



Contents lists available at ScienceDirect

## Socio-Economic Planning Sciences

journal homepage: [www.elsevier.com/locate/seps](http://www.elsevier.com/locate/seps)

## Discrete choice approach for assessing deprivation cost in humanitarian relief operations

Victor Cantillo <sup>a,\*</sup>, Iván Serrano <sup>a,d</sup>, Luis F. Macea <sup>a,b</sup>, José Holguín-Veras <sup>c</sup>

<sup>a</sup> Department of Civil and Environmental Engineering, Universidad del Norte, Km 5 Vía a Puerto Colombia, Barranquilla, Colombia

<sup>b</sup> Department of Civil and Industrial Engineering, Pontificia Universidad Javeriana de Cali, Calle 18 No 118-250, Cali, Colombia

<sup>c</sup> Department of Civil and Environmental Engineering, Rensselaer Polytechnic Institute, 110 8th St., Troy, NY, 12180, USA

<sup>d</sup> Department of Civil and Environmental Engineering, Universidad de la Costa, Calle 58#55-66, Barranquilla, Atlántico, 080002, Colombia

### ARTICLE INFO

#### Article history:

Received 9 November 2016

Received in revised form

10 June 2017

Accepted 11 June 2017

Available online xxx

#### Keywords:

Humanitarian logistics

Externalities

Deprivation costs

Disasters

### ABSTRACT

One of the key objectives of humanitarian logistics is to guarantee the timely delivery of supplies to people affected by disasters during the response phase. In this regard, it is fundamental to design appropriate models to minimize the social costs of response operations to distribute essential supplies to populations in need. In addition to merely cover logistics cost, social costs include deprivations costs, which are an increasing function of deprivation time, derived from the human suffering caused by the lack of access to a good or a service. This research uses the theory of discrete choices to assess deprivation costs due to the time spent waiting for the delivery of a basket of basic supplies, defined as the changes in the welfare of people affected by disasters. To this end, we designed a stated choice survey, applied to people living in areas affected by floods and earthquakes in Colombia. The estimated models consider the influence of individual's socioeconomic characteristics and random effects on the deprivation cost functions. The functions have a nonlinear structure, strictly increasing, and convex on the deprivation time. The results are useful for estimating the social costs of humanitarian relief operations.

© 2017 Elsevier Ltd. All rights reserved.

### 1. Introduction

Natural disasters affect thousands of people each year in many countries around the world. Most of them have the potential to cause catastrophic loss of life and physical destruction. They affect people differently and at a variety of scales, impacting the most vulnerable groups (i.e. the poor, infants, women and the elderly) the most. Disasters such as the South-East Asia earthquake and tsunami that occurred in 2004 and the 2010 earthquake in Haiti give a dimension of the effect on these different segments of the population. In the first disaster, more than 220.000 people lost their lives [40], being most of them women. In countries such as Sri Lanka and Indonesia, one-third of the casualties were children, and thousands of others were registered as orphans [43]. The second disaster killed over 220.000 Haitians and caused the displacement of 2.3 million people [42]. It is estimated that 1.5 million children were affected while another 38.000 died. There were 103.000 registered cases of infants unprotected by relatives or family [44].

According to Unicef [44] moments after the earthquake, just 5% of the poorest women in the country had access to medical supplies.

These statistics illustrate the vulnerability of modern societies and the challenges faced by first responders. Moreover, they reflect how impact varies according to socio-economic characteristics. It implies that each group experiment diverse needs and assistance. In this sense, a proper and efficient humanitarian assistance process should respond in a differentiated way considering the specific requirements of each group, especially the most vulnerable, as social inequities exacerbate suffering. Nevertheless, there are common repercussions in all of the affected that must be considered, as the absence of critical supplies (e.g. food, water, shelter, medicine). This kind of suffering induces anxiety and depression as well as psychosocial problems. In all cases, affected people depend on a proper and efficient humanitarian assistance process [33].

Operations management research has created logistical humanitarian models to decide how to allocate scarce resources best. However, current methodologies typically use approaches based on commercial logistics, which are inappropriate for humanitarian logistics purposes. According to Holguín-Veras et al. [17] the main goal of humanitarian logistics is the timely assistance of affected people in a disaster situation, beyond the private costs that this

\* Corresponding author.

E-mail address: [victor.cantillo@uninorte.edu.co](mailto:victor.cantillo@uninorte.edu.co) (V. Cantillo).

could represent. In consequence, appropriated models must be based on social costs minimization, thus allowing a socially optimal level of distribution of scarce available resources.

Social costs are the summation of the impacts of each logistical decision over all sectors of society affected by the relief operation [45]. They include the logistics costs carried out by the relief groups (e.g., inventory, transportation, delivering and distribution), but also the direct impact on the population affected, which is the economic value of the deprivation of essential goods and/or services. This measure of suffering is known as “deprivation costs,” which are externalities associated with the aid distribution after disasters [18]. In most post-disaster environments, the relief supplies available are frequently not sufficient to meet the needs of all those affected. Then, aid agencies must decide on how best to allocate the scarce resources available while, at the same time, account for their logistic costs. Thus, the trade-offs between impacts on beneficiaries and logistic costs ought to be considered.

In response to this necessity, new approaches have proposed humanitarian logistics models based on social costs. Such is the case of Gutjahr and Nolz [13], who present the term “distress” as “psychological or social costs.” On the other hand, Hu and Sheu [20], and Sheu [36] include feelings like stress, anxiety, grief and depression as social costs. Meanwhile, Holguín-Veras et al. [17,18], Khayal et al. [23], Rivera-Royero et al. [35], and Balza-Franco et al. [2] emphasize that humanitarian logistics models must be based on approaches that incorporate the cost associated with human suffering in the delivery process of humanitarian aid. If the humanitarian logistics models do not include such externalities in the decision-making process of aid distribution, social optimum will not be reached. However, including such cost in humanitarian logistics models requires estimating proper Deprivation Cost Functions (DCF) for critical supplies and services. These DCFs represent the economic value of human suffering derived from the lack of a critical supply, such as water, food, and medicine, among others.

Despite the difficulties in estimating appropriate DCFs, some efforts have been developed. Holguín-Veras et al. [16] estimated DCFs using the Contingent Valuation (CV) method. In the same sense [7], proposed a microeconomic approach based on the classical consumer theory to estimate DCFs. In both research papers, the results evinced the high magnitude of the social costs and the importance of their estimation in order to obtain logistic models sensitive to human suffering. Nevertheless, the econometric approaches presented above did not include socioeconomic variables on individuals. This entails considering affected people as a homogeneous population. Consequently, the deprivation costs are expressed only in terms of deprivation time without any consideration of the socioeconomic or demographic aspects of the affected people, which limits their use. It evokes the debate about equity measurement in humanitarian logistics involving social costs.

For Gutjahr and Nolz [13] equity is referred as providing fair treatment to all social groups. In emergency contexts, this means an equitable process of humanitarian aid distribution which should not affect or bring prerogatives to some social groups over others. In this sense, an interesting academic discussion about components of efficiency, effectiveness, and equity arises in the humanitarian aid distribution process [21]. Nevertheless, it is worth mentioning that this kind of events have different consequences on social groups, according to their socioeconomic characteristics. Factors such as age, gender or previous experience in emergency situations determine vulnerabilities during the occurrence of a natural disaster. PAHO [33] states that children, adults and the elderly experience dissimilar repercussions. Children are more exposed to risks due to their limited possibilities of surviving by themselves. They are more susceptible to developing conditions such as anxiety,

loss or increase of appetite and fears about environmental conditions. The NSWIP [30] has concluded that the elderly face reduced mobility, and limited abilities to see and hear. These conditions directly affect their capacity to evacuate, to follow emergency protocols or to look for help in a disaster context.

In the case of women, they are more vulnerable in countries where gender discrimination is practiced. In addition to some physical limitations -in comparison to males-, in discriminatory societies, women count with fewer tools and mechanisms to survive in disaster contexts. For instance, females have reduced access to information, which increases their vulnerability. After analyzing information from 141 countries affected by natural catastrophic events during the period 1981–2002, the UNDP [42] concluded that disaster situations diminish women's life expectancy more than men's and that females and children are 14 times more susceptible to perish than men during the occurrence of a natural disaster. Besides, pregnancy and fertility are biological aspects that increase their vulnerability [33]. This is due to their higher nutritional needs and limited mobility during the gestation period.

Given these remarkable dissimilarities between social groups and their suffering, it is mandatory for humanitarian logistic models to respond to the different needs of each socio-economic group. In this way, the humanitarian delivery process will bring proper assistance to the affected population in a more equitable manner.

To this effect, this paper uses discrete choice models, based on the random utility theory, to estimate DCFs that consider systematic and random heterogeneity over individual preferences and responses. To accomplish this objective, a stated choice survey was designed and applied to people living in areas affected by floods and earthquakes in Colombia. As a result, two different kinds of family models were specified with socio-economic variables and random variations in order to include specific measures equity over the population. The resulting DCFs can be used to evaluate the monetary value of deprivation due to lack of access to essential supplies in the immediacy of a disaster. Such DCFs can also be incorporated into comprehensive humanitarian logistics models to perform risk analysis as well as to conduct an economic evaluation of humanitarian aid operations.

## 2. Econometric approach and theoretical background

The environmental and socioeconomic impacts of natural disasters and their increasingly frequent occurrence have led governments and relief organizations to spend significant resources in prevention, planning, attention, and mitigation. A key aspect is identifying and assessing the economic value of real losses associated with disasters.

Affected populations experience deprivation and suffering due to lack of essential goods and services. Markets, where people can buy, sell or trade goods and services, disappear [18]. As a result, the demand for critical supplies rises as well as the population's suffering, forcing to an almost immediate action from relief agencies in a race against time [39]. The more the response is delayed, the lower the welfare of the beneficiaries [9]. In consequence, relief agencies must design a prioritized plan to provide life-saving emergency assistance for people in need, which must be based on social costs minimization as the objective function, [16–18,34].

Social costs include the logistics cost associated with the relief distribution and the deprivation costs perceived by the beneficiaries in the relief effort. The latter can be approximated by econometric models that allow estimating the utility change (in monetary terms) due to an increase in the deprivation time. In this paper, we use the change in the consumer surplus as an

Download English Version:

<https://daneshyari.com/en/article/7388640>

Download Persian Version:

<https://daneshyari.com/article/7388640>

[Daneshyari.com](https://daneshyari.com)