Journal of Public Economics 93 (2009) 620–633

Contents lists available at ScienceDirect

Journal of Public Economics

journal homepage: www.elsevier.com/locate/econbase

Valuing flood disasters using the life satisfaction approach ☆

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ARTICLE INFO

Article history:
Received 13 September 2007
Received in revised form 12 June 2008
Accepted 6 October 2008
Available online 28 October 2008

JEL classification:
D61
D81
H40
I31
Q51
Q54

Keywords:
Life satisfaction approach
Non-market valuation
Cost-benefit analysis
Subjective well-being
Risk-prevention
Natural hazards
Flood

ABSTRACT

This paper argues that life satisfaction data can be used to value natural disasters. We discuss the strengths of this approach, compare it to traditional methods and apply it to estimate and monetize utility losses caused by floods in 16 European countries between 1973 and 1998. Using combined cross-section and time-series data, we find a negative impact of floods on life satisfaction that is sizeable, robust and significant. The estimates are comparable to price discounts found in housing markets. In an exploratory analysis, we find that risk transfer mechanisms such as mandatory insurance have large mitigating effects.

Well, before the flood I was happy.

Victim of the Bufallo Creek flood, West Virginia, in 1872, cited in Erikson (1976)

1. Introduction

Regarding natural disasters, the last years have often been described as *anni horribili*. The tsunami in the Indian Ocean, Hurricane "Katrina" on the U.S. Gulf Coast and the Pakistan earthquake are the most prominent catastrophes of the recent past. In Europe, floods rank highest among natural disasters. During the past two decades, several extreme floods have occurred in Central

☆ We would like to thank [to be completed]. This paper was presented at the annual meeting of the European Economic Association 2006 in Vienna, the annual meeting of the Verein fuer Socialpolitik 2006 in Bayreuth, the annual meeting of the Economic Association of Austria 2006 in Vienna and the International Disaster Reduction Conference 2006 in Davos.

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doi:10.1016/j.jpubeco.2008.10.003

European rivers (including the Rhine, Danube, Odra, and Wisla), culminating in the disastrous August 2002 flood in the Elbe River basin and parts of the Danube basin. Likewise, the U.S. Federal Emergency Management Agency (FEMA) calls flooding "America's #1 Natural Hazard" (FEMA, 2004). And more is to be expected! Climate-induced changes in the timing of runoff for several European river basins and small Alpine catchments increase the risk of winter floods (Schröter et al., 2005). Dramatic increases in flood frequency and intensity are also likely in parts of the United States (e.g. Gleick, 1999). Questions regarding the financing of flood protection and prevention strategies are likely to raise in significance on the political agenda.

Preventive measures, and natural disasters themselves, have the characteristics of a local public good or local public bad, respectively. It is commonplace that individuals have no incentive to disclose their true demand for public goods. It is advantageous to understate demand when it positively affects contribution requirements and to overstate demand otherwise. No exception is to be expected in the case of natural hazards. Therefore, it is important to assess the utility losses caused by natural disasters. Moreover, the increase in risk raises the question to what extent risk transfer mechanisms such as (mandatory) catastrophe insurance can mitigate the effects of disasters. The higher the non-insurable psychic costs are, the less relief such a system will provide.

In economics, essentially two avenues have been pursued to elicit people's preferences for public goods: *revealed preference* methods on the one hand and *stated preference* methods on the other hand. The former are based on actual behavior and utilize complementary and substitutive relationships between public and various marketed goods to infer the value attributed to public goods from market transactions in private goods. A primary example is the hedonic method (HM). In the case of stated preference methods, individuals are directly asked to value the public good in question; the most prevalent method is the contingent valuation method (CVM). Both avenues have their weaknesses. Revealed preference methods are based on stringent assumptions and crucial elements are inherently difficult to measure. The hypothetical nature of CVM surveys, on the other hand, may entail unreliable results and strategic behavior.

We propose a novel and potentially effective complementary method to value public goods in general and natural hazards in particular, the *life satisfaction approach* (LSA). A growing literature in economics demonstrates that reported subjective well-being can serve as an empirically adequate and valid approximation for individually experienced welfare or utility. Hence, it is an obvious and straightforward strategy to directly evaluate public goods in utility terms. The partial correlations between the public good and life satisfaction and between income and life satisfaction capture the marginal utility of the public good and the marginal utility of income, respectively. This allows for estimating the trade-off ratio between income and natural hazards. This approach obviates some of the major difficulties inherent in both the revealed preference and stated preference methods. As it is not based on observed behavior, the underlying assumptions are less restrictive and non-use values can – to some extent – be measured. Furthermore, individuals are not asked to value the public good directly, but to evaluate their general life satisfaction. This is presumably a cognitively less demanding task, does not evoke answers considered desirable by the persons asked, and there is no reason to expect strategic behavior.

This paper has three major objectives. First, we present the LSA and discuss some conceptual issues (Section 2). Second, we apply it to measure the utility consequences caused by major floods for 16 European countries in the period between 1973 and 1998 (Section 3). The analysis is based on combined cross-section and time-series data and 56 major flood events. We find that flood disasters have a significant and robust negative impact on people's reported life satisfaction. The effect is monetized by calculating the compensating surplus for prevention of events. These monetized effects lie within the range of estimates found in hedonic housing studies. Third, in an additional explorative analysis, we estimate the effects of different risk transfer mechanisms. We find risk-transfer mechanisms to have large mitigating effects that come close to fully compensating the impacts of a flood event. Consequently, the effects of flood disasters in regions without such a mechanism are larger than the effect in all regions and the effect in regions with such a mechanism is small. Section 4 offers concluding remarks.

2. The life satisfaction approach to valuing public goods

2.1. The basic concept

Due to extensive work by psychologists, the measurement of experienced utility has made great progress (see the surveys by Diener et al., 1999; Kahneman et al., 1999). We follow the terminology proposed by Kahneman et al. (1997) to differentiate between decision utility as a representation of preferences derived from choice and experienced utility as an interpretation of utility in hedonistic terms broadly understood. Experienced utility is usually measured by survey questions on respondents' life satisfaction. Economists have begun to use these measures to tackle a variety of questions and shed light on individuals' utility functions. Examples are studies on preferences over inflation and unemployment (Di Tella et al., 2001), on preferences for inequality (Alesina et al., 2004) and for political institutions (Frey and Stutzer, 2000), on interdependent preferences such as status concerns (Clark, 2003; Blanchflower and Oswald, 2004; Ferrer-i-Carbonell, 2005; Luttmer, 2005) and altruism (Schwarze and Winkelmann, 2005), and on time-inconsistent preferences (Gruber and Mullainathan, 2005). The literature is reviewed by Frey and Stutzer (2002), Layard (2006) and Clark et al. (forthcoming). In order to use life satisfaction data to value public goods, several necessary conditions have to be met that we make explicit in the following:

First, life satisfaction scores contain information on respondents' global evaluation of their life. It is necessary in other words, that life satisfaction is not mere a subutility function as Kimball and Willis (2006) conjecture for measures of current affect.

Second, life satisfaction scores not only reflect stable inner states of respondents but also current affect (Schwarz and Strack, 1999). This adds noise to life satisfaction data as a measure of true experienced utility. Therefore, the signal-to-noise ratio has to be sufficiently high to make empirical research productive (Di Tella and MacCulloch, 2006). There is substantial evidence for this and life satisfaction passed a series of validation and reliability studies (for references see Frey and Stutzer, 2002; Clark et al., forthcoming).