

FLOOD DAMAGES AND TOOLS FOR THEIR MITIGATION

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University of Economics, Prague, 2006, pp. 418. ISBN: 80-86684-35-0

English Summary

In 1997 and 2002 the Czech Republic was heavily affected by large floods and suffered enormous flood damages. These events re-opened the issues of the flood protection strategy in the Czech territory. Flood causes, history and predicted frequencies became a hotly debated issue across the academic and political scene.

The outcomes of the research project VaV-1C/4/44/04 „Damages caused by natural disasters“, which are gathered in this book, fully cover the current knowledge in the field of the economic and institutional analyses of flood (or generally natural) disasters. Answers to the following questions were sought: How can we prevent flood damages? What is the ideal distribution of responsibility for the flood protection among citizens – local governments – the state? What is the best method for evaluating the efficiency of public flood expenditures and the flood protection system as such? The structure of the book is as follows:

- I. Basic principles – an economic approach to flood protection.
- II. Classifying flood damages.
- III. The role of insurance regarding the catastrophic floods of 2002 in Central Europe.
- IV. The effectiveness of public flood expenditures in the CR.
- V. Flood programmes.
- VI. Classifying flood protection measures and evaluating their impact.
- VII. Floods in the CR – the potential for economic and sociological analyses.
- VIII. The problem of global warming and its impact on extreme weather events and water in the countryside.

In the following text we will briefly introduce the content of particular chapters as well as some conclusions and recommendations formulated within the research project.

I. Basic principles – an economic approach to flood protection

Economics is the science of dealing with human activities. Its goal is to discover and explain causalities between human behaviour and the goals which individuals follow. Economics also describes the means that people choose to reach their goals and the external tools through which we can, to some extent, influence human behaviour. The generally valid economic principles (i. e. rules of human action) so far discovered can be applied to every social problem in which individuals or groups of individuals interact. Therefore, they can be applied to the problem of flood protection as well. Regardless of the fact that flood protection is a very complex and multi-faceted problem, with a strong political and institutional dimension, the key actor is always the individual. It is they who adjust their behaviour in the existing system so as to maximize their immediate benefits and minimize their losses connected to the possible danger of floods.

In part I. of the book, besides a brief description of the institutional framework, we focus on the economic context of the flood protection measures realized so far and the distribution of responsibilities and flood risks among citizens, local governments and central government.

Conclusions and recommendations:

- Floods are a natural phenomenon that have a large impact on the lives and property of those affected. However, it is also a disaster which only affects some territories and against which the existing tools of risk diversification can be used – i. e. feasible commercial insurance. At the level of the citizen (or individual), there are, therefore, possibilities which can be used to prevent flood risks or to lower their extent. These are mainly locating properties outside of floodplains and commercial flood insurance.
- In some cases, people continue living in floodplains uninsured, in economic terms it is stated that they have low risk aversion – they prefer the current benefits (in “peace” time) while taking the risk of large future losses (in the case of floods).
- The system of flood protection that enables citizens to decide what to do according to their individual risk aversions (while minimizing external influences) can be labelled as efficient.
- If the government or other institutions participating in the national flood protection system decide to correct the low risk aversion of individuals (e.g. by compensating flood damages or by realizing flood protection measures, etc.), the citizens’ individual responsibility for the consequences of flooding is lowered. The system invokes greater solidarity among citizens, but is necessarily less efficient.
- Systems with flood protection measures relying on reimbursement lead to a preservation of the current status and little learning about floods among the citizens concerned. i. e. damaged property is rebuilt from subsidies at the same spots, people are reluctant to insure, any flood protection walls and dikes that are built are mistakenly understood to be an absolute protection against future damages. Therefore, future floods of the same extent will cause the same damage as before. The damage can even be higher due to continued development in flood plains.
- From the economic perspective, the main goal of the state’s flood protection system has to be to increase efficiency and decrease solidarity. This requirement is fully justifiable regarding the increase in the probability of flood events in the coming decades and society’s the limited resources.

II. Classifying flood damages

In the second part of the book we leave economic theory behind and describe different types of flood damage classification. The reasons for different classifications and the current status of this process in the Czech Republic are also discussed. The cause of flood damage is considered to be the most important criteria for flood damage classification. Not all damages can be labelled as “damages caused by heavy rainfalls”. In different groups of causes (e.g. water channels’ capacity, floodplain development, inhabitants’ awareness, etc.) the human factor always plays a more or less significant role. The main purpose of discussion the causes of flood damages is to describe causalities “human activity – damage” and to learn from any failures discovered in the future.

In the last chapter, based on the theoretical example, we compare the extent of flood damages and the costs of flood protection measures and we discuss their mutual adequacy. The key idea is to include the opportunity cost into the analysis as the crucial economic variable. The costs of financial resources expended, significantly decrease the effectiveness of long-term flood protection measures (i. e. protection against 50-year flood, etc.).

Conclusions and recommendations:

- Flood damages need to be quantified with respect to temporal and territorial criteria. They should be expressed locally and further classified according to ownership of the affected property, its type etc. In this structure, the data should be available to the expert public. Due to the lack of time, the quantification cannot cover all types of damages (especially natural damages and different types of indirect damages).
- Besides flood damage quantification, the monitoring of property values situated in floodplains represents the second important source of data for the economic evaluation of flood protection. This data should be monitored, especially by local governments, who contribute through their decision making regarding the municipal territory's flood protection.
- We cannot prevent a flood occurrence, but we can significantly lower damages caused by floods. This can be done by adjusting human activities in floodplains (in the period of "peace") and also by operational responses to imminent flood dangers.
- Even from the data sources from the large floods in 2002 we can derive a certain portion of flood damages caused by human's failure to act appropriately. However, this sort of classification of flood damages is very sensitive politically and not welcomed, because it could be easily followed by personal reprimands. On the other hand if you do not know the real cause of the damage, it is difficult to prevent it happening again in the future.
- Regarding the structure of floods, it seems to be more dependent on the damaged property than on the extent of the floods (in a reasonable manner). Therefore, it is important to focus the flood protection measures on protecting particular objects according to their values, rather than to build large square barriers for an n-year flood.
- From the hypothetical example of lowering flood damages through a certain level of flood protection it is clear that (with the acceptance of opportunity cost) it is not effective to build protection against anything larger than 20-year floods. In a period of more than 20 years, any resources spent on flood protection are not competitive in comparison with their alternative uses (e.g. with the assumed commercial interest rate, etc.).

III. The role of insurance regarding the catastrophic floods of 2002 in Central Europe

The third part of the book amends previous outputs with knowledge from the perspective of the insurance sector. It gathers data on insured and uninsured damages from the floods in 1997, 1998 and 2002. We also discuss the reasons and consequences of the status thus described and we compare the situation in the CR with that abroad.

Conclusions and recommendations:

- In 1997, commercial insurance only covered 15% of flood damages. In 2002, this portion was 50%. However, such a large increase in insured flood damages was not caused by an increase in demand for flood insurance. Only the structure of the damaged property was different (more urban and less rural areas were affected).
- Therefore, floods have still not been an incentive for the public to accept the necessity of commercial insurance.
- Because most of the financial resources spent by Czech insurance companies after the floods in 2002 came from the international insurance sector, there was large pressure to tighten conditions of flood insurance according to real flood risks. Therefore, the flood insurance started to be diversified according to a certain property's probability of flooding and its price increased by about 15 – 20% on average.
- The Czech Insurance Association, which groups together the main insurance companies, played an important role immediately after the floods in 2002. In this period the Ministry of Regional Development suggested lowering state subsidies for flood recovery to people who were insured. Under strong pressure from the public and the Czech Insurance Association this suggestion was finally refused. But simply the existence of such a tool proves that the role of commercial flood insurance to diversify flood risks is still undervalued.

IV. The effectiveness of public flood expenditures in the CR

The evaluation of public expenditures' effectiveness in general (as an important tool for increasing transparency and better targeting of resources) still has very little tradition in the CR. In the fourth part we therefore summarize all available public flood expenditures data. We cluster it according to different criteria and show the means for evaluating its effectiveness. We were primarily focused on the financial resources spent from the state budget and some other centralized funds. The results of this evaluation are confronted with the overall macroeconomic situation in the CR and with the declared principles of the Czech Strategy for Flood Protection.

Conclusions and recommendations:

- The public flood expenditures, made after the floods in 1997 and 2002, show the same extent and the same structure (according to purpose, type, institutions, etc.). From this finding we conclude that, in the CR, there is some constant vision at the central government level on how to solve catastrophic floods. This vision is realized despite the adopted strategic goals of the flood protection system.
- More than 95% of public expenditures were given over to direct property recovery (i.e. to cover flood damages). Only a very small portion targeted the realization of flood protection measures and prevention as such. We can therefore consider the Czech system of flood protection invoking solidarity among the citizens involved, but also being very inefficient.
- Greater efficiency can be achieved either by an overall decrease in the government resources spent (which covered about 20% of flood damages after both large floods) or by a significant increase in the amount of money devoted to prevention.

- However, from the results it is also clear that a large portion of the resources (about 50%) is devoted to recovering public property, e.g. roads and other infrastructure, schools, water bodies and channels, etc. Since such property is situated in floodplains and thus damaged, the structure of public flood expenditures can hardly be changed.

V. Flood programmes

A very small but extremely important portion has been separated from the previous part of the book, where public expenditures as a whole were discussed, that being – flood prevention programmes. This category was mainly formed by two tools after the floods in 1997 and 2002: a large programme from the Ministry of Agriculture “Prevention against Floods” and the programme of the Ministry of the Environment “Retention of Water Systems”. The fifth section includes a detailed analysis of both programmes and their mutual comparison, which is particularly interesting because they represent two sides of the dispute regarding flood protection measures in the CR – the technical and the environmental approach. An evaluation of the strong and weak characteristics of both programmes is carried out in the respective SWOT analyses.

Conclusions and recommendations:

- Both programmes are sometimes characterised by both ministries’ departmental approaches to floods, but only the “Prevention against Floods” has an ex-ante focus on the flood problem.
- After the floods in 2002, the Ministry of Agriculture created a clear plan for the construction of flood protection measures for the Czech territory in the period 2002 – 2010. It also ensured a reasonable amount of financial resources for this plan via political consensus.
- This development contrasts with the rather passive behaviour of the Ministry of the Environment regarding flood protection on the one hand and the huge criticism the designed plan evoked from environmental non-governmental groups on the other.
- It is no surprise that realising the flood protection measure is currently driven by the one-sector approach of the Ministry of Agriculture, which means that technical measures such as dikes, walls, etc., mostly on water courses, are preferred. This is done despite the fact that the general discussion on the “ideal” combination of technical and environmental flood protection measures is still going on.

VI. Classifying flood protection measures and evaluating their impact .

The sixth part is focused on the scientific discussion regarding different types of flood protection measures, which is, as mentioned above, still a very hot issue in the CR. Different opinions were expressed by the representatives of a rather technical approach (experts from the Czech Technical University in Prague) as well as environmental scientists who are actively involved in revitalizations. Technical experts classified the technical flood protection measures and introduced a new risk analysis using a cost-benefit approach to evaluate the effectiveness of specific measures (by assessing the decrease in potential flood damages and

construction costs). This method started to be used in practice within the programme “Prevention against Floods” by the Ministry of Agriculture.

On the other hand, environmental experts classified environmental flood protection measures and defended their importance by explaining the basic principles of the water cycle in the county-side. They also supported their opinions by many case studies from the CR as well as from abroad (especially from Germany).

Conclusions and recommendations:

- From the presented opinions it is possible to find consistent points (e.g. to prevent constructions in floodplains) as well as controversies between both approaches. The main controversy lies in the direction of public expenditures into certain types flood protection measures.
- Technical analyses, mathematic modelling and cost-benefit analyses based on strict assumption can provide some answers regarding the constructions of “optimal” flood protection measures in a specific territory. However, there is always some portion of uncertainty, which comes from the limits of human knowledge about a natural phenomenon such as floods (e.g. it is not possible to calculate all possibilities, to evaluate all the relevant factors, to perfectly assume a level of risk, etc.).
- From this perspective, the general principles of the water cycle in nature and the (often unquantifiable) consequences seems to play the same role as the most sophisticated mathematic models and technical studies.
- As often mentioned, the final solution for flood protection in the CR is not represented by any of the extremes described here (i.e. stream regulation or revitalization). It is an appropriate combination of both.

VII. Floods in the CR – the potential for economic and sociological analyses

Within the research project, we also organized a discussion seminar called “Floods in the CR – the Potential for Economic and Sociological Analyses”. The main goal of the seminar was to open up discussion about the possibilities for research regarding flood issues other than simply hydrological or meteorological research. We therefore invited several experts from research institutions throughout the CR who deal with different types of economic or sociological flood research. The expert knowledge was represented by representatives of Czech Technical University in Prague, the Czech Agricultural University in Prague, the Institute of Geonics in Brno, the organization CityPlan and the Institute for Economic and Environmental Policy of the University of Economics as well. The seventh part of the book contains text versions of all presentations and a transcription of the discussions from the seminar.

Conclusions:

- At the seminar there were detailed presentations and risk analysis was discussed, the historic, economic and sociologic context of floods regarding the large floods in CR was also presented.
- Due to the large number and scale of topics it was difficult to gain a potential for mutual learning.

VII. The problem of global warming and its impact on extreme weather events and water in the countryside

The last part of the book is aimed at briefly answering the question of the unexpected large flood in the CR which occurred in the last decade, as linked to the problem of global warming. Based on the available information from Czech and international scientific sources, the main arguments for and against the hypothesis of global warming and the causality between human activities and climate change were summarized. In the CR, this kind of research is undertaken at the Czech Hydrometeorological Institute. From its reports, some conclusions on the impact of the global climate on the Czech hydrological cycle can be derived, although we always have to keep in mind the large degree of uncertainty.

Conclusions and recommendations:

- Based on the available meteorological time series about global climate, there is still a large degree of uncertainty about the direction and the extent of climate changes (i. e. global warming or global cooling) and their causes.
- The catastrophic floods in the CR and Central Europe in 2002 cannot be (according to expert opinions) considered a consequence of global warming.
- Research studies focused on modelling the impact of global warming on the hydrological cycle in the CR, considering the situation of a 2 – 4 °C temperature increase . However, their conclusions are unclear – in such a case, the total volume of rainfall may increase, though some areas of the Czech Republic may get drier too.
- Czech and international studies agree that, in the future, we can expect a large number of extreme climate events such as floods, drought, tornados, etc. This assumption is supported by international statistics on natural disasters. According to this statement we can therefore assume increasing flood risks in the Czech Republic in comparison with the past 100 years.