Article

A Methodological Approximation of the Measurement of Instrumental Social Exclusion from the Capability Approach: The Case of Vulnerable Areas in the City of Murcia, Spain

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Abstract: The indirect effects of social exclusion in different fields of the lives of individuals have been scarcely studied. The literature that addresses social exclusion from the capability approach is sparse, and a methodology for measuring the instrumental effects of social exclusion on capability deprivation has not yet been implemented. Therefore, the main objective of this research is to propose a methodological framework to quantify these effects, based on two techniques: Structural equation modelling and principal component analysis. Likewise, this study presents a practical application in the vulnerable areas of the city of Murcia, Spain. In order to obtain the data, fieldwork was carried out using 464 questionnaires. The theorised model was statistically contrasted, confirming that it is not false. The study revealed that instrumental social exclusion had a moderate impact on the deprivations experienced by the study population.

Keywords: social exclusion; deprivation; capability approach; instrumental social exclusion; structural equation modelling; Murcia; vulnerable areas

1. Introduction

The capability approach is the normative or ethical framework that guides this study. It is not a theoretical framework because the purpose is not to explain the formation of poverty or the formation of social exclusion [1]. The aim of this approach is distinct in that it provides a framework for conceptualising and assessing different social phenomena, in this case, social exclusion.

Social exclusion is an old idea. A reference to this social phenomenon can be found in the work of [2] when talking about deprivations that are not material in nature, but relational, using as an example appearing in public without shame. However, the more recent use of the term social exclusion stems from the political discourse of the 1960s in France [3], in part, because the concept of poverty is associated with the English tradition, the French are reluctant to use it [4], but also to pinpoint the weakness of the systems that integrate society [5]. Such systems include: access to a job, the fulfilment of social rights and participation in society, or family ties [6].

The conceptual origin from politics, and not from the academic world, means that social exclusion lacks a theoretical corpus. Therefore, it has been defined ambiguously, while used in literature as a disguise to explain any deprivation. When studied, more attention is paid to the condition or situation of social exclusion rather than examining its processes. For this reason, the main objective of this paper is to design and apply an original methodology to measure an uncommonly addressed aspect of social exclusion: the indirect impact on other deprivations. The proposed methodology is based on two statistical techniques: structural equation modelling and principal component analysis.

The proposal put forward in this article is not only oriented towards the design of a methodology, but also incorporates a practical application which was carried out in the city of Murcia, Spain.

In order to be sensitive to the reality of the social phenomenon being addressed, the unit of analysis is the impoverished and the deprivations they suffer. Nevertheless, in a study of the general population, the tails of the distribution are lost for both the richest and the poorest in society. This would not guarantee the statistical significance of the many and varied situations of social exclusion. For this reason, the scope of the research is restricted to the vulnerable areas of the city of Murcia. A higher proportion of the impoverished population is expected to be found in these areas. It is worth mentioning that the resident of a vulnerable area is not necessarily considered to be in this situation, but it is associated with a higher risk of suffering deprivation in their capabilities.

Given the holistic nature of this research, it has been necessary to carry out fieldwork by administering 464 surveys in the vulnerable areas of the city of Murcia. This corresponds to the third method of [7] to collect information on the capabilities of individuals. That is, the external researcher is the evaluator, while the observers are the different individuals who form the sample.

The statistical procedures for this work were executed using the *R* language (3.5.2). The *lavaan* package (0.6.5) was used for the structural equation modelling and the *FactoMineR* (1.41) and *psych* (1.8.12) packages were used for the principal component analysis.

The article is composed of five sections. In addition to the introduction, Section 2 begins by reviewing the literature on social exclusion in terms of its meaning by various international bodies and authorities on the subject. Subsequently, Sections 2.1 and 2.2 are developed where social exclusion is contextualised from the capabilities approach and the hypotheses that guide this research are pointed out. After that, Section 3 details the characteristics of the fieldwork and the methodological proposal. In Section 4, the results of the case study of the vulnerable areas of the city of Murcia are presented and discussed. Finally, in Section 5, the main contributions to knowledge are indicated, the usefulness of this type of work for the design of public policies to combat social exclusion, as well as the future lines of research derived from this work.

2. Literature Background and the Hypotheses Development

The term social exclusion is coined by René Lenoir, in the paper *Les Exclus: Un Français sur dix*, published in 1974. In this work he identifies that about 10% of the French population is excluded, that is, they have the greatest social disadvantages [8]. This is the primordial feature of social exclusion: the accumulation of disadvantages in different fields of human life.

Given the French origin of the term, social exclusion has been treated with greater emphasis in the European context, mainly since its institutionalisation and implementation directly in the public policies of the European Union. The year 1990 marked the beginning of the institutionalisation of social exclusion in the European Union, with two instruments: the Community Programme for the Social and Economic Integration of the Least Privileged Groups—popularly known as 'Poverty 3'—and the Observatory on National Policies to Combat Social Exclusion [6]. The European Union also formalised the institutionalisation of social exclusion in the Maastricht Treaty of 1992. This treaty identifies two key aspects in the fight against social exclusion: a high level of employment and social protection policies [9]. However, the Maastricht Treaty would have further modifications. The first, in 1997 in Amsterdam, enshrines the eradication of social exclusion as an objective of European Union social policy [10]. Now the signature of the United Kingdom does appear, due to the fact that the Tony Blair government reversed British policy of not recognising the problem of social exclusion [11]. The next one, in Nice, in 2000, where four objectives are specified to fight against social exclusion: 'Facilitating participation in employment and access by all to resources, rights, goods and services; preventing the risks of exclusion; helping the most vulnerable; and mobilising all relevant bodies in overcoming exclusion' [12] (p. 124).

Nevertheless, the meaning of social exclusion varies between the different countries of the European Union, due to the models of social integration that exist on the continent. This shows the relative nature of social exclusion. The work of [13] distinguishes three general paradigms in line with the three main models of social integration: solidarity, specialisation and monopoly. The solidarity paradigm, considered the primordial, has its roots in French republican thought, where social exclusion is seen as the opposite of one of its ideals: fraternity. Thus, social exclusion is understood as: 'The rupture of a social bond between the individual and society, referred to as social solidarity' [14] (p. 66). The specialisation paradigm is Anglo-Saxon and its conceptual core are the processes of discrimination. The third paradigm, the monopoly paradigm, is characteristic of Scandinavian countries and Weberian thinking. This paradigm specifies that some individuals may be deprived of access to certain goods and services due to the establishment of hierarchies in social relations, which are known as social closure.

However, the different paradigms of social exclusion have a very important point in common: the emphasis on the social or relational sphere. But what is meant by the relational sphere? According to [4], there are three characteristics that shape this sphere: social participation in certain essential activities; social integration, both through family and social networks and through the fulfilment of certain social rights; and finally, it is a question of power.

A definition of social exclusion can be found in the report prepared by the [15] (p. 9):

> It is a process whereby certain individuals are pushed to the edge of society and prevented from participating fully by virtue of their poverty, or lack of basic competencies and lifelong learning opportunities, or as a result of discrimination. This distances them from job, income and education opportunities as well as social and community networks and activities. They have little access to power and decision-making bodies and thus often feeling powerless and unable to take control over the decisions that affect their day to day lives.

In short, this definition of social exclusion combines the main features of each of the paradigms identified by [13]. Even the three characteristics that [4] presented when talking about the relational sphere can be observed.

The concept of social exclusion has also been applied by international bodies to regions other than Europe [11,16]. Among all of them, the contributions made by the institutions dependent on the United Nations stand out. Some of the contributions of the International Labour Organisation (ILO), the World Bank and the United Nations Development Programme (UNDP) are briefly reviewed below.

The ILO makes a strong push in applying the concept of social exclusion outside Europe through different case studies [17]. Because social exclusion is relative, its definition has been adapted to the context of each case study [18]. Nevertheless, the various definitions refer to one or more of the relational sphere characteristics outlined above by [4]. There is also a common thread running through all the definitions: the cumulative process of social exclusion. Consequently, there are various interrelationships between different deprivations that end up forming an accumulation of social disadvantages.

The World Bank takes the baton from the ILO. In fact, in 1998, social exclusion was included in its annual report, as well as in the design of various studies and projects [16]. Namely, a year later, a technical workshop on social exclusion and poverty in Latin America and the Caribbean was organised [19]. In this case, social exclusion is defined as the opposite of effective participation in the life of the community, whether in the economic, political or cultural spheres.

The UNDP has also incorporated the concept of social exclusion in its studies. This programme [20] defines social exclusion as a state and a process, where individuals are pushed to the margins of society and prevented from full participating in society. They also point out that the processes of social exclusion are closely related to the denial of freedoms.

Nonetheless, despite these efforts, the incorporation of this concept by authorities in other countries outside the European context has not been as successful as expected. One

of the reasons for this is the existence of other similar, though not identical, concepts such as marginality approaches and the concept of marginalisation in Latin America [21].

2.1. Social Exclusion and Capability Approach

The capability approach is based on two essential concepts: functionings and capabilities. On the one hand, functionings are the primary unit of information referring to different beings and multiple activities of an individual in Senian terminology. Capabilities, on the other hand, are the freedoms to achieve these functionings [22]. Among the whole set of capabilities, Sen [23] distinguishes a subset that he calls basic capabilities, which are those that allow a person to avoid poverty, they are few and equal for all human beings. The achievements of these basic capabilities are basic functionings.

In this research, due to operational limitations, the focus is on basic functionings. In any case, capabilities and functionings share the same evaluative space [24]. However since this choice implies a loss of precision by not accounting for the substantive freedom to fulfil this valuable achievement, the definition is adjusted based on the idea of refined basic functioning, reflecting on whether the deprivation is involuntary or not [23,25].

In this work, five basic functionings were selected:

- Acquiring basic knowledge (education).
- Taking part in the life of the community (social).
- Leading a dignified life through a job (labour).
- Living in a safe environment (environment).
- Living in decent dwelling (dwelling).

Functionings depend on the commodities that an individual can access and control. However, this research is not focused on the commodities *per se*, but on the different characteristics of those commodities, that is, what they can do for people [26]. Accordingly, two people with the same commodities can obtain different results in their functionings because there are diverse factors that condition the conversion of commodities into functionings [22,24,26].

In this connection, Sen [24] (pp. 70–71) identifies five different types of sources of variation: personal heterogeneities, environmental diversities, variations in social climate, differences in relational perspectives, and the distribution within the family.

Of all the conversion factors stated, this research focuses on differences in relational perspectives. In this regard, Sen [24] gives the example of being relatively poor in a rich community. In such a case, one would need a higher income to take part in the life of the community compared to living in a poorer community. This conversion factor highlights that an individual's membership in a given social group may affect a different degree of taking part in the life of the community. This aspect links with the case study since this conversion factor refers partially to the effects of residing in a particular neighbourhood [27]. It is also closely related to the concept of social exclusion because this conversion factor underlies a very important mechanism: social discrimination. In essence, these differences in relational perspectives can affect the lives of individuals living in vulnerable areas in varying ways. These relationships, which are key aspects in assessing social exclusion, will be identified later in this article.

Sen [28] establishes a framework for analysing social exclusion, in which he proposes two ways of connecting it with the capability approach. The first focuses on distinguishing the effects of deprivation of capability: direct effects, whether social exclusion implies a constitutive deprivation of capabilities, and indirect effects, if social exclusion is an instrumental cause of the deprivation of a given capability. Constitutive and instrumental deprivation are not mutually exclusive. Social discrimination, for example, may result in a constitutive deprivation of capabilities, such as taking part in the life of the community. Even so, the same constitutive deprivation may result in other deprivations in other capabilities, such as an individual not being able to access a job. The second way analyses the deliberate or unintentional attempt to exclude an individual or social group, that is, to distinguish between an active or passive motivation.

The quantitative orientation of this investigation restricts the first method. Nevertheless, the novelty of the study of social exclusion from the capability approach presented here is not given by the analysis of the constitutive deprivations, but in the processes that imply the deprivation of capabilities: instrumental social exclusion.

However, literature on this subject is scarce. From a qualitative perspective, the works of [29,30], on Pakistan and China, respectively, investigate the effects of social exclusion on educational opportunities. From a quantitative approach, the study of [31], based on structural equation modelling and from a longitudinal study, examines the effects of social exclusion on adolescence and middle age, given the deprivation of certain resources in the childhood of the individuals under study.

In addition, from the capability approach, the works that apply structural equation modelling and principal component analysis have done so from different perspectives than the one proposed in this document. Krishnakumar and Ballon [32] have used structural equation modelling within the capability approach to estimate basic capabilities in Bolivia. The works of [33,34] have used principal component analysis as a weighting system from the capability approach. There are other works that use techniques derived from structural equation modelling, such as Multiple Indicator, Multiple Cause Models (MIMIC) [35,36], factor analysis [37] and latent class analysis [38,39].

This paper conceptualises social exclusion as a further expression of capability poverty. Specifically, it evaluates the social relations of an individual within the different institutions of society, in other words, his or her taking part in the life of the community. All of these social relationships are called the 'social bond'. Therefore, social exclusion is defined as the rupture of the social bond, and the instrumental consequences that result.

2.2. The Structural Relationships of Social Exclusion

Following the idea of instrumental deprivations, an important question arises: does a deprivation in one basic functioning have an equal impact on the rest? In this case, there are two possible answers represented in two models: horizontal and hierarchical. In the horizontal model, all the relations of deprivation of functionings adopt a perfect interdependence; in practice, they all have the same relevance. On the contrary, in the hierarchical model, there are some relations of deprivation of functionings that have more relevance than others, in other words, the relations take a hierarchical form. These relationships are referred to as 'structural relationships', which together form the 'structure of functionings'. Thus, the hypotheses considered in this paper imply that each one of the structural relationships that shape the hierarchical model is statistically significant. If so, this means that the concept of the structure of functionings is not false.

The following is a brief description of the structural relations caused by instrumental social exclusion in the vulnerable areas, which arise from examining the differences in relational perspectives of the residents of the vulnerable areas concerning the rest of the inhabitants of the city.

Vulnerable areas, in general, have a lower quality of public services compared to the rest of the areas of the city. In the case, for example, of the quality of basic services such as education, the Salzillo public school in the Espíritu Santo neighbourhood in the city of Murcia has eight times more drop-outs than the La Milagrosa charter school [40]—which is located just a few metres away. In addition to the fact that public schools in vulnerable areas stand out for the social homogeneity of their students, as in this case, where the students belong to the Roma ethnic group.

A quality and heterogeneous education are key for the residents of vulnerable areas to elude poverty [41]. A heterogeneous education facilitates the accumulation of social capital [42]. This helps facilitate access to the labour market through the use of weak ties—that is, those people with whom we interact occasionally—which guarantees greater employment opportunities [43]. Thus, the following hypothesis is proposed: the structural relationship that goes from educational functioning to labour functioning is statistically significant.

Residents of vulnerable areas suffer intense discrimination processes [44]. These can have an instrumental impact on numerous aspects of an individual's life. One may be the denial of access to a quality educational centre because they belong to a certain ethnic group or the interruption of their studies prematurely due to being female. The latter can be observed in Murcia, where some Roma girls are forced to abandon their basic studies to take care of their families [45]. Similarly, the values learned through education also have an impact on the formation of discrimination processes, since an education represented by heterogeneity and human diversity is essential to curb such processes. Therefore, the second hypothesis is established: the structural relationship between educational and social functioning is statistically significant.

Discrimination processes do not only concern the access to basic education, but also influence access to the labour market. For instance, an individual may be discriminated against and unable to access a job because of his or her place of residence or because he or she belongs to a certain ethnic group. In line with this idea, the processes of discrimination, plus the low accumulation of social capital, results in jobs available to residents of vulnerable areas being characterised by the absence of employment contracts and poor wages [46]. As a result, a third hypothesis must be considered: the structural relationship that goes from social functioning to labour functioning is statistically significant.

In addition to the above, vulnerable areas are also associated with the establishment of certain subcultures that influence the lives of their residents. With greater vulnerability, the implementation of these subcultures also increases [47]. Specifically, when referring to marginal subcultures. These outline illegal behaviours and activities, generally accompanied by violence and delinquency, forming an unsafe environment for the development of the daily life of its inhabitants. These subcultures have settled in some vulnerable areas in the city of Murcia, where a level of insecurity and a focus on drug trafficking can be observed [48]. In this way, a fourth hypothesis is highlighted: the structural relationship that goes from social functioning to environment functioning is statistically significant.

The difficulty faced by individuals living in a vulnerable area in finding a decent job has been discussed. Without a sufficient income, an individual will lack access to essential goods such as a decent dwelling. In this sense, they are dependent on social programs or support services to access housing. Moreover, in the context of Murcia, it should be taken into account that there is a high concentration of social housing in the same vulnerable areas [49]. To get an idea of the housing problem in the areas under study, the price of housing is four or five times lower than in nearby neighbourhoods that are not classified as vulnerable [48]. In cases where the citizens are unable to access social housing, they are forced to either construct their own precarious dwellings or to live in environments hostile to their health [50,51]. Therefore, the last hypothesis is established: the structural relationship that goes from labour functioning to dwelling functioning is statistically significant.

3. Fieldwork and Methods

3.1. Fieldwork

The data for this study were obtained from the application of surveys with open-ended and closed questions on the objective conditions and subjective perceptions of the population regarding social exclusion and poverty. The questionnaire can be found in the Supplementary Material of this article. For more information, see [44].

- Period for obtaining the information: first half of 2018.
- Scope: the vulnerable areas of the city of Murcia, see Figure 1.
- Universe: private households [52].
- Sampling: probabilistic with allocation proportional to the population size of each census tract. The selection of a private household was by means of a simple random sample.
- Sample size: 464 surveys.
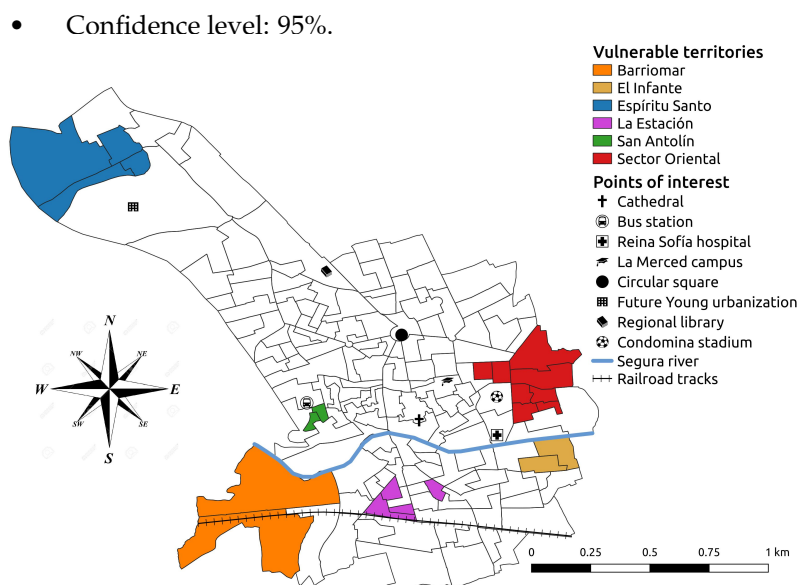- Sampling error: 4.5%.

- Confidence level: 95%.

Figure 1. Vulnerable territories in the city of Murcia.

3.2. Evaluating the Functionings Structure

The conceptual framework of this methodology is based on the structure of functionings, that is, there are more relevant relationships of deprivation of basic functionings than others in vulnerable areas. This gives rise to the structural model (hierarchical model), whose structural relationships correspond to the instrumental effects of social exclusion in vulnerable areas. In contrast to the structural model, there exists the measurement model (horizontal model), which is translated as a perfect interdependence between the relations of deprivations of basic functionings. In short, the intention is to study the interdependence of the different basic functionings to understand how these deprivations are produced.

Structural equation modelling is the perfect tool to carry out this work. This technique has structural nature since in a single model it analyses both the relationships between measurement variables and their respective latent variable, as well as the relationships between latent variables. Consequently, it does not assume the independence of the different latent variables, but it allows the establishment of different dependence relationships between them. This means several facts: it allows the statistical contrast of the theorised structural relationships, it serves to study the accumulation of the effects of such relationships, and it measures errors, since measurement variables may not be a faithful reflection of a latent variable [53,54].

Structural equation modelling is composed of two parts: confirmatory factor analysis and causal diagrams. Confirmatory factor analysis is related to the measurement model because the focus of attention is on the relationships between the latent variables and the measurement variables. In fact, in confirmatory factor analysis, all latent variables are perfectly interdependent, which means that the horizontal model is assessed. In contrast, structural equation modelling is based on the evaluation of the different relationships between latent variables—where multiple effects exist—and these relationships form a structure. In this way, the hierarchical model is assessed. The main purpose is to statistically contrast that this model is not false.

Structural equation modelling can follow two methods: those based on analysis of covariance and those based on analysis of variance. The first ones have a confirmatory purpose and focus on estimating parameters, while the second ones are oriented to prediction and exploratory purposes [53]. Given the nature of this research, methods based on the analysis of covariance were selected, since they allow us to validate the structural relationships theorised, in addition to calculating their effects.

In such a case, the objective is to compare the covariance matrix of the population (Σ) with the covariance matrix estimated by the model parameters ($\Sigma(\theta)$). Therefore, the math-

ematical formula governing the structural equation modelling is $\Sigma = \Sigma(\theta)$ [55]. Since it is not known the reality of Σ, the focus is on estimating the sample which originates from the fieldwork (S), rather than the population. Therefore, the goal is to minimize the following difference: $S - \Sigma(\theta)$. This difference is called the residual. Now, to perform this exercise, four steps are followed: specify, identify, estimate, and evaluate the proposed model.

3.2.1. Specification of the Model

The different basic functionings cannot be measured directly, so they are conceptualised as latent variables. As in the work of [36]. This paper then departs from the research of [32,35], who select capabilities as latent variables. In this way, a basic functioning is assessed by means of indicators (measurement variables), which provide information about the characteristics of a given valuable achievement. Consequently, the basic functionings are reflective variables of the indicators. Table 1 provides the basic information on the different indicators used in this methodology.

Table 1. Latent variables and measurement variables.

Indicators	Functionings	Type	Description
Educational lag (x_1)	Education (ξ_1)	Continuous	Average number of adults in the household with educational lags [1].
Residence permit (x_2)	Social (ξ_2)	Binary	Not having a residence permit.
Medical attention (x_3)	Social (ξ_2)	Binary	Not having received medical assistance every time he or she needed it.
Discrimination (x_4)	Social (ξ_2)	Ordinal	Having been treated in a discriminatory manner in the last six months [2].
Income gap (y_1)	Labour (η_1)	Continuous	The percentage of income needed to move out of monetary poverty.
Food (y_2)	Labour (η_1)	Binary	Not being able to afford a meal of meat, poultry or fish at least every other day.
Energy (y_3)	Labour (η_1)	Binary	A household is in energy insufficiency when its energy expenditure exceeds 10% of its income.
Delinquency (y_4)	Environment (η_2)	Binary	Presence of delinquency in the area.
Pollution (y_5)	Environment (η_2)	Binary	Presence of pollution, contamination or other environmental problems in the area.
Noises (y_6)	Environment (η_2)	Binary	Presence of noises from neighbours or from outside.
Leaks (y_7)	Dwelling (η_3)	Binary	If the dwelling has leaks, damp or rotting problems.
Services of the dwelling (y_8)	Dwelling (η_3)	Ordinal	In the last twelve months, if due to economic difficulties, you have had any delays in the payment of electricity, water, gas, etc [3].
Temperature (y_9)	Dwelling (η_3)	Binary	Whether the dwelling has the necessary means to maintain the temperature of the home.

[1] A person over 16 years of age has educational lag when he/she is illiterate, can only read and write or has only completed primary education. [2] No; rarely; many times. [3] Has had no delays; has had one delay; has had two or more delays; has no such services.

Latent variables can be of two types: exogenous or independent—i.e., those which are unaffected by other latent variables—and endogenous or dependent—i.e., those which are affected by other latent variables and have no impact on any other latent variable. However, these two modalities are not mutually exclusive, since in a structural model, a latent variable can be exogenous in one relationship while in another it acts endogenously. In order to present the structural model clearly, Figure 2 shows its causal diagram. The mathematical formulation is detailed below.

$$\eta_1 = \gamma_{11}\xi_1 + \gamma_{12}\xi_2 + \zeta_1$$
$$\eta_2 = \gamma_{22}\xi_2 + \zeta_2$$
$$\eta_3 = \beta_{31}\eta_1 + \zeta_3$$
$$x_i = \lambda_{xi}\xi_j + \delta_i$$
$$y_i = \lambda_{yi}\eta_j + \epsilon_i$$

- x equal the measurement variables of the exogenous latent variable.
- y equal the measurement variables of the endogenous latent variable.
- Λ equal the matrix of factor loadings (λ), either dependent on x or y. They are interpreted as the change in the measurement variable when the latent variable changes by one unit, ceteris paribus.
- δ equal the measurement errors on the part of the independent measurement variable.

- ϵ equal the measurement errors on the part of the dependent measurement variable.
- η equal the endogenous latent variables.
- *B* equal the matrix of regression coefficients between endogenous latent variables (β). These coefficients are analogous to those of regression since they are interpreted as the change that exists in the endogenous latent variable when there is an increase of one unit in the exogenous latent variable, ceteris paribus.
- ξ equal the exogenous latent variables and Φ is the covariance matrix between exogenous latent variables (ϕ).
- Γ equal the matrix of regression coefficients from the exogenous latent variables to the endogenous latent variables (γ). Its interpretation is identical to the previous one.
- ζ equal the errors of the endogenous latent variables (specification errors). They are defined as the factors that affect the endogenous latent variable but are not taken into account by the model.
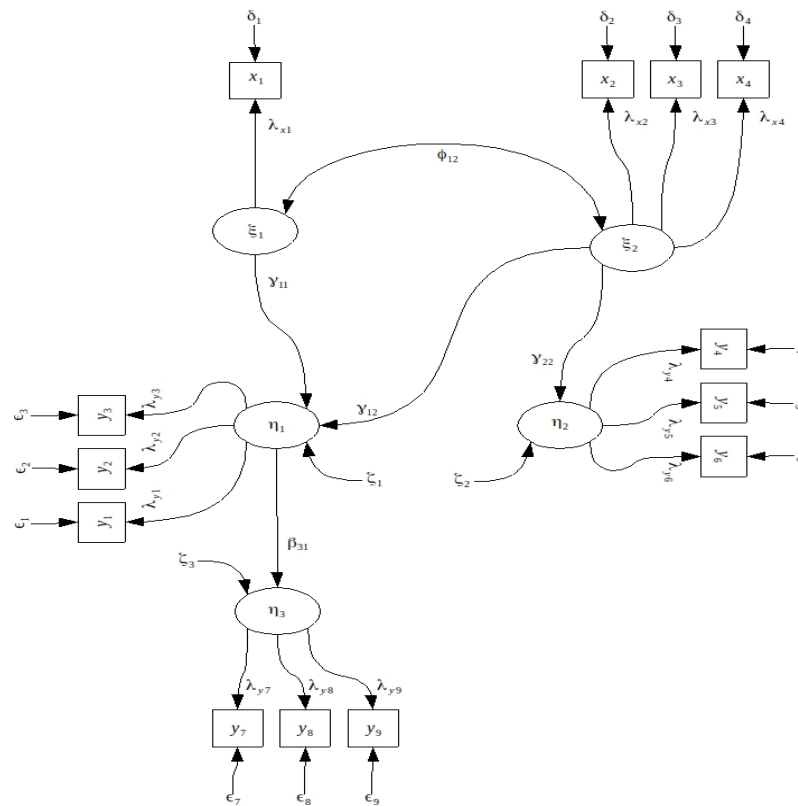

Figure 2. Diagram of the structural model.

Since the object of study of this article is the instrumental effect of social exclusion, the structural relationships start from the rupture of the social bond or, in other words, from the deprivation of social functioning. Hence, the general approach is to measure the intensity of these relationships in each of the proposed indicators, that is, to generate the structural coefficient (κ). Structural relationships adopt different types. A reciprocal relationship can be found between educational functioning (ξ_1) and social functioning (ξ_2). In this case, to calculate the structural coefficient κ_{x1}, only the factor loading λ_{x1} must be multiplied by the covariance coefficient ϕ_{12}. There are also direct relationships, namely from social functioning (ξ_2) to labour functioning (η_1). In this case, the example of the structural coefficient κ_{y1}, associated with the income gap indicator (y_1), is given. To carry out this task, the factor loading λ_{y1} is multiplied by the regression coefficient γ_{12}. There are also indirect relationships, for example, from social functioning (ξ_2) to dwelling functioning (η_3), where labour functioning (η_1) works as an intermediary. In particular, the structural coefficient κ_{y8}, which is associated with the services of the dwelling indicator (y_8), is of interest. In this case, the calculation is somewhat more complicated than in the previous

ones, but by continuing to multiply the different coefficients in the diagram, the process becomes easier. The mathematical formulation is as follows: $\kappa_8 = \gamma_{12} \times \beta_{31} \times \lambda_{y8}$.

3.2.2. Identification of the Model

The model is identified and can be estimated—see [55] for the different rules of model identification. Nonetheless, a priori, it may bring up an issue that needs to be addressed, since each latent variable must contain at least three measurement variables [56]. The reason being that with three measurement variables the latent variable is precisely identified. In practice, however, the scale of the latent variable must be fixed, in order to interpret the estimated parameters more easily. This means that there is one less parameter to estimate, so that with two measurement variables, one latent variable is precisely identified. Now, it can be observed that the latent variable of education has only one measurement variable. In order to solve this case, the measurement variable can be recorded as free of errors. In this case, the latent variable of education is precisely identified. Despite the recommendation of three measurement variables for each latent variable, in some cases, there is no alternative.

In terms of sample size, the criteria established by [57] are fulfilled. Likewise, the advice proposed by [58] is fulfilled: the ratio between measurement variables and sample must be greater than ten.

3.2.3. Estimation of the Model

Model estimation requires the selection of an algorithm to minimize the residuals. The default algorithm in the *lavaan* software is Maximum Likelihood (ML). Even so, as the data contains non-continuous indicators, *lavaan* automatically selects the Diagonally Weighted Least Squares (DWLS) algorithm [59]. This method is suitable for small sample sizes and indicators that violate the assumption of normality [60]. Similarly, *lavaan* takes into account the typology of the measurement variables and *lavaan* is responsible for automatically calculating the correlations.

3.2.4. Evaluation of the Model

The model is evaluated by the goodness of fit, that is, small residuals generate a better fit for the model. In such a case, the fit function is distributed as a χ^2 with the same degrees of freedom (g) as the model. Nevertheless, χ^2 is sensitive to the sample size (N) and the complexity of the model. Namely, as the number of variables increases, the value of χ^2 also increases. For this reason, other indices are used to correct these biases.

- χ^2 test. This test checks whether the sample covariance matrix is statistically different from the estimated covariance matrix. A *p*-value greater than 0.05 is considered as statistically significant [55]. The χ^2 function can be described as follows: $\chi^2 = (N-1)(S - \sum(\theta))$.
- Root Mean Square Error of Approximation (RMSEA). This index attempts to correct the biases of the previous one. The mathematical formulation is defined as follows:
$$\text{RMSEA} = \sqrt{\frac{(\chi^2 - g)}{(N-1)}}.$$
- Goodness of Fit Index (GFI). This index compares the minimum of the fit function for k degrees of freedom (F_k) with the minimum of the fit function of the null model (F_c). A null model (c) is one where its latent variables have no relationship between them.

  The equation of this index can be expressed mathematically as follows: $\text{GFI} = 1 - \dfrac{F_k}{F_c}$.
- Tucker-Lewis Index (TLI). This index also compares the proposed model with the null model. A value greater than unity means an overparameterization of the model.

  The mathematical formula is as follows: $\text{TLI} = \dfrac{(\chi_c^2/g_c - \chi_k^2/g_k)}{(\chi_c^2/g_c - 1)}$.

- • Comparative Fit Index (CFI). Similar to TLI. The equation for this index is as follows:

$$\text{CFI} = 1 - \frac{(\chi_k^2 - g_k)}{(\chi_c^2 - g_c)}.$$

The interpretation of the values generated by the above indices should be guided by the complexity of the model and the size of the sample. Taking into account the characteristics of the model proposed here, RMSEA values between 0.06–0.08 indicate a good fit and below 0.05 is considered a very good fit. GFI, TLI, and CFI values above 0.90 are considered acceptable. Even so, in the model proposed by this article, these values must be above 0.92, and ideally, they should be above 0.95 [57].

Once the model has been assessed in a general way, a more specific evaluation is carried out through the diagnosis of the different components of the model. In this way, the latent variables, the measurement variables, the factor loadings, the regression coefficients, and the covariances between the latent variables are examined. First, the statistical significance of the measurement variables, regression coefficients, and covariances is evaluated, that is, a *p*-value below 0.05 is sought. Subsequently, a diagnosis of the factor loadings is carried out, which must be greater than 0.50 and, in the best case, be above 0.70. In addition, the intensity of the relationships between the latent variables is analysed, that is, the regression coefficients and covariances. To complement the analysis, the R^2 of the endogenous latent variables is reviewed.

In addition, it is imperative that there are no improbable statistical facts in the results, such as a standardised coefficient greater than unity or a negative variance ('Heywood case'). However, one should not forget theoretical validity, in other words, that the definition of each latent variable and the relationships between the latent variables make logical sense.

3.3. A Weighting System Based on Principal Components Analysis

The calculation of the structural coefficients for each indicator (κ_i) is insufficient to measure the instrumental effect of social exclusion since an important aspect would be forgotten: its weighting. This is because some deprivations have a higher incidence among the population than others. Namely, there is no doubt that deprivation in the indicator of food is critical, nonetheless, it is not a widespread deprivation among the population of Murcia. Only a minority of the population residing in vulnerable areas suffers from such deprivation. Therefore, a lower weight is expected for this indicator compared to the income gap indicator.

The principal component analysis is used as a basis to establish the weighting system. However, before it is applied, the data must be processed and evaluated. As for the treatment, if the indicators are in different scales, they must be standardised. A good option from the *R* language is the use of the *scale* function. Regarding the evaluation, it must be ensured that the data are valid to apply the principal component analysis. In this case, the Kaiser–Meyer–Olkin (KMO) test is chosen, which provides information on the degree of intercorrelation of the indicators. Basically, a value as close to the unit as possible is sought, with a result above 0.80 being considered very good, 0.70 is an average result, and above 0.60 is considered mediocre. Results lower than 0.50 are not accepted. The KMO test can also be extended to the local level, that is, each of the indicators is examined [57].

There is a twofold purpose of applying principal component analysis: first, to reduce the various indicators of a series of patterns of deprivation of basic functionings—patterns of deprivation for short—and second, to weight the structural coefficients obtained (κ_i). In this way, the instrumental effect of social exclusion (ι) can be calculated. As a matter of fact, the weighting system designed does not use only the first principal component, as has been done in other studies on poverty [33,34]. In this sense, [61] does not agree with losing so much explanatory power, so he proposes to use a subset of all the principal components. The weighting system based on patterns of deprivation follows this proposal.

Although it has been theorised that each indicator is related to a particular basic functioning, this reasoning differs in practice since a pattern of deprivation may represent a basic functioning with all its indicators, but it may also reflect several indicators belonging

to different basic functionings. In order to define patterns of deprivation, the correlations and contributions of the indicators in each principal component must be analysed. It should be noted that all indicators register deprivation, so a positive sign is expected. In any case, a principal component is not immediately equated with a given pattern of deprivation, as it must meet certain requirements.

N being the number of indicators, then the finite set $I = \{i_n : n = 1, ..., N\}$ is defined as the set of indicators. The set of patterns of deprivation can be defined as $P = \{P_m : m = 1, ..., N\}$, where P_m is a subset of I, which satisfies the following: $P_m \subsetneq I$, $\cap P_m = \emptyset$. Every pattern of deprivation must have at least one indicator with a correlation greater than 0.5. In addition, there cannot be an indicator with a correlation less than -0.5. Apart from that, only indicators with a positive correlation are candidates to represent the pattern of deprivation. Also, a uniqueness rule applies, that is, an indicator can only belong to one pattern of deprivation, in particular in that where it has registered the highest contribution.

After this exercise, it is possible to move on to the weighting of the indicators (i_n), but also of each pattern of deprivation (P_m) since some patterns of deprivation are more important than others and will have a greater weight in the overall model. To do this, it examines the contributions of each indicator (w_n) and the eigenvalues (W_m), that is the percentage of explained variance by each principal component. Thus, you have the necessary ingredients to calculate the weighting of each indicator (ω_i) in the overall model. Mathematically speaking, it is defined as follows: $\omega_i = w_n \times W_m$. In short, the instrumental effect of social exclusion on a given indicator (ι_i) is calculated by multiplying the structural coefficient of the indicator (κ_i) by its weighting (ω_i). The mathematical formula is as follows: $\iota_i = \kappa_i \times \omega_i$.

4. The Case Study of the Vulnerable Territories of the City of Murcia

4.1. Results of the Measurement Model

In the measurement model, which has been called horizontal, the focus is on the evaluation of the relationships between the different latent variables (basic functionings) and their measurement variables (indicators). It is also of interest to confirm whether the covariances between the basic functionings are statistically significant. First, however, the model needs to be validated in general. Table 2 shows a summary of the different indices used.

Table 2. Results of the evaluation of the measurement model.

Variables	Values
Free parameters	40
Degrees of freedom	56
Test χ^2	116.40
p-Value χ^2	0.000
GFI	0.975
CFI	0.946
TLI	0.925
RMSEA	0.048

The horizontal model has 40 free parameters with 56 degrees of freedom. The χ^2 test provides a not significant p-value since it is close to 0. Nevertheless, this test is not sufficient to evaluate the model, so other indices are reviewed. In fact, GFI obtains an ideal result of 0.975. In addition, CFI and TLI give good results: in both of them, the values are above 0.92. The value provided by RMSEA is considered very good since they fall below 0.05. In short, the horizontal model presents a good fit.

So far, the model has been evaluated in a general way. Table 3 presents the results of the indicators and the covariances. All indicators are significant, that is, their p-value is close to 0. Likewise, each basic functioning has at least one indicator with a standardised

factor loading above 0.70. The lowest standardised factor loadings in the range of 0.50–0.60 are in the indicators of temperature, leaks, and energy. Consequently, the indicators associated with each of the basic functionings have been validated.

Table 3. Results of the indicators and covariances of the measurement model.

Indicators	Completely Standardized	Standard Error	*z*-Value	*p*-Value
Educational lag	1.000			
Residence permit	0.842			
Medical attention	0.790	0.160	5.879	0.000
Discrimination	0.634	0.145	5.188	0.000
Income gap	0.802			
Food	0.714	0.452	6.922	0.000
Energy	0.589	0.330	7.814	0.000
Delinquency	0.739			
Pollution	0.809	0.121	9.022	0.000
Noises	0.767	0.118	8.763	0.000
Leaks	0.535			
Services of the dwelling	0.747	0.168	8.285	0.000
Temperature	0.535	0.159	6.270	0.000

Covariances	Completely Standardized	Standard Error	*z*-Value	*p*-Value
Education—Social	0.044	0.029	0.546	0.585
Education—Dwelling	0.412	0.022	4.173	0.000
Education—Labour	0.409	0.009	4.261	0.000
Education—Environment	0.251	0.022	3.552	0.000
Social—Dwelling	0.583	0.057	4.648	0.000
Social—Labour	0.454	0.017	5.212	0.000
Social—Environment	0.138	0.075	1.147	0.251
Dwelling—Labour	0.857	0.016	6.451	0.000
Dwelling—Environment	0.296	0.039	3.015	0.003
Labour—Environment	0.179	0.013	2.309	0.021

With respect to the basic functionings, not all the covariances are significant. In particular, the covariance between social and educational functioning is discussed, as well as the covariance between social and environmental functioning. Consequently, the idea of perfect interdependence between deprivations of basic functionings is ruled out.

4.2. Results of the Structural Model

In the structural model, the evaluation of the relationships between indicators and basic functionings is put aside to focus attention on the relationships between different basic functionings. The aim is to confirm that the theorised structure of functionings is not false. Initially, however, the structural model is assessed in a general way. For this purpose, Table 4 is shown below, where the proposed indexes are observed in a concise form.

Table 4. Results of the evaluation of the structural model.

Variables	Values
Free parameters	35
Degrees of freedom	61
Test χ^2	149.00
p-Value χ^2	0.000
GFI	0.963
CFI	0.922
TLI	0.900
RMSEA	0.056

The structural model—being more restrictive than the measurement model—has fewer free parameters, thus, the structural model registers 61 degrees of freedom. The χ^2 test is not significant, as it registers a *p*-value close to 0. Moreover, GFI obtains an ideal result of 0.963. Also, CFI and TLI give good results—the TLI value is located at the limit of 0.90. Likewise, RMSEA indicates a good result, below 0.06. In short, the structural model presents an acceptable fit.

A more detailed evaluation focuses on the different relationships that hold the basic functionings, which are presented in Table 5. It shows that all regression coefficients and the covariance coefficient are significant. Thus, all the structural relationships have been statistically validated. Therefore, it is accepted that the concept of the structure of functionings is not false. This means that some basic function deprivation relationships are more relevant than others.

Table 5. Results of the regressions and the covariance of the structural model.

Regressions	Completely Standardized	Standard Error	*z*-Value	*p*-Value
Labour—Education	0.308	0.040	3.860	0.000
Labour—Social	0.573	0.035	4.596	0.000
Environment—Social	0.327	0.107	2.905	0.004
Dwelling—Labour	0.954	0.392	6.106	0.000
Covariance	**Completely Standardized**	**Standard Error**	***z*-Value**	***p*-Value**
Education—Social	0.216	0.027	2.535	0.011

Among all the structural relationships theorised, the most intense is the dependence of dwelling functioning on labour functioning, with a standardised regression coefficient of 0.945. The second most important is the relationship of dependence of labour functioning on social functioning, where the standardised regression coefficient obtains a moderate intensity, specifically, 0.573. The rest of the deprivation relationships present lower results. For example, the relationship of dependence of labour functioning on educational functioning obtains 0.308. Thus, labour functioning depends to a greater extent on social functioning than on educational functioning. As a result, the processes of discrimination and loss of social rights are a serious obstacle to access decent work, even more so than the presence of educational lag.

To continue with the analysis, the R^2 of the endogenous basic functionings is examined. In view of the previous results, dwelling functioning obtains a very high R^2, since it reaches 0.91. On the other hand, labour functioning presents a moderate R^2 since it approaches 0.50. Thus, the exogenous basic functionings explain approximately half of the variance of labour functioning. Additionally, there is environmental functioning, which obtains a very low R^2, with a value of 0.11.

4.3. Patterns of Deprivation

Although the structural coefficients can be calculated, they are unweighted. To remedy this situation, a principal component analysis is applied to the indicators. The idea is not only to calculate the weighting of each indicator, but also to define the patterns of deprivation and calculate their weight within the overall model.

Before starting, it is important to ensure that the principal component analysis can be applied. The KMO test is used to carry out such a task. At the global level, KMO presents a value of 0.67, which is considered an acceptable result. Regarding the local level, all indicators exceed 0.50. In any case, only three indicators register values below 0.60, among them, residence permit, medical attention, and energy. In summary, the KMO test confirms the suitability of applying the principal component analysis.

Of all the principal components, only three are candidates for becoming patterns of deprivation. Table 6 shows their explained variance and their cumulative variance. The first

principal component obtains a good explained variance, namely 21.10%. In total, the three principal components that are candidates for patterns of deprivation are able to explain 45.24% of the variance.

Table 6. Explained and cumulative variance of candidate principal components (%).

Components	Explained Variance	Cumulative Variance
Component 1	21.10	21.10
Component 2	14.14	35.24
Component 3	10.00	45.24

In order to define the patterns of deprivation, Table 7 is used as a reference, where the correlations and contributions of each indicator for each of the three main components are observed. Positive correlations are used to define patterns of deprivation. If any doubt should arise, the contribution of the indicator is used. This is also used to weigh each indicator in its pattern of deprivation.

Table 7. Correlations and contributions (%) of candidate principal components.

Indicators	Correlation 1	Correlation 2	Correlation 3	Contribution 1	Contribution 2	Contribution 3
Educational lag	0.5315	0.1172	−0.1987	10.30	0.75	3.04
Residence permit	0.1531	−0.4745	0.5545	0.86	12.25	23.66
Medical attention	0.2102	−0.4669	0.6349	1.61	11.86	31.01
Discrimination	0.3530	−0.0197	0.2862	4.54	0.02	6.30
Income gap	0.7528	−0.2079	−0.2865	20.66	2.35	6.31
Food	0.4685	−0.1949	0.0199	8.00	2.07	0.03
Energy	0.4660	−0.1926	−0.4156	7.92	2.02	13.29
Delinquency	0.3825	0.6033	0.1797	5.34	19.81	2.48
Pollution	0.3802	0.6069	0.2545	5.27	20.04	4.98
Noises	0.3110	0.6378	0.3122	3.53	22.13	7.50
Leaks	0.4900	0.0795	−0.1322	8.75	0.34	1.34
Services of the dwelling	0.6579	−0.1698	−0.0246	15.78	1.57	0.05
Temperature	0.4518	−0.2970	0.0100	7.44	4.80	0.01

The first pattern of deprivation is mainly linked to labour functioning. Also, although to a lesser extent, with dwelling functioning and educational functioning. This is a pattern of deprivation called low social rank. There are three indicators with positive correlations greater than 0.50, ordered from highest–lowest: the income gap, services of the dwelling, and educational lag. The income gap is by far the indicator with the highest contribution, 20.66%. However, there remain other indicators that have not yet been associated with the pattern of deprivation. In this case, there are four indicators with a positive correlation whose greatest contribution is in the first principal component. These are food and energy on the labour functioning side, and leaks and temperature on the dwelling functioning side. In summary, all these indicators contribute to 78.85% of the first principal component.

The second pattern of deprivation is associated with the functioning of living in a safe environment. This pattern of deprivation is exactly in line with the functioning of the environment, since its three indicators are present: delinquency, pollution, and noises. In total, these three indicators account for 61.98% of the contribution of this principal component.

The third pattern of deprivation is related to the functioning of taking part in the life of the community. The two indicators with a correlation greater than 0.50 and positive are residence permit and medical attention. Additionally, discrimination is also part of this pattern of deprivation, since it presents a positive correlation, and its greatest contribution is found in this principal component. In this way, the third pattern of deprivation is formed by the same indicators as social functioning, that is, this pattern of deprivation is considered

to be the constitutive form of social exclusion. If the contribution of these three indicators is combined, a weighting of 60.97% is obtained.

In short, the weighting system based on patterns of deprivation is an excellent alternative to the exclusive use of the first principal component. In fact, it obtains a better explanatory power since it is capable of explaining 32.38% of the variance, compared to 21.10% of the first principal component. In addition, the patterns of deprivation provide deeper analytical sophistication.

4.4. The Instrumental Effects of Social Exclusion

Based on the above, the designed methodology allows calculating the instrumental effect of social exclusion on each indicator. Nevertheless, the third pattern of deprivation is the equivalent of a deprivation that is constitutive of social functioning. Therefore, it has no instrumental effects. However, it is considered to generate the weights of the other two patterns of deprivation. Table 8 shows the calculation of the instrumental effects of social exclusion (ι_i).

Table 8. Instrumental effects of social exclusion.

Indicators	κ_i	Standard Error	z-Value	p-Value	ω_i	ι_i
Educational lag	0.216	0.027	2.535	0.011	6.092	1.316
Income gap	0.422	0.035	4.596	0.000	12.220	5.157
Food	0.404	0.120	4.448	0.000	4.732	1.912
Energy	0.317	0.095	4.440	0.000	4.685	1.485
Delinquency	0.234	0.107	2.905	0.004	9.990	2.338
Pollution	0.263	0.118	2.951	0.003	10.106	2.658
Noises	0.260	0.116	2.969	0.003	11.160	2.902
Leaks	0.288	0.092	4.159	0.000	5.176	1.491
Services of the dwelling	0.408	0.122	4.436	0.000	9.334	3.808
Temperature	0.298	0.097	4.058	0.000	4.401	1.311

The highest structural coefficients (κ_i) are recorded in the income gap, food, and services of the dwelling indicators, with values above 0.40. However, when the structural coefficients are weighted (ω_i), there are some important changes. The income gap continues to be the indicator with the greatest value: 5.16%. Subsequently, there are other indicators with a result of more than 2%. These include services of the dwelling and environmental indicators. The rest of the indicators show a result between 1–2%. Of these, the food indicator has the highest value. In sum, the instrumental effects of social exclusion account for 24.38% of the patterns of deprivation.

5. Conclusions

This study provides an original methodology for measuring instrumental social exclusion from the capability approach. Nevertheless, it has been necessary to identify the most relevant instrumental effects of social exclusion suffered by residents of vulnerable areas in order to design the proposed methodology. To this end, the various ways in which differences in relational perspectives impact the lives of the residents of vulnerable areas have been examined. This generates a new concept: the structure of functionings.

The designed methodology combines structural equation modelling with the principal component analysis. Structural equation modelling has been used both to confirm that the structure of functionings is not false and to estimate the effect of instrumental social exclusion on a given indicator. In addition, each of the deprivations was weighted using a principal component analysis. For this purpose, an alternative weighting system based on patterns of deprivation has been proposed. By using patterns of deprivation, rather than the traditional weighting system based exclusively on the first principal component, this study has been given deeper analytical sophistication and better explanatory power.

　　　　Nonetheless, this research also has a practical application in the vulnerable areas of the city of Murcia. As a result, instrumental social exclusion contributes in a moderate way to explain the deprivations suffered by the residents in the vulnerable areas of the city of Murcia. This has a very important political implication since the fight against social exclusion. Not only has an impact on greater social integration, but also significantly reduces other deprivations of functionings that social exclusion causes indirectly. In fact, it is worth noting that the most intense instrumental effect, by far, affects the indicator related to income.

　　　　Social exclusion is incompatible with a developed welfare state. For this reason, public policies to combat social exclusion are essential. However, social exclusion not only represents a situation of social deprivation, but also has repercussions on deprivations of various kinds. As this study shows, the greatest effect is on income. This results in a reduced ability of the state to mobilise social security resources to address these system failures. In fact, state resources are necessary to implement such public policies, so looking the other way and failing to curb social exclusion creates a vicious circle of welfare state destruction. Furthermore, the methodology designed in this study can be applied in the evaluation of such public policies, with the intention of measuring the reduction of social exclusion and its effects on other deprivations.

　　　　The present methodology is universal and can therefore be used in vulnerable areas in other countries or regions. In this way, it would be possible to continue confirming the structural relationships of social exclusion that have been theorised, as well as to establish new ones. In summation, it would deepen the study of the concept of the structure of functionings.

　　　　Finally, it is worth arguing that this methodology is an approximation, since it has a serious operational limitation; that is, the focus has been placed on functionings and not on capabilities, which implies a loss of precision in the measurement. For this reason, it would be interesting to extend the methodology with even more complex models that assess not only functionings, but capabilities as well.

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