. Types of catastrophes

Source: Poundrik (? , p. 2).

* Mentioned phases of risk management process are presented by P. Young and S. Tippins (P. Young, S. Tippins, *Managing Business Risk. An Organization-wide Approach to Risk Management*, American Management Association, Nowy York 2001, p. 60 i 123).

Scheme presented in Figure 1 can be exploited in projecting both: so called “physical risk control”, which includes: risk avoidance (not taking actions bounded with risk), risk prevention (counteracting risk realization) and risk repression (limiting magnitude of losses caused by catastrophe occurrence) and financial risk control, which consists in selecting sources of financing losses caused catastrophe occurrence.

Presentation of catastrophic risk management from public finance perspective requires first of all identifying domains of public sector responsibility for catastrophic risk management as well as factors that determine those domains. Deliberated responsibility should not be understood in a legal sense, but as a responsibility that derives from public and private sector entities interests. Schematic division of responsibility for catastrophic risk management between private sector and public sector is presented in Figure 2.

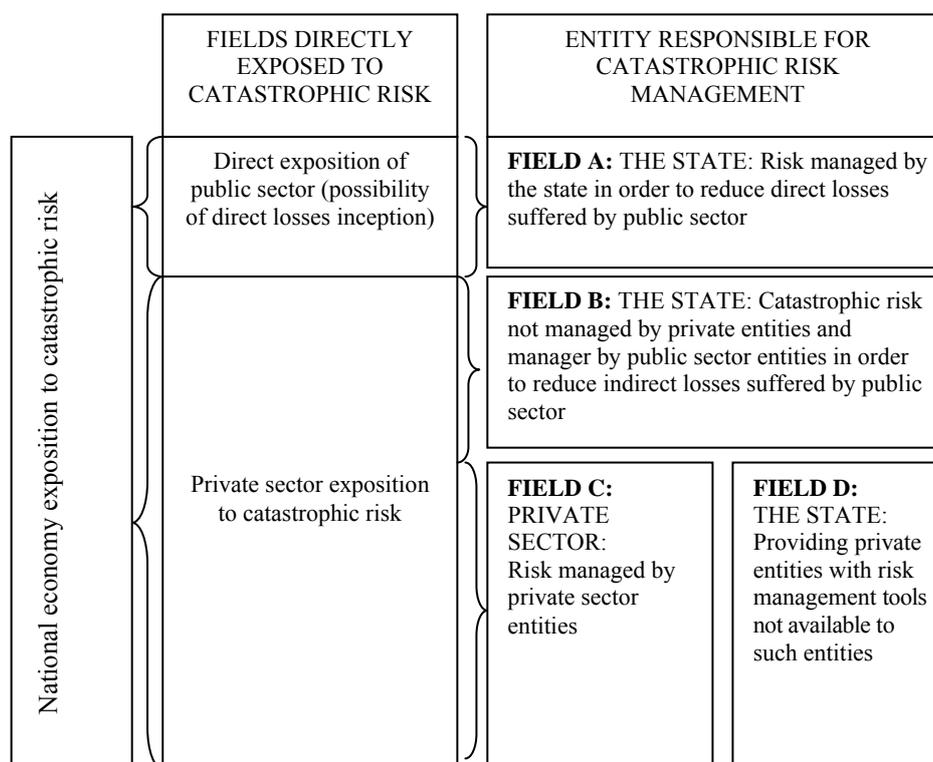


Fig. 2. Division of domains of responsibility for catastrophic risk management

Presented pictorially division of responsibility for catastrophic risk management domains requires deepen explanation. First of all it is clear that the division of responsibility for catastrophic risk management is determined by national economy structure. The more resources are allocated in public sector the greater is the threat of this sector by direct losses, and thereof the greater is the responsibility of the state for catastrophic risk management (Field A).

At once with stating that catastrophic risk threatens national economy it should be noticed, that each entity, that such economy consists in, can manage risk to which it is exposed. The effects of this management determine the scale of public sector threat by indirect losses (the scale of threat by direct losses does not depend on any actions taken by entities other than public). For that reason another factor determining division of responsibility for catastrophic risk management is effectiveness of catastrophic risk management performed by private sector entities. Private sector entities approach towards their risk management may be deliberated and programmed or not deliberated and chaotic. The less effective are actions taken by private sector entities in order to reduce their exposition to catastrophic risk the greater is exposition of public sector to in-

direct losses and greater the demand for public sector engagement in catastrophic risk management (Field B)*.

It should be stressed that the state is able to stimulate private sector entities to manage their risk in effective way, what includes especially stimulating savings by exploiting tax incentives** or imposing compulsory insurance.

Savings are one of appropriate ways of households coping with catastrophe's consequences: by lowering consumption in time of relatively high income (when lowering consumption does not reduce significantly utility of this consumption) households are able to increase consumption in time of risen needs caused by catastrophe occurrence (what, considering low level of income due to catastrophe occurrence, results in significant augmentation of consumption utility)***. Usually equalizing consumption utility in times of different income levels can be reached by utilization of loans or other financial commitments. However their availability in case of catastrophe occurrence is limited.

Insurance is a tool which in even better way than savings makes risk financing possible. The reason for this is that insured has a confidence of gaining compensation appropriate to suffered loss. Such confidence is possible because insurance companies possess knowledge on risk and because insurance system includes guarantees of system security (which means guarantees of insurance companies paying capacity).

In case of savings it can't be stated if they are sufficient to finance suffered losses. One entity may build up reserves that exceed suffered losses and experience alternative costs due to keeping its' monetary means out of day-to-day usage. Another entity may save much too little relating to needs caused by catastrophe occurrence. When entities are insured, insurance company is responsible to settle needed amount of money and setting this amount is much easier, because possible random irregularity of losses is not dangerous, when losses are financed from aggregated fund (not divided into individual accounts).

Remarkable notice is that the ability of private sector entities to manage their catastrophic risk effectively is determined by (among others) catastrophic risk management tools availability (considering distinguished phases of risk management process such tools can be classified as risk assessment tools and

* For instance: if inhabitants of territories threaten by flood react to communicate about coming inundation and leave their residences the state is not forced to engage in their evacuation. But if these inhabitants do not react to communication about coming inundation the state has to take care of them. Parallel problem is related to risk financing. If private sector entities are insured to i.e. hurricanes, hurricane occurrence does not require disposing public sources, but if they are not insured, catastrophe occurrence results in claims to the state for compensation.

** Exploiting fiscal stimulus should be preceded by examining for how much costs of the stimulus result in lowering public sector exposition to indirect losses and if, in consequence, such stimulus is effective.

*** More about the theory of households savings in: (2003, p. 754-758).

risk control tools: risk prevention tools, risk repression tools and risk financing tools). Risk management tools availability is usually limited, what results in demand for public sector engagement in supporting managing catastrophic risk that threatens private sector entities (Field D).

Catastrophic risk management tools availability can be limited for following reasons:

- catastrophic risk management tools may be, so called – public goods,
- catastrophic risk management tools may be too expensive, considering financial conditions of private entities exposed to such risk,
- costs of applying certain catastrophic risk management tools may, in case of particular entities, exceed benefits related to applying these tools (thereof applying these tools becomes – from particular entity perspective – economically not justified).

Mentioned reasons should be analyzed more deeply.

Certain good may be recognized as public good, when is characterized by specific features. These features are especially: lack of competing in access to such good (nonrival goods), impossibility of anybody exclusion from such good consumption (non-excludable goods) and marginal costs of providing such good to additional consumer is equal to zero (Stiglitz, 2004, p. 150).

Mentioned attributes of public good make supplying of such goods by the market impossible (or not sufficient) (Stiglitz, 2004, p. 94-95). Providing such goods requires engagement of public resources. Some of catastrophic risk control tools are characterized by enumerated attributes (riverside barriers, retention reservoirs systems, fireguard, anti-terrorist units, projecting and performing supervision over financial institutions etc.). Thus providing of such catastrophic risk management tools depends on the state.

Following two of mentioned reasons for limited availability of catastrophic risk management tools to private sector entities are: such tools are too expensive and costs of applying such tools exceed benefits related to such application considered individually. Good examples are: gathering, registering and analyzing information on catastrophic risk (weather phenomena, earthquakes, terroristic attacks) or building bunkers. Costs of such activities in majority exceed financial capacity of households and enterprises and if a particular household or an enterprise can afford making such expenses, benefits of this activities, that such household or an enterprise may experience, are below costs. It should be noticed, that considered catastrophic risk management tools are not characterized by pure public good features. Thereof the state supplies such tools only if such supply derives from the country's socio-economic doctrine (adopting certain doctrine is determined by the result of public choice). Such tools belong to the group of so-called social goods*. It should be underlined, that including catastrophic risk management tools in catalogue of social goods is advantageous, because benefits

* Wider deliberation over pure public goods and social goods in: (1999, p. 24-32).

experienced by the whole national economy, when such tools are provided by the state (and the benefits are truly experienced by the whole national economy, because these tool become available to each entity), exceed costs.

When the state supports catastrophic risk management performed by private sector entities by providing risk management tools, otherwise not available to such entities, the state reduces public sector exposition to indirect losses*.

Simplified graphic presentation of domains of responsibility for catastrophic risk management is a model conceptualization. It should be stressed that in the reality in both systems: public catastrophic risk management system and private catastrophic risk management system, gaps emerge. Such gaps result in uncontrolled exposition to catastrophic risk, which, when realize, takes effect in losses depleting resources indispensable in economic processes.

3. Public monetary means in catastrophic risk financing

Remarkable notice is that physical catastrophic risk control tools may fail and do fail. In many cases they turn out to be simply insufficient. Thereof justifiably such tools are called risk reduction tools, because while reducing risk, physical risk control tools do not eliminate it. As a result it can be stated, that indispensable element in every catastrophic risk control system is risk financing. Thus financing catastrophic risk with utilization of public monetary means** is going to be deliberated more extensively.

Engaging public monetary means in catastrophic risk financing should be deliberated in reference to distinguished domains of responsibility for catastrophic risk management. The state is first of all responsible for financing catastrophic risk that endangers resources allocated in public sector. Than – the state is often forced to pay compensations for losses in resources allocated in private

* Implementation of catastrophic risk management tools results in augmentation of public expenditures as well as change expenditures structure.

** Public monetary means include:

- 1) public incomes (taxes, charges and others),
 - 2) monetary means derived by European Union budget and monetary means that are not reimbursed derived from EFTA,
 - 3) monetary means derived from foreign sources other than mentioned in points 1 and 2,
 - 4) public proceeds including:
 - a) monetary means derived from public securities issuance,
 - b) monetary means derived from states and local authorities' property privatization,
 - c) monetary means derived from granted by the state and local authorities borrowings reimbursement,
 - d) monetary means derived from granted loans and credits,
 - e) monetary means derived from other financial operations.
 - 5) public proceeds derived from activities performed by public sector entities and other sources.
- Ustawa z dnia 27 sierpnia 2009 r. o finansach publicznych (2009, art. 5, nr 157 poz. 1240).*

sector (if entities that exploit such resources do not project sources of losses financing). In the end – financing some categories of catastrophic risk is not available to private sector entities (ie. flood insurance is not included in Dutch insurance companies offer), what creates social need for state intervention. Such need satisfaction may be included in socio-economic doctrine adopted in the country.

In each of mentioned domains of responsibility for catastrophic risk financing the state may apply risk retention and/or risk transfer. Both: risk retention and risk transfer, when performed by the state, are advantageous. That is because public monetary means* come from burdens imposed on each private entity (this results in some kind of social justice in incurring the costs of catastrophic risk financing) and are aggregated funds, what allows financing losses even if these losses are irregular (financing losses from individual account is risky, because losses are irregular**).

Risk retention means financing risk from states own monetary means. Risk transfer is financing risk from monetary means derived from other entities.

Risk retention should be programmed in detail. This means that concrete monetary means should be designated for risk financing. This may include current inflows and/or – created especially for catastrophic risk financing – reserves.

Risk transfer may be presented sectioned according to the moment of choosing and organizing external sources of risk financing as: transfer ex ante and transfer ex post (Borys, 2010). Transfer ex ante requires an agreement of risk transferring to another entity (usually at a settled price). Such agreement is made before catastrophe occurrence. This method of risk financing guarantees granting monetary means necessary for restitution of damaged resources. Tools of transfer ex ante include insurance contracts, hedging contracts and risk transferring to a contractor. Transfer ex post consists in searching for needed monetary means after catastrophe occurrence (like international help). Wide approach to catastrophic risk financing (including deliberating both ex ante and ex post transfer) allows comprehensive identification of possibilities of gaining monetary means for losses repair. Yet among identified possibilities there are some, which do not assure granting means in case of catastrophe occurrence.

Selection of catastrophic risk financing sources is determined by number of factors, from among internal and external factor can be distinguished. Internal factors determining risk financing tools selection are public sector conditions, external factors are located in the public sector environment. Internal factors determining risk financing tools selection are especially: regulation and public

* Risk transfer is also bound with utilization of public monetary means, because these means are needed to finance costs of transfer.

** Risk related to financing catastrophic risk form individual accounts realizes as insufficiency of accumulated money towards losses or in excess of accumulated money over losses resulting in alternative costs.

finance situation (level of public debt, expenditures structure etc.). External factors are especially: availability and cost of contracting a debt, availability and costs of insurance and other risk transfer agreements as well as international situation.

Exploiting public monetary means in order to finance losses related to catastrophe occurrence is these means disposing that has a certain legal status – making public expenditures. Public expenditures can be made for purposes and in extent settled in budgetary act (government expenditures), local budgetary resolution (local authorities expenditures) or financial plan of public sector entities (such entities operate at both national and local level and their financial plans are coherent with budgetary act and budgetary resolutions) (*Ustawa z dnia 27 sierpnia 2009 r. o finansach publicznych*, art. 44). This means that public expenditures have to be made according to certain plan. This is a kind of restriction of exploiting public monetary means in catastrophic risk financing, because level of needed engagement can't be planned precisely. Thus it can be stated that law, which regulates public expenditures, blockades catastrophic risk retention consisting in financing losses from current inflows. What can be planned is a reserve created in order to finance possible losses. Public Finance Act regulates principles of creation and disposal of so called general reserve and purposeful reserves. Mentioned reserves are the only public expenditures which do not have planned purpose. They can be disposed during budgetary year according to conditions which become known during the budgetary year. General reserve can't exceed 0,2% of public expenditures and sum of purposeful reserves can't exceed 5% of public expenditures (*Ustawa z dnia 27 sierpnia 2009 r. o finansach publicznych*, art. 140).

Reserves can be designated in order to counteract natural disasters and such disasters effects elimination. Taking into consideration, that such reserves have number of other destinations it should be noticed that law, which regulates public expenditures, determines the scale of catastrophic risk retention by exploitation of reserves. This has negative consequences, for instance: in 2010 current expenditures from purposeful reserve designated to natural disasters counteraction and their consequences elimination reached only 450 mln of polish zloty and accounted for 0,15% of all states budget expenditures. Simultaneously catastrophic losses caused only by flood in 2010 (not taking into consideration other catastrophes, like: industrial emergencies, transport catastrophes etc.) reached 2,9 mld euro and exceeded 0,6% of polish GDP in 2009 (*KE ostatecznie potwierdziła pomoc dla Polski*, 2010). (this equals to 12 mld polish zloty, using in calculation average euro to zloty course given by Polish National Bank on July 2010). This means that reserves planned by the state inter alia for catastrophic risk financing last out to finance less than 3,8% of losses*. Although there are

* Another indicator of the scale of public reserves adequacy towards losses may be sum of losses suffered by an individual enterprises: in Karpacka Spółka Gazownictwa, owned by PGNiG S.A., sum of losses reached 20 mln polish zloty (2010).

not detailed data on the level of the state's engagement in losses financing doubts raise if sum of mentioned purposeful reserve was enough to finance at last direct losses in resources allocated in public sector (like damages in infrastructure). Thus it should be examined if the state may exploit other than reserves tools of catastrophic risk financing.

From among factors that determine exploitation of public monetary means in catastrophic risk financing also the budget structure should be analyzed. Public expenditures are often analyzed sectioned according to possibility of unconstrained projecting their designation. This allows distinguishing flexible public expenditures and fixed public expenditures. Flexible public expenditures are shaped according to government policy in the phase of budget planning (like investment). In the phase of budget prosecuting permissible shifts can be made only within flexible expenditure. Fixed public expenditures are strictly defined by law and the government can't change their level and designation in both phases: budget planning and budget prosecuting. If the budget structure is toughen (this means that fixed expenditures account for a large part of the budget), catastrophic risk financing may be performed only via reducing flexible expenditures, which are usually pro-development expenditures (investment, research, education). Unfortunately in Poland flexible expenditures account for a relatively small part of the state's budget and assuring dynamic economic growth requires augmenting pro-development expenditures (Kasperowicz-Stepień, 2009, p. 155). Thereof it can be stated that compilation of public finance condition and serious need for exploiting monetary means that can be freely shaped by the government in assuring economic growth limits possibilities of utilizing that means in creating reserves for catastrophic risk financing and possibilities of making admissible shifts during the budgetary year.

Exploitation of external monetary means in order to finance losses caused by catastrophe occurrence is a risk transfer that can take diverse forms. Relatively most simple issue is pointing appropriate way for financing direct losses. Such losses are consequences in damages in resources allocated in public sector. The state, being their owner, may insure resources. At Polish insurance market there are many insurance products created for protection of diverse resources (real estate, movable property) against following catastrophic risk categories: floods, earthquakes, hurricanes, heavy rain or even tsunamis. However coverage often does not include nuclear damages, droughts, wars and terrorists attacks. This means that extent of available coverage is a factor that determines possibility of insurance application in catastrophic risk financing.

Much more problematic is the issue of engaging public monetary means in financing losses emerging in private sector due to catastrophe occurrence. There is possibility of exploiting reserves created by the state in order to manage cata-

strophic risk, but – as it has been demonstrated above – the amount of reserves is definitely insufficient in relation to possible needs. If risk retention is limited, risk transfer should be deliberated. In case of financing losses in resources allocated in private sector the state, which takes on responsibility for financing such losses, may transfer this risk exploiting international help or by contracting an debt. Scale of available international help is difficult to assess*, especially when international situation has lost its' stability (Greek crisis). It is usually granted when the catastrophe is large and when lack of possibility of managing situation by affected country is presumed (earthquake in Haiti). In turn contracting a debt is determined by number of factors and has a few important negative consequences. First of all determinants of contracting a debt by the state should be deliberated.

Public Finance Act states that contracting a debt at both, national and local level, should be planned (*Ustawa z dnia 27 sierpnia 2009 r. o finansach publicznych*, 2009, art. 76, 77, 89). This means that incurring a debt is admissible only when it serves to finance activities planned at the stage of budget planning (before budgetary year starts). Additional needs caused by catastrophe appearance during budgetary year can't be planned, thereof incurring a debt in order to finance losses suffered by private sector may result in authorities problems at the stage of budget control (vote of acceptance granting). Thus the weaker is the government (or local government), the less stabile politic situation, the greater the anxiety against incurring unplanned debts.

Contracting a new debt augments the existing debt. Sum of debt upper limit (at both levels: national and local) is settled by law (*Ustawa z dnia 27 sierpnia 2009 r. o finansach publicznych* (2009, art. 861, 243). This means that another determinant of financing losses in private sector from public monetary means is existing indebtedness. In Poland the level of indebtedness at governmental level is dangerously near to settled limit. Among local governments significant diversity of indebtedness is observed. As a result it can be stated, that incurring a debt by the government in order to finance losses in private sector caused by catastrophe occurrence can't be recommended. In case of local authorities recommendation is dependent on particular authority situation. Anyway the authority, which decides to incur a debt in order to finance catastrophic losses must take into account debt's negative consequences. These are mainly:

- intergeneration equity disturbance,
- significant costs of debt,
- toughening of budget structure,
- indebtedness trap.

* I.E. Inter-American Development Bank (basing on 40 years experience) estimated, that a country can expect international assistance to cover only about 8% of direct disaster losses (*Closing the Financial Gap*, 2011, p. 7).

The more serious are mentioned problems in particular country the less is authority prone to undertake activities that intensify these problems. Poland experiences noticeable intergeneration equity disturbance and toughening of budget structure. Thus it can be stated that there are some consequences of public debt incurring that constrain augmenting this debt when catastrophe occurrence creates needs for financing losses in private sector from public monetary means.

Deliberation over international aid and contracting a debt, as catastrophic risk financing tools (transfer ex post), allows stating that pre-financing (assuring sources of financing consequences of catastrophe occurrence before such occurrence) is much more valuable in catastrophic risk management than transfer ex post.

Pre-financing tools are especially: reserves and insurance. Yet it should be noticed, that more advanced ways of using public monetary means in catastrophic risk financing are being developed. Observing ways in which some countries project their catastrophic risk financing* leads to the conclusion that reserves may be exploited as some kind of trampoline to the capital markets, what augments available sources needed for repairing losses. Forms of such exploitation are:

- creating SPV company (possibly with private partner), which issues catastrophic derivatives bought by private investors,
- creating captive or company insurance company that gives access to reinsurance markets.

Presented distinction is draft, considering very low number of concluded contracts, and serves only better acknowledgement of possibilities that such contracts create. Each of few such contract is tailor-made and significantly differs from others.

Considering that there are new possibilities of using reserves, that augment financial resources available in case of an event, allows stating that this form of catastrophic risk financing is particularly valuable.

Conclusions

Public sector responsibility for managing catastrophic losses should be delineated according to distinguished domains. This allows highlighting factors determining states responsibility level and risk control tools application. The most interesting issue – when it comes to catastrophic risk control – is risk financing. The most appropriate tool of catastrophic risk financing is exploiting reserves build up from public monetary means. That is because insurance may be applied only in financing indirect losses and incurring a debt is constrained by political situation and public finance situation in Poland and results in objectio-

* Pioneering solutions are presented in document *Closing the Financial Gap* (2011).

nable intensifying intergenerational equity disturbance and budget structure toughening. However the sum of reserve, that can be utilized in catastrophic risk, is in Poland definitely too low. Thereof augmenting and shaping this reserve should be taken into consideration, especially because economic sense of reserves – creating savings – is coherent with appropriate way of equalizing consumption in time (when level of consumption is disturbed by catastrophe occurrence). Considering that the state is able to gain appropriate knowledge on catastrophic risk it can be presumed that the state is able to calculate adequate level of needed reserves. Such reserves can give the state access to the capital markets. Augmenting reserves may demand imposing additional charge on private sector entities (taxes, charges). The form of cumulated reserves may presume depending particular entity burdens on this entity approach towards catastrophic risk (risk reducing or excessive risk exposition), what in turn promotes limiting moral hazard. Shortly described reserves for financing catastrophic risk are similar to social insurance. This resemblance is not coincidental, because social risk, which led to creating social insurance, is in fact catastrophic risk. Issue of magnitude and form of reserves created by the state in order to finance losses suffered by private sector due to catastrophe occurrence requires wide-ranging research.

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RYZIKO KATASTROFICZNE Z PERSPEKTYWY FINANSÓW PUBLICZNYCH

Streszczenie

Państwo jest odpowiedzialne za zarządzanie ryzykiem katastroficznym, które zagraża zasobom alokowanym zarówno w sektorze prywatnym, jak i w publicznym. Zarządzanie ryzykiem katastroficznym wymaga podjęcia kroków w kierunku rozpoznania tego ryzyka, zapobiegania jego realizacji, minimalizowania konsekwencji i organizowania funduszy koniecznych dla restytucji utraconych zasobów, co jest szczególnie istotne w kontroli ryzyka katastroficznego. Rozważenie źródeł finansowania ryzyka katastroficznego dostępnych dla państwa ukazuje, że wartościowym rozwiązaniem są rezerwy. Rezerwy zapewniają potrzebne środki, można je zorganizować w sposób, który zminimalizuje hazard moralny, i wykorzystywać jako swoistą „trampolinę” w kierunku rynków kapitałowych, a tym samym stwarzać dostęp do dodatkowych środków.