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Security Economics: Definition and Capacity

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Security Economics

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Content

1 Introduction

Security economics, its definition and potential capacity constitutes a chapter which deals with the basic meaning of security, the various fields of security economics and the proposal for policy guidelines.[1] Insofar it covers a broad spectrum of security related aspects. Nevertheless, we will limit the scope and concentrate on the economic aspects of security and the consequences for policy guidelines while only briefly touching the various fields of security economics. The main objective of this chapter is to extract economic aspects of the notion "security" and its provision. For this we introduce and analyse security as private/public good. The character (private or public) of the good "security" determines the kind of provision, the (optimal) degree as well as the financing of security measures including spillover effects. From this, criteria for a typology of security measures can be derived

In the next chapter we develop a definition of security which is also appropriate for economic analysis. It focuses on the two key elements of “security threat” and "responsibility". Whereas security analyses often try to define and deal with security threats, the issue of responsibility is mostly neglected. We try to approach a new definition of security by presenting briefly the (conventional) analyses on security economics (chapter 3). Thereby, we give brief overview of the literature on security threats as well as economic impacts of terrorist attacks. We also identify some issues related to security threats which are rarely addressed by researchers. Hereafter, we rise the question of responsibility and look in more detail on the provision of security (chapter 4). On principle, security can be provided as private good or as a public good. Security is often assumed to be a public good, but this presuppose a stable society and a strong government. As there are some advantages supplying it as a (global) public good, we discuss the precondition for public provision, as well as the (optimal) degree and financing in some detail. From this background, we finally develop a taxonomy for an economic analysis of security measures. This may also be helpful for developing policy guidelines.

[1] We concentrate on the capacities of security economics as scientific area of research and do not present issues of institutional capacity. For the latter see Brück et al. (2008).

2 Defining security and extracting the economic basics

There is no commonly accepted definition on what constitutes "security" or even "security economics.[2] Often "security" is defined as absence of threats or risks. Thereby, the attention nowadays shifts away from the state-centred notion as "national security" to a concept of "human security" which focuses on individuals. One example for this approach is the definition of the UNDP (2005, 28):

> "Human security aims at addressing today's security threats in an integrated multidimensional and comprehensive way. By focusing on individuals and communities human security looks beyond the security of borders to the lives of the people and communities inside and across those borders, and provides the analytical framework for developing policies that not only shield people from critical threats but also empower them to take charge of their own lives. (United Nations, 2005)

The UNDP lay one focus of its definition on security threats. Definitions of other authors or organizations characterize "security" as the absence of risk. However, it might be not quite the same if we live without risks or if we feel secure. There are additional positive emotions involved in feeling secure instead of not being exposed to a (certain) risk. That means, that we cannot easily substitute the positive notion "security" by the notion of "risk" or threat which has negative connotations. In addition, the notion "security" refers to a situation which can be valid for the individual as well as the society as whole, whereas "risk" can be differentiated into different types or threats which can either affect the individual, groups of individuals or complete societies. Furthermore, "security" has the characteristics of being in a steady state with positive emotions in the present and an endless horizon. In contrast, risk circumscribes the danger of an abrupt damage of today's live which often causes negative consequences in the future. All in all, one must be aware that there is some kind of loss if the notion "security" is simply substituted by the absence "risk" or threats.

Nevertheless, economists prefer to use the concept of "risk" instead of dealing with "security" because "risk" is calculable. Economists are well aware of the typical differentiation between risk and uncertainty. According to Knight (1921) "risk" is measurable and can be assigned with probabilities. Contrary to that uncertainty is not measurable and has a non-quantitative

character. Thus, security threats can be grouped in the categories "uncertainty" and "risk". Thereby different kinds of risk can help to further characterize the various manifestations of security threats and to develop guidelines for policy measures.

The UNDP definition has a second focus, namely the competence for security. It indirectly asks who is responsible for providing and maintaining human security. Whereas, in the past the nation state and national security was at the centre of security policy, nowadays cross-border and regional aspects are considered. In addition, the emphasis is laid on the individual's responsibility to enhance his own security (and not on the individual's feeling of being secure). Thus, the pendulum swings into the direction of the individual. However, the individual alone obviously is overstrained by solely producing an maintaining security. Instead, it is an integral part of a wider security concept. There might be a complex trinity of international, national/regional and individual responsibility.

All in all, to handle security with economic tools requires a pragmatic approach. First, we can focus the analysis on security threats and define security as the absence of risk. But by doing so, we shall be aware that "something positive" is lost. Therefore, further research should make economists more sensitive of what means "feeling secure". Second, the responsibility for security nowadays cannot be assigned solely to the individual or the nation state. Economists try to answer the question "who is responsible for providing human security" by characterising "security" as an economic good, in particular as a "global public good" (see below). We will follow these two aspects of "security" and deepen our understanding of security economics in the next chapter. Thereby, we will first present the (conventional) approach to analyse security threats, its origins and impacts.

[2] Security economics is defined as "those activities affected by, preventing, dealing with and mitigating insecurity, including terrorism, in the economy " and further it "refers to the application of tools to analyse the origins and dynamics of (in-)security" (Schneider and Brück 2007).

3 Security threats and economic fields of security research

The analysis on human-induced security threats it a relatively new field of research. Among others, it analyse the motives of the actors as well as the economic impacts of violent attacks. Thereby, economic research has emphasised the (economic) impact of security threats at the macroeconomic and microeconomic level (e.g. impact for economic development, international trade or certain branches of the economy such as tourism and airlines). However, there are also other issues ahead, like the private sector's contribution to reduce security threats and the individual's perception of security. In the following we present some key definitions and give a brief overview of the main fields of security research. Thereby we point to some of the neglected issues. We refer to the compilation of Llussa and Tavares (2007) and the survey of Brück et. al (2008).

3.1 The jungle of definitions: different ends! irrelevant origins?

The International Task Force on Global Public Goods distinguishes six clusters of interconnected security threats (2006): war between states, internal conflicts, terrorism, organized crime, the use and spread of nuclear, biological and chemical weapons, poverty, infectious disease and severe environmental degradation. This broad definition encompasses natural catastrophes as well as criminal attacks. Causes and consequences of these events differ a lot. Therefore, a further distinction can be made with regard to natural or biological threats, war and (internal) conflicts of societies and human-induced insecurity (i.e. terrorism and organised crime). In the following we will focus on human induced insecurity: terrorism and organised crime. Various definitions exist for both types of violent groups. A clear distinction between them is still missing.

There is no internationally agreed definition of terrorism. According to the online encyclopaedia "wikipedia" more than 100 definition with about 22 definitional elements exist. Only two element are generally agreed upon: "violence" and "threat of violence". The US State Department (title 22 United States Code) defines terrorism "premeditated, politically motivated violence perpetrated against noncombatant targets by subnational groups or clandestine agents, usually intended to influence an audience" (cited by Frey 2004). A similar definition has been used in economic studies, where the term terrorism is described as “the premeditated use or threat of use of extranormal violence or brutality by sub-national groups

to obtain a political, religious, or ideological objective through intimidation of a huge audience, usually not directly involved with the policymaking that the terrorists seek to influence (Enders and Sandler, 2002). According to Brück et al. (2008) this definition has its shortcomings since it does not reflect the varieties of terrorism and the political characteristics of the term terrorism. Frey (2004) emphasises with reference to Laquer (1977) "that it is neither possible to provide a definition, nor worthwhile to make the attempt because terrorism is a complex phenomenon. In addition, any definition – even the use of the basic elements violence and threat of violence is controversial because it presupposes an agreement on when an action is legitimised and when it is violent. Frey (2004), therefore suggests a pragmatic approach and defines four crucial elements: the perpetrators 1) use force on civlians 2) act in an unofficial capacity (...) 3) want to attain political goals and 4) intend to have far-reaching effects beyond the immediate victims, particularly through media.

Similar to the term terrorism there does not exist a generally agreed definition of organised crime. Fiorentini (1999) and Fiorentini and Peltzman (1995) discuss four (economic) definitions of organised crime. A first definition assumes that the core business of organised crime is the supply of illegal goods and services. However, this definition describes organised crime as a highly integrated firm and misses the differences between an organisation that supplies illegal goods and a governance structure which imposes regulations and supply goods to independent illegal firms. Therefore Fiorentini prefers the definition of Schelling (1971) who defines the core business of organised crime as imposing its protection to other legal and illegal firms under the threat of violence. Thereby, organised crime must act under the condition of monopolistic control over the supply of violence, at least in a limited area. Gambetta (1993) developed a third definition by arguing that organised crime cannot be reduced to the supply of illegal goods. Organised crime also implies a governance structure for the underworld. Gambetta emphasises the element of trust between organised crime and illegal firms. Trust is at the core of the supply by organised crime and is demanded voluntarily. According to Fiorentini, a further definition has been provided by Reuter (1983) who defines organized crime as a hierarchical structure and with the characteristics of long-term horizon and involvement of multiple illegal activities.

An ongoing debate is on the distinction between terrorism and organised crime. According to Garoupa et al. (2006) the organisation of terrorist activities has similarities to organized crime. Garoup et al characterise organised crime as “....exhibiting economies of scale,

undertaking violence against other legal and illegal businesses, creating a hierarchy which internalizes negative externalities and manages a portfolio of risky activities, and avoiding resource dissipation through competitive lobbying and corruption." The authors even see similarities between terrorist activities and organised crime. Others (e.g. Shelley) point to the fact, that terrorist groups and organised crime use similar means to communicate or operate in areas where governmental control is low and law enforcement is weak. In addition, terrorists also undertake activities of organised crime to finance their activities and both groups use money laundering. According to Bovenkerk and Abou Chakra, who also support a convergence of both phenomena, „organized crime is generally held to focus mainly on economic profit and on acquiring as much of an illegal market share as possible, while terrorism is said to be motivated chiefly by ideological aims and by a desire for political change".

Ion the end, the distinction between terrorism and organised crime is rather made with regard to their ends and objectives (profits opposed to political motives) and not with regard to their (historical or geographical) origin and organisational structures.

3.2 Origin and motives of human-induced insecurity

Origin and motives for human induced insecurity are quite different across regions. According to Llussa and Tavares (2007): "Terrorism ranges from ethnically motivated to state-sponsored, from religiously or ideologically motivated, and can directly target the government, the military or the civilian population, assassinate individuals or threaten the use of weapons of mass destructions." Therefore, any generalisations on the nature and motives of human-induced insecurity are inappropriate.

In theoretical investigations on terrorism the typical economic assumptions on individual behaviour (rationality, utility maximisation) are applied to analyse the incentives and motives of terrorists. The traditional assumptions are extended by theories of group behaviour, social sanctions and club good theory (Berman and Laitin 2005). By doing so, the individual motives can be compared with group rationality. In addition, various origins of terrorism have been discussed in the literature (see Llussa and Tavares 2007 for the following examples), ranging from modernisation (Crenshaw 1981 and Aziz) to religious-based fundamentalism (Crenshaw 1981). Terrorism is also seen as a substitute for other forms or political conflict where an internal fight over resources occurs (e.g. Garfinkel 2004). Terrorists are modelled as

"players" in a signalling game where government are uninformed of the terrorist strength (Lapan and Sandler 2007).

So far, economic studies have shed light on various origins and motives of human-induced insecurity. However, often there is no clear differentiation between the different terrorist or groups or between the various organisations of crime. This might also be due to the fact that little information is available on the motivations of these groups. In addition, (historical) origin obviously plays a minor role in economic research activities. The question arises if economic tools are solely appropriate to analyse the emergence of terrorist activities. By doing so, the limits of an economic research have to be clarified and the economic analysis can be enriched by interdisciplinary work.

3.3 Economic impacts of security threats

Economic analyses of economic impacts distinguish the macroeconomic and the microeconomic level.[3] So far, studies concentrate on the macroeconomic level (or special branches of the economy), whereas economic research has neglected microeconomic issues.

On the macroeconomic level many studies try to assess the impact of attacks on economic output and growth. Thereby, the analyses concentrate on regional events and often have the character of case studies (e.g. Abadie and Gardeazabal 2003). However, there are also studies which analyse the difference between rich and poor countries (Blomberg et al. 2004 and Sandler and Enders 2007). Special attention is given to the development and recovery of capital markets after attacks occurred (Chen and Siems, 2004). In sum, the studies show that the economic impacts are limited and short-termed, particularly in large economies. The economic impacts are more severe in small and developing countries.

Special studies analyse the economic impacts on consumption and investment. On principle, terror attacks have negative effects on these aggregates (as for example has been documented by Eckstein and Tsiddon 2004, Blomberg et. al 2004). Special attention has also been given to capital flows and cross border trade; (Abadie and Gardeazabal 2005, Nitsch and Schumacher 2004). Special attention is also paid to fiscal effects of security spending. Spending has

[3] Impacts are also analysed with regard to geographic factors and population density since terrorist activities concentrate on urban areas (see for example Glaeser and Shapiro 2001).

negative effects, in particular for low and middle income countries where financial resources are scarce and opportunity costs are high (Gupta et al. 2006)

Apart form the overall macroeconomic impacts ongoing research often investigates the impact of criminal attacks on certain industries such as tourism and airlines (see for example Drakos and Kutan (2003) and Ito and Lee (2004) for airlines). Special analysis is denoted to the insurance industry, partly as a result of US-Terrorism Risk Insurance Act (TRIA) which come into force in 2002 (see Chalk et al 2005). Supply and demand for terrorism insurance have also been analyzed for other countries (see for Germany Thomann and Schulenburg, 2006; for Israel Berrebi and Klor, 2005).[4] Beyond sector analysis, trans-sectional consequences have also been studied.

Little is known on microeconomic issues. Microeconomic impacts affect households and the private sector. Frey et al. (2004) conclude that terrorism decreases life satisfaction of households. However, there is no comprehensive analysis of changes in household's demand for security measures after attacks have occurred. Apart from the insurance issues mentioned above the economic analysis of impacts on the private sector is also limited.

Economic impacts for the governmental sector are mainly discussed with regard to fiscal consequences as mentioned above. Few studies also analyse the question of private and compulsory public anti-terrorism insurance. Beyond fiscal effects and insurance issues, the question remains on the appropriate measures of governments to counter security threats, that means on security policy.

3.4 Security threats and policy responses

Special studies analyse the design and effectiveness of anti-terrorism policy. According to Frey (2004) two basic policy options exist: stick (use of force) or decrease of benefits. The latter implies the diffusion of targets or a decentralisation of potential targets resulting in an increase of costs. In addition, changes in media reporting deny terrorists the public attention and diminish the benefits.

According to Llussa and Tavares (2006) in the literature special anti-terror policies are discussed. Among others, deterrence which is the main response to security threats, but which

[4] The security industry itself constitutes another area of research.

must be seen as a negative sum game (Frey 2004, Arce and Sandler 2005). Enders and Sandler (2006) show that governments favour defensive measures over proactive measures. Thereby defensive measures tend to be oversupplied, whereas underprovision seems to be a typical result with regard to proactive measures. Proactive measures may even result in an increase of terrorist attacks (Rosendorff and Sandler 2004) . Economic sanctions also have limited effects. In contrast, control of terrorist funding has been believed to be an effective policy measure. However, it is difficult to get the necessary information and control over the sources of funding as well as over the various financial channels. This holds true, in particular, with regard to the cooperation with the banking sector on an international scale (see FitzGerald 2004). As Brück et al. (2008) mentions terrorists avoid the freezing of their assets through diversifying their income sources and, in addition, they blur the traceability of their transaction. This is quite similar to the techniques used by organised crime. In sum, the control of terrorist funding is laborious and ineffective since terrorists have learnt to circumvent financial regulation.

Llussa and Tavares (2006) emphasise that terrorists change their means and targets over the time. According to Brück et al (2008), theoretically effective policies would have to address all possible modes of attack, on all targets, in all possible countries, at all times. This can hardly be achieved due to the asymmetric information between terrorists and governments. Moreover, it remains difficult because actual threats are unknown. In the long run it might be more favourable to increase security instead of reacting to (past) violent events.

4 Security as private/public good and security policy

4.1 On private and public goods

A first attempt to find an economic approach to "security" is to characterize it in terms of an economic "good". Economists use two characteristics to define goods: rivalry and excludability. Rivalry in consumption means that two persons cannot use the respective good at the same time; excludability means that a particular person has exclusive control over the respective good and that a mechanism exists to exclude other persons to use the good. Four groups of goods are distinguished: private goods, public goods, club goods and common goods.

The four subgroups are best explained by examples: If one uses a pencil, nobody else can use the pencil at the same time, it is excludable and rivalry of consumption exists (private good). In contrast, if you enjoy the fresh air in the mountains, all other people in the mountains can also enjoy the air and are not restrained in any volume; in this case air is a public good. The non-excludability rises the problem of free-riding. The individual wants to benefit from the public good but it has no incentives to reveal its true preferences and contribute (e.g. by a fee or tax) to its provision. Therefore, public goods tend to be undersupplied, on principle. A similar case is with common goods which are non-excludable and rival. Here, one example is fishing. The fishing stocks is non-excludable and definite. Regulations must be established to avoid overfishing. And finally economists speak of a club good, if users can be excluded but if the use of one user does not reduce or affect the consumption of other users. In practice, goods do not always have the pure character, for example, of being a private or a public good. In addition, some goods are supplied publicly because the government wants to increase or decrease consumption compared to the "normal" market solution (e.g. education). Therefore, economic goods often cannot easily be allocated into one of the subgroups. However, the concept of private-public goods helps to identify the beneficiaries of those goods and the problems of voluntary provision.

Private and public goods

	excludable	non excludable
rivalrous	private good (cars, clothes, food)	common good (water, fish)
non- rivalrous	club good (cable television)	public good (security, air)

Security – in the sense of human security or national/international security - often is assumed to be a public good. This however, presuppose a stable society and a government which has the monopoly on the legitimate use of physical force. In this case, the government takes measures to enhance the security of the citizens. In contrast, in anarchy or in a failed state, the government is absent or it is too weak to guarantee the security of its people. Here, people must seek their own ways to protect their lives. They can do so, for example, by employing a

security firm. In this case measures to enhance the security of a person are provided as private goods and is financed privately. It is also conceivable that people organize themselves as a "club" and initiate jointly measures to enhance their security. Within the group the provision is non-rivalrous; outsiders do not benefit from the supplied security measures. An example for such a club good is mutual or neighbourly help (looking after your neighbour's house while he is on holidays). However, the provision of security measures as club good is obviously of minor importance.

The type of economic goods determines the kind of provision, the (optimal) degree of supply and the financing. For example, in case of private goods the basic conditions of provision are determined by the market and the (given) price mechanism (in accordance with market morphology and the level of competition). In contrast, in case of public goods economists speak of market failure and insufficient provision. Provision and the degree of supply underlies special conditions. “Security” is assumed to be a typical public good. However, not security itself, but **measures to enhance security** can be provided privately of publicly. A priori, those measures must not have the character of a public good. But, there are some reason which makes the public provision of security measures advantageous and some obstacles which makes it unlikely.

4.2 Security measures as public goods

The public provision of security measures can have positive externalities for all economic agents. As Dulbecco et. al (2005) emphasize: "Security tends to demonstrate a convergence of interests between firms and governments". That means, all actors have a common desire in security, on principle.

The joint organization or the provision of security as public good has economic advantages as it reduces costs compared to the situation where each person has to organize security measures individually. In addition, if individuals with the common objective to make their lives more secure get together then the reliability of a secure environment may also increase.

Nevertheless, the provision of security as public goods is uncertain from the very beginning. Individuals do not necessarily have the incentives to interact with other individuals, agree voluntarily on the joint provision of security measures and pay an adequate contribution. From an economic perspective public goods are an example of market failure, because the

behaviour of individuals to maximise their gains do not necessarily provide efficient results. Therefore, the questions arise 1) under which conditions are individuals willing to interact and to commonly create the desired public good and 2) which is the optimal degree of the public good.

4.2.1 The tragedy of the commons

The question whether a public good will be provided at all is often tackled under the heading "problem of collective action". The problem of collective action and the provision of public goods is not limited to economic analysis but embedded in the wider context of (sociological investigations or political science into) cooperation and convention (see Lewis, Axelrod). For economists, these approaches are essential because they try to trace back cooperation to individual rationality and utility maximization. Thus, these approaches focus on the individuals willingness to cooperate taking into account the individual cost benefit situation. Thereby, they give some answers to the question under which conditions the public good is likely to be produced at all.

Coase (1960) argued that public goods are likely to be provided if transaction costs between the potential beneficiaries are sufficiently low. In this case the individuals have better chances to interact and pool their resources. In addition, Olson (1965) has shown that larger groups are less likely to achieve their goals (e.g. provision of public good) than smaller groups. One reason for this is that smaller groups have less costs for self-organization (transaction costs). In smaller groups individuals do know each other and there might be some kind of social control. In contrast, large groups face high costs when their members attempt to organize for the decision on a public good. In addition, in large groups the individual has few information on all other group members and no incentives to obey vague informal rules. In the end, according to Olson, those groups which are small enough to be called "privileged" groups have economic as well as social incentives to achieve a common decision for the provision of a common good.

Hardin (1982) referred to Olson's analysis and analysed the problem of collective action with a game theoretical approach. By doing so, he extended the static view by dynamic aspects. Hardin first introduced the conventional prisoners' dilemma of individual interaction: In this context two individuals have to chose whether they cooperate with each other or not. If they both cooperate they receive a positive payoff, if both individuals defect they each have

negative payoffs. If only one cooperates, the cooperating individual receives a worse payoff than the defector who gets a positive payoff. Thus the players have strong incentives for defection, although cooperation generates positive payoffs for both individuals and would be the societal desired outcome. In the end, defection is the dominant strategy of the interaction process in the ordinary prisoners dilemma. That means, that the players do not find a common solution (to provide a public good). Therefore, in the simple game theoretical example, the societal desired outcome must be created by a third party (e.g. the government).

In contrast to a single-play prisoner's dilemma in iterated games cooperation can be achieved by mutual agreement. In addition, Hardin (1982) introduced overlapping activities, so that subgroups better get to know each other. Under the conditions of overlapping activities and small subgroups it seems easier to establish and maintain a contract by convention (that means a voluntary agreement on the provision of a public good) even if the size of the group is large. Hardin has thus transferred the advantages of small groups in a single play situations to large groups into a more dynamic setting. In addition, he broadened the narrow (economic) view on the individual's rationality and the interaction of individuals and show that the individual takes into account his neighbour's actions and reaction. In general, game theory has taught us that coordination problems can be solved easier if communication between players is possible and if players can learn in repeated games.[5] In addition, the setting of collective action must not imply that individuals always make their decisions with complete information, in particular on their future situation. Uncertainty of the future state can even improve the individual's willingness to cooperate and agree on a common decision as has been shown by Buchanan (1975) with regard to constitutional contracts. Under "the veil of uncertainty" individuals are apt to agree on a common rule which they judge to be fair. Thus, communication, repetition and uncertainty on the future may help individuals to escape the tragedy of the commons (see below).

[5] For a typology of collective action games see Holzinger 2003.

Axelrod's advice for participants and reformers

Axelrod has developed some general principles which make co-operation more likely. These principles can be taken as guidelines for policy makers to enhance (international) cooperation in case of an underlying prisoners' dilemma.

First, he recommends to "enlarge the shadow of the future". If the future is sufficiently important relative to the present, then the players can learn that they benefit form cooperation. There are two basic ways of promoting cooperation: more durable interaction and more frequent cooperation. According to Axelrod hierarchies and organizations are especially effective to foster interactions between individuals. Organizational practice may allow that people interact more frequently. Hierarchy allows to transfer an issue which requires the coordination of different branches or levels to policy makers at higher levels. Another possibility to foster interaction is to break it down into small pieces. Then, the parties involved can decide on small issues and make small moves. Reciprocity will be more effective since action and reaction are more transparent and calculable for the players. Thus, the method of decomposition, increasing frequency and fostering durability may also be appropriate for measures to enhance security.

Second, the "change of payoffs". According to Axelrod, a primary function of the government is to escape from the Prisoner's Dilemma. The government passes laws and forces the citizens to pay their taxes in order to provide and finance a public good. By doing so, the government changes the effective payoffs in a way that the long-term incentive for mutual cooperation will be greater than the short-minded incentive for defection.

Third, cooperation can be promoted by "teaching the people to care about each other". Thereby, the preferences of the people are changed in a way that enhance altruism and foster cooperation. This suggestion to some extent leaves the strict economic assumption of an individual cost benefit calculus.

The fourth strategy is to "teach reciprocity ". If people use strategies based upon reciprocity they can learn that a strategy of defection is unprofitable and cooperation is advantageous for them. This generates a self-policing feature since people learn to built mutual rewarding relationships. This can be indicative even for those individuals who do not directly interact.

The fifth suggestion is to "improve recognition abilities" by shedding light on past interaction and experience. People should have the ability to recognize activities of the past (e.g. defection) and the actions that have been taken. to sustain cooperation it is important to remember the relevant features of past interaction.

The problem of provision may even increase if we shift from individual or national security measures to the international perspective. In recent years the literature on public goods has been enriched by a (territorial) differentiation of those goods. There are not only (simple) public goods, but also global public goods, national public goods, regional public goods and transregional public goods (Sandler 2007). These goods differ, among others, with regard to their providers (the international community, the nation state, regions etc.) and the beneficiary

communities (e.g. national states, regions).[6] Security measures are pure global public goods if everybody can benefit from their provision. They are "mixed" if the advantages are limited to either national or transnational beneficiaries (Dulbecco et. al 2005). Irrespective of their pure or mixed character the provision of global public goods confront the involved countries with the problem of collective action on a transnational or even international scale.

Governments do have an incentive to cooperate and provide transnational or international public goods because common provision can reduce security risk and emergency costs. Thereby, an insurance motive can foster the creation of alliances in order to reduce or share commonly perceived risks. McGuire (1994) has shown in the framework of a general equilibrium model that voluntary provision of a public good together with an insurance motive can generate common benefits. We will come back to the insurance motive in the next chapter.

4.2.2 The degree of a public good: theoretical optimum and daily underprovision

We turn to the second question: the optimal level of a public good. Theoretically, the efficient output of a public good is derived from the vertical summation of the individual demand curves and its intersection with the marginal cost curve (Samuelson rule): this contrast public goods form private goods for which horizontal summation is applied.

There are some reservations against the traditional analysis which assumes that the available amount of public goods is the simple sum of the separate amounts produced by the members of the community because security measures which are provided as global public goods have some peculiarities. In particular, there might be a special technology of supply aggregation. According to Hirshleifer (1983) the traditional analysis has assumed that the production of a public good is the simple sum of the amounts "x_i" produced by the members of the community. However, this neglects the fact, that the amount of the public good cannot be determined by a simple summation. Instead, the provision can be determined by the "weakest

[6] The territorial differentiation imply that these "public goods" are often not "pure" public goods. Instead, they are "mixed" because (partial) non-rivalry or (partial) non-excludability exist; for example, the advantages of a national public good are limited to either national or transnational beneficiaries. In addition, mixed public goods have spillover effects on other regions or nations (see The World Bank, International Monetary Fund 2007).

link" (e.g. the lowest portion of a dyke determines the safety of all islanders) or by the "best shot" (e.g. development and provision of vaccination).

It is assumed that the supply of "security" corresponds to the weakest link technology.[7] The provision of security measures as global public goods depends on the participation of all members of a group respectively the countries involved. In case of the weakest link the underprovision of the public good does not change significantly if the members of the group increase; that means that group size has almost no effects on the level of public goods. However, if the group itself becomes more heterogeneous, then some tendency for increased underprovision of the public good can be derived. According to Sander (2007) that means, that on an international scale, the provision of security measures is more difficult if the countries have quite different preferences or if the incomes differ and the low income country cannot meet the provision standard desired by a rich country. Sandler (2007) mentions another aggregator, namely "threshold". In the case of a threshold the benefits of global public goods will only be experienced if the cumulative quantity of the global public good surpasses a certain amount (e.g. the manpower and equipment needed to put out a forest fire).[8] Therefore, the resources and efforts must be pooled. As a rule, the maintenance of peace and security as (regional) public good is confronted with coordination and capacity concerns.

Lohse, Robledo and Schmidt (2006) extend Samuelson's allocation rule and the degree of public goods with an insurance aspect of public goods. They point to the fact that the standard literature on public goods assumes that the level of the public good is a direct functional argument of the individual's utility function. However, there are also public goods (e.g. lighthouses and dikes) which do not provide direct utility for the individual but resembles an insurance device. Lohse et al. make the example of a fire department which reduces the size of the loss in a fire case but whose sheer existence does not increase the utility of the individual. Following Ehrlich and Becker (1972), those public goods can be considered as insurance devices which decrease the size of the loss (self-insurance) or the probability of the loss (self-protection). The efficient degree of the public good (here: self-insurance and self-protection) changes if a market insurance is available. The efficient provision of a public good

[7] Recently, the weakest link technology has been criticised. According to Michael Brooks in many cases individuals are not restricted to consuming the minimum contribution (of the good) provided by other indivdiuals, Instead, individuals can privately provide the good independently.

[8] McBride (2006) has developed a model with uncertainty of the theshold level of contribution for the provision of discrete public goods.

decreases if market insurance is available because fully insured people behave as if they were risk neutral. In contrast, a high provision level of public goods will result, if risk aversion is high in the society and if the insurance sector is underdeveloped. Thus, the optimal degree of provision of public goods also depends on the existence of private insurance provision and the preferences of the users. The study of Dulbecco et a. indirectly refers to the case when security measures can be provided either as public good or as private goods.

The theoretical analysis show that special principles respectively aggregation technologies may apply for the provision of security measures as public goods with the result of underprovision. However, the level of underprovsion can vary according to the kind of public good. Sandler (2007) emphasises that the degree depends whether it refers to regional, national or transregional public goods. In addition the geographical range of spillovers matters. For example, nations have an incentive to provide and finance public goods, since the citizens gain the benefits. In contrast, nations have low incentives to supply regional public good which generates also benefits for the neighbour country. In this case, the provision of the regional good is only likely if both countries will contribute partially to the provision. However, the actors involved have a strong incentive to benefit form the public good without paying an adequate contribution for it (free-rider problem). Samuelson (1954) himself has already emphasised that individuals have the incentive to give false signals and not to reveal their true preferences. [9] Thus, the theoretical calculation "on paper" does not take into account the free-rider problem which occurs in practice. In practice the benefits of security measures cannot be easily attributed to the different users (or user groups) and calculated accordingly because of non-excludability. The different users hardly agree on the (financial) contribution which is needed to provide the public good. In the end, security tends to be undersupplied (or not supplied at all).

As with other public goods an optimal degree of security can hardly be calculated on pure economic grounds. Thus, the degree must be determined by political process. Even within the framework of the national state a consensus cannot easily be achieved. In the case of global public goods the search of an sufficient degree – and beyond financing - shifts away from the national perspective to the international community.

[9] Economists have made several proposal to solve or circumvent the free-rider problem and to reveal the true preferences (e.g. voting schemes, compensations).

4.2.3 Financing: sources and principles

The probability and the degree of provision of a public good is tightly connected to the question of financing. The discussion above has already shown, that the provision will be less likely if the preferences largely differ between the actors involved or if they have different capacities. In a world wide context this holds true for (economic) differences between developed and less developed countries. Therefore, analyses of financing of global public goods often focus on less developed countries.

Dulbecco et al (2005) derives two essential objectives for global financing programmes: efficiency and equity. Efficiency means that the provision of the good should achieve the desired level, while a neutral competitive situation is maintained and incentives exist for the actors to supply the public good. Equity refers to a "fair" contribution. That means, that the contributive capacities of the countries involved have to be taken into account. In addition Dulbecco et al. distinguish three sources of finance: a) users b) private sources and c) public sources. The example of trade security unveils the limits of these sources of financing. The contribution by users is confronted with the problem that international trade is concentrated in the developed countries which therefore would have to take over most of the contributive burden but which are not the weakest link. Therefore, the supply level of security measures as weakest link will not increase. The second alternative – private sources – will also have limited success because private financiers must not voluntarily supply security measures or obey to given security norms. For them the provision of the public good is advantageous as long as they (directly) benefit. Therefore, the level of private financing does not generate a level of security that corresponds with the societal or international desired outcome. Instead, the degree of provision is likely to remain insufficient. In the end, the third solution –public financing – seems the most appropriate.

With regard to public financing the question arise which jurisdiction should be responsible for provision. Sandler (2007) emphasise that the provision and financing of public goods must not correspond to the principle of regional subsidiarity. Subsidiarity means, that the lowest appropriate jurisdiction should provide the public good. However, if spillovers occur underprovision of the public good will be the result if only the citizens of the jurisdiction will contribute to its provision. In particular, the actors who finance the supply of a public good can only imperfectly control those actors who benefit from the provision. In more theoretical terms: Imperfect information and moral hazard are typical phenomena of financing public

goods. Dulbecco et al. (2005) who have analysed the regional, bilateral and multilateral level find two advantages in multilateral cooperation. Multilateral cooperation provides all countries with access to financing and financing is in accordance with the desired level of the public good. On the bilateral level there are chances for the creation of a "spider's web" effect, that means, that a leader country initiates the supply of security measures by multiple bilateral relationship. This however, is unstable, since countries can leave the web.

Dulbecco et al (2005) analyse public financing also with regard to the appropriate financial instruments. The authors show that national financing of security measures can be achieved through redistribution of budget allocations as it is the case in EU. However, this kind of financing has only low incentives for countries to provide security measures as public goods. On the international scale various financing schemes are applied: grants, loans and conversion of debts. Grants have the disadvantage of being non durable. In addition, as they generate additional funding they may substitute those financial resources which originally would have been allocated for security measures. Loans contribute to excessive debts in those countries which are highly indebted and which therefore have only limited financial resources to provide public goods. In these countries the provision of security measures as public goods often is in competition to the provision of other public goods. Therefore, it is highly uncertain that the level increases from the weakest link. In contrast conversion of debt has the advantages that it diminishes the debt burden and may contribute to the provision of the public good. However, again, conversion of debt does not guarantee sufficient financing.

The supply and financing of public goods also depends on the nature of the production process (see Jaquet and Marniesse 2004). Public goods can be discrete (that means in the binary case that it either happens or not) or continuous. Jaquet and Maniess believe that discrete public goods are easier to supply because incentives for an action are concentrated in time, whereas continuous public goods require ongoing efforts. However, from a transaction cost perspective, continuous supply can be advantageous if it results in ongoing interaction whereas nonrecurring supply might cause high transaction costs.

4.3 Five criteria for a typology of security measures

Security is a complex domain. A commonly accepted definition on "security" or "security economics" does not exist. Economists approach the issue by emphasizing two basic characteristics: absence of risk and responsibility. Whereas the (microeconomic) analysis and the question of insurance refers to "risk ", the question of responsibility is connected with security as an economic good which is provided either as a private good or as public good. In the following we develop criteria which help to distinguish the variety of security issues and measures.

The following table provides a typology of security measures as economic goods and summarises some of the key features of provision, degree of supply and financing.

type of good	private	public	club
kind of provision	market	social coordination	coordination of group members (small group)
aggregation technique	horizontal summation	vertical summation, weakest link, dependent on security measure	vertical summation
degree of provision	supply and demand	Samuelson rule, threshold, dependent on security measure	Samuelson rule
insurance	private	(forced) state	private
financing	private	dependent on jurisdiction and spillover	contribution of group member

A first criteria is the economic goods character: private good, public good or club good. The latter obviously is of minor importance. Therefore, the basic differentiation refers to private or public good (pure or impure). Public goods can further be distinguished in regional, national, transnational and international public goods. As the geographical provision does not always correspond with the beneficiaries, potential spillover effects must be taken into account.

The second essential criteria for the provision of public goods is cooperation. Security issues and measures should be characterised by the underlying cooperation game taking into account the size of the group (family, regions, nations) This allows to identify the potential policy measures to enhance coordination. In case of a Prisoners' Dilemma Axelrod's advice provide first guidelines for policymakers.

A third criteria is aggregation technology. Security measures can be grouped according to the aggregation technology applied (e.g. summation, weakest link). Thereby the technology determines the expected degree of provision. Whereas in the case of summation the ordinary problem of collective action must be overcome, in case of the weakest link, special activities have to be taken to assure and increase the provision of the least active producer.

The (efficient) degree of the public good can change if private insurance exist. Insurance can aim at reducing directly the loss of an event or at reducing the potential of a loss. The combination of public provision and private insurance can vary with regard to the various security issues.

A fifth criteria is financing. Again, financing can be provided privately or by national or international resources. With regard to public goods two essential objectives – efficiency and equity - can help to evaluate financing. Thereby, various instruments (e.g. redistribution of budget allocation, grants, loans, conversion of debts) to finance security measures can be distinguished. With regard to the weakest link in developing countries some instruments seem to be more efficient (debt conversion) than others (loans).

The presented criteria provide a first rough inside into the provision of security. With regard to public provision further distinction of jurisdiction and spillovers are necessary since they determine the (voluntary) agreement of the degree and financing. From this a detailed taxonomy of security measures on a international scale can be developed.

5 Short summary and some remarks

The objective of task 6 "definitions and capacity" is twofold. First, to present an overview on the existing literature, including definitions and capacities of security economics. Second, to develop some basic elements of security policy analysis.

The definition of security show two basic elements: security threats and responsibility. These two elements have provided the guideline for the following analysis. Thereby, the part on security threats have provided a short overview of the literature on security economics and its capacities. The presentation of definitions show that commonly accepted definitions on terms like "security threats", "terrorism" as well as "organised crime" do not exist. Therefore, economic researchers often follow a pragmatic approach. Studies on the origin and motives take into account a variety of incentives and motivations. However, they neglect historical

settings and cannot clearly differentiate between the different groups. In recent years, many studies have concentrated on macroeconomic impacts of violent attacks with regard to output as well as investment and consumption. Also international trade and fiscal effects have been analysed by economists. In contrast to these macroeconomic issues, little is know with regard to the microeconomic level, in particular, households' perception of the notion "security" and the responses of households to security threats. With regard to the government, the focus has been laid on fiscal effect. Some studies also examine anti-terror polices. Deterrence has been the main response to security threats. The effects of other policy measures are not clear. It could be observed that defensive measures tend to be oversupplied, whereas proactive measures are often supplied insufficiently. However, in sum there is no systematic analysis of the governmental provision of security measures.

The responsibility of the provision of security measures has been the core of security as private/public good. The provision of security measures as public goods have some advantages (e.g. cost reduction). The public provision is, however, uncertain from the very beginning, in particular with regard to global public goods. Therefore, analyses on the emergence of cooperation and advice for durable coordination have been presented. The (optimal) degree of security as (global) public good does not always follow standard assumptions; instead it can be determined by the weakest link. The emergence of cooperation and the optimal degree of a public good are also dependent on financing. Basic normative requirements such as efficiency and equity help to select appropriate financial instruments, in particular, with regard to the cooperation of rich and poor countries. In the end, at least five criteria can be derived for a typology of security measures and guidelines for policy makers. For global public goods this typology can be enriched by jurisdiction and range of spillovers. From this background security measures can be grouped and evaluated. Nevertheless, as security measures across countries will be versatile in the future it will be difficult to develop a general and comprehensive taxonomy of security policy.

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