



Multidimensional Well-being in Switzerland: Towards New Synthetic Measures for Social Reporting

Katia Iglesias (University of Neuchâtel, Switzerland)
Tugce Beycan (University of Neuchâtel, Switzerland)
Christian Suter (University of Neuchâtel, Switzerland)
B. P. Vani (Institute for Social and Economic Change, Bangalore, India)

Work in progress
Do not cite nor distribute

Conference Paper presented at the 34rd IARIW General Conference,
Dresden, Germany
Session 7: Well-being,
August 21-27, 2016

Multidimensional Well-being in Switzerland: Towards New Synthetic Measures for Social Reporting

Katia Iglesias (University of Neuchâtel, Switzerland)¹
Tugce Beycan (University of Neuchâtel, Switzerland)
Christian Suter (University of Neuchâtel, Switzerland)
B. P. Vani (Institute for Social and Economic Change, Bangalore, India)

Abstract

Background

Well-being is a multidimensional concept and as such cannot be reduced to any economic performance indicator. The Swiss Social Report, edited every four years (cf Suter et. al 2009) documents and examines the quality of life and well-being in Switzerland in a multidimensional way.

In the framework of the current edition of the Swiss Social Report (to be published end of 2016) we aim to develop synthetic measures of multidimensional well-being and quality of life based on the five conceptual dimensions used in the Swiss Social Report: (1) the production and distribution of social goods (e.g. education, employment, income, wealth, poverty), (2) cultural diversity (e.g. nationalities and migration, languages, religion, media, leisure, lifestyles), (3) social integration and social cohesion (e.g. family and social networks, population and age structure, social security, equality and fairness, health, voluntary work, crime and insecurity), (4) political participation and integration (e.g. political trust, freedom, political mobilization, democracy), and (5) environment and ecological sustainability (e.g. use of environmental resources, energy consumption and climate change, environmental behavior, ecological awareness). A synthetic measure is expected to allow monitoring long-term social change, distinguishing between societal and individual well-being as well as combining objective and subjective indicators.

Nowadays, several subjective indicators were already proposed and evaluated in European and International reports during the last decade (OECD, 2011; Helliwell, Layard and Sachs, 2013) to assess societal well-being in reaction to objective indicators. To capture the multidimensional aspect of well-being in a robust and reliable operationalization, several challenges come up: the definition of relevant dimensions of well-being (which is related to the theoretical framework), the quality of the indicators chosen (depending on the available data) and how indicators are combined into a synthetic measure (based on the methodological approach).

Therefore, following the Swiss Social Report's theoretical model, this paper aims to develop and compare various measures of multidimensional well-being using different synthesizing methodologies,

¹ Katia Iglesias,
MAPS
Université de Neuchâtel
A. L. Breguet 1
CH-2000 Neuchâtel
Switzerland
Katia.Iglesias@unine.ch

in order to show their advantages and shortcomings, in particular regarding the monitoring of social changes.

Methods:

Different methodological approaches are proposed in the literature to construct and aggregate synthetic measures, notably measures based on Alkire and Foster's counting approach (2009). In our contribution, we propose to compare this later approach with a more recent method of partially ordered set theory (POSET). The POSET approach (posetic approach) developed by Maggino and Fattore (2011) and Fattore et al. (2012) points to important shortcomings of the counting approach, notably regarding weighting and aggregation issues, and proposes to measure and synthesize quality of life, well-being, inequality or other complex multidimensional phenomenon on the basis of ordinal data. The objective is to create a synthetic statistical measure providing different profiles from large micro data sets through evaluation processes. The comparison and evaluation of different profiles is obtained by applying the partially ordered set theory (POSET). The main advantages of the POSET methodology compared to Alkire and Foster's counting approach is that the assessment of profiles does not require any aggregation process.

The development of these two multidimensional measures was done using the Swiss Household Panel (SHP) data, a longitudinal yearly panel data survey available since 1999. The SHP is a comprehensive survey addressing a broad range of life domains and topics that allow us to include all five conceptual dimensions (and their related life domains) of well-being as defined by the Swiss Social Report. Both measures, the POSET based profiles and the Alkire and Foster's counting approach, will cover the five dimensions of the Swiss Social Report. These measures will be applied to 2013 Swiss Household Panel (ordinal data) by combining both objective and subjective indicators. All the analyses will be performed using partial order R package PARSEC (Arcagni and Fattore, 2015).

The main contribution of the proposed paper is to evaluate two different synthetic approaches to measure multidimensional well-being, the counting and the posetic approaches. The results will demonstrate the advantages and shortcomings of each two approaches, the impact of using both objective and subjective indicators, and will present well-being profiles by household structures in Switzerland.

The proposed contribution addresses topics of session 7 on well-being.

Key words: well-being, quality of life, POSET, counting approach, Switzerland, social reporting, synthetic measures.

1. Introduction

Well-being is increasingly conceptualized and measured from a multidimensional and longitudinal perspective both by academia and national and international statistical agencies in order to provide policy makers and the general public with the necessary tools for monitoring social change. Furthermore, the traditional income-based economic welfare indicators to assess happiness do not seem satisfactory any more. Nowadays, subjective measures of well-being are frequently presented as substitutes for, or complements to, the traditional welfare measures (Deaton, 2008; Kesebir & Diener, 2008). Several subjective indicators have already been proposed and evaluated in European and International reports during the last decade (OECD, 2011; Helliwell, Layard and Sachs, 2013) to assess societal well-being in reaction to objective indicators. It is also recognized that individual's evaluations about their lives provide relevant information for policy decisions (Diener and Seligman, 2004) and information about their quality of life (Stiglitz et al., 2009).

To capture the multidimensional aspect of well-being in a robust and reliable operationalization, several challenges come up: the definition of relevant dimensions of well-being, the quality of the indicators chosen and how indicators are combined into a synthetic measure. According to several guidelines of composite indicator (CI) construction, the first step consists in defining the theoretical framework that will provide the basis for the selection and combination of variables (OECD, 2008). The quality of CI depends on the quality of the theoretical framework, but also on the operationalization of the concepts (variable/item selections) and on the quality of the available data. This approach is called a top-down approach of developing synthetic measures (from theory to data) by opposition to a bottom-up (from data to theory) or bidirectional approaches (pragmatic approaches) (Michalos, Sharpe, & Muhajarine, 2010).

Therefore, in a top-down approach and following the Swiss Social Report's (SSR) theoretical model, this paper aims to develop and compare various objective and subjective measures of well-being. We will compare an uni-dimensional objective income-based indicator to multidimensional well-being indicators integrating objective and subjective information operationalizing the SSR theoretical model.

Once the theoretical framework is defined and the variables selected, the question of combining the information arises. Indeed, presenting the results using dashboards containing a large number of indicators does not easily allow to highlight changes, and different indicators can send contradictory signals. Synthetic measures of multidimensional concepts such as well-being are, therefore, needed. A usual way to proceed is using aggregation processes (sum, mean, etc.) (Eurostat, 2015; OECD, 2008). This point is controversial step that can affect the quality of the CI (Booyesen, 2002; Saltelli, 2007), particularly when including ordinal measures.

In order to test the impact of aggregation we will compare top-down methodological approaches: the Alkire and Foster counting approach (AF) and the posetic approach (POSET). The *AF* methodology (Alkire & Foster, 2009) combines two methods. On the one hand, it uses a method based on the counting approach which counts the number of (weighted) people's deprivations (in terms of well-being), and on the other hand, it uses an aggregation process to obtain an overall deprivation rate (Alkire & Santos, 2013). The second approach, POSET, was developed in order to solve a major construction issue of composite indicators (Maggino & Fattore, 2011), namely the aggregating issue. It uses the partial order theory

which allows to identify the binary relationship between two objects in a set which can be ordered. Specifically, it enables to describe properly the relation between ordinal objects based on profiles and evaluation process (Fattore, 2015) based on the same dual cutoff as the AF.

This paper provides a systematic comparison of objective, subjective and mixed objective and subjective indicators of well-being within two top-down methodological approaches (AF and POSET) using the same theoretical framework and the same data. Our conceptual framework is based on the Swiss Social Report theoretical framework for three main reasons. Firstly, the Swiss Social Report develops a social reporting perspective with a strong policy-making orientation and also an orientation that highlights the need to simplify complex developments and structures (and thus to use synthetic measures). Secondly, the Swiss Social Report explicitly defines its theoretical framework, which is essential for our top-down approach. Thirdly, the Swiss Social Report has been created within the framework of specifically established longitudinal data sets, notably the Swiss Household Panel, a large comprehensive longitudinal survey measuring the living conditions and the quality of life of individuals and households.

The paper is structured as follows. We start by two theoretical sections, in which we respectively describe the theoretical framework used to define well-being (section 2) and present the background of the two compared methodological approaches (section 3). In section 4, we present our approach's operationalization, the data used and the statistical analyses. In section 5, we presented our results including the validation of the theoretical model; the results by approaches; and the results between approaches. Finally, in section 6, we discuss the impact of using objective or subjective indicators and the differences and similarity between approaches.

2. Conceptual framework: a social reporting perspective of multidimensional well-being and deprivation - the Swiss Social Report

Published every four years the Swiss Social Report is documenting and monitoring social change and well-being in Switzerland from a multidimensional and comprehensive social reporting perspective (Suter et al., 2009; Bühlmann et al., 2013). In accordance with the recent body of literature (Abbott, Wallace, & Sapsford, 2015; Glatzer, Camfield, Møller, & Rojas, 2015; Michalos, 2014; OECD, 2015) the Swiss Social Report conceptualizes well-being as a multifaceted phenomenon, including various life domains, different components and system levels (e.g. individual and societal well-being), as well as subjective and objective aspects. In our contribution, we shall also refer to the concept of deprivation, which has been developed within the context of poverty research (e.g., Townsend, 1979; Boarini & Mira d'Ercole, 2006). Although well-being is more than just the positive counterpart of deprivation, both concepts share the common key characteristic of multidimensionality (including the combination of objective and subjective living conditions) – and, therefore, present the same basic challenge of how to synthesize multidimensional information.

Inspired by Parsons' AGIL (Adaptation, Goal-attainment, Integration, Latency) scheme (Parsons, 1970) the Swiss Social Report distinguishes five core areas covering the basic subsystems of human society, namely a socio-economic subsystem ("production, distribution and consumption of social goods"), a cultural subsystem ("cultural diversity"), a social subsystem ("social integration"), a political subsystem ("political shaping") and an ecological

subsystem (environment). Each of these subsystems is itself structured into various interrelated sub-areas and dimensions. Thus, the socio-economic subsystem dealing with the production, distribution and consumption of social goods – including material goods (consumer goods, monetary goods, economic capital), symbolic goods (knowledge, human capital, cultural competencies), positional and institutional goods (hierarchical positions in organizations, firms, administrations and institutions) – is composed of four sub-dimensions constituting the nucleus of social stratification in contemporary societies: educational attainment and occupational positioning, the employment situation, the earnings, income and financial situation, as well as the work-life balance. Each of these dimensions is operationalized in the Swiss Social Report by 3-4 variables.²

The various sub-areas and dimensions within the five core areas are, of course, not independent of each other. Concerning the four dimensions within the subsystem of social goods, for instance, the level of educational attainment provides access to the labor market, employment, occupational earnings and income. Empirical research on social stratification in Switzerland demonstrates that the interrelationship among the dimensions of the so-called “meritocratic triad” (educational attainment, employment, income) is moderate, i.e. with correlations around 0.40 (see Levy, Joye, Guye, & Kaufmann, 1997; Stamm, Lamprecht, Nef, Joye, & Suter, 2003). Similarly, the work-life balance is expected to be related to the quality of life at work (e.g. employment security, working conditions) and likewise to the hierarchical occupational position and the income level.

The Swiss Social Report contains 75 indicators in all, divided into the five core areas and subsystems. Up to now no attempt has been made to construct summary indicators or synthetic measures based on all or a subset of the 75 indicators. For theoretical and practical reasons such synthetic measures should be conceptualized on the level of the five subsystems. The present paper, therefore, focuses on one of the five core areas of the Swiss Social Report, the domain of production and consumption of social goods, conceptualized by the four well-being dimensions already described above: (1) the work-life balance, (2) the financial situation, (3) the employment situation, and (4) the educational and occupational positioning.

3. Methodology

As mentioned earlier, we chose two different methodologies to construct synthetic measures well-being (namely AF and POSET). As the principle of computation underlying each methodology and their assumptions differ substantially, we will present them in this section. This will enable us to compare the different approaches and to identify their respective strengths and weaknesses.

² The subdimensions of the other four core areas are: *cultural diversity*: (1) ethnic and migration-related aspects of diversity, (2) linguistic diversity, (3) religious diversity, (4) diversity in cultural consumption, cultural practices, leisure and sports activities; *social integration*: (1) integration and disintegration in the sphere of the couple and family life, (2) social contacts outside the family and the household (including intra- and intergenerational contacts), (3) health and healthcare, (4) social security and social policies, (5) social integration through volunteering, (6) deviant behavior (e.g., crime); *political shaping*: (1) political opinions, political concerns and political trust, (2) political activities, political participation and political mobilization, (3) relationships between political elites and the population, (4) relationships between national government and the population; *environment*: (1) Use of, and burden on, environmental resources, (2) perception of environmental problems, (3) environmental (ecological) behavior, (4) environmental policies.

3.1 AF

Measurement of multidimensional deprivation such as well-being involves defining a set of relevant indicators, identifying the deprived units which compose it and aggregating these units (Sen, 1976). In our research, the aggregation process corresponds to the combination of different indicators of deprivation at the individual level – this aggregation process could be further carried out to form an aggregate index at the societal level (e.g. country, region). Aggregation can be carried out using the union approach i.e., including all those deprived on at least one dimension, or using intersection approach i.e., including only those deprived on all dimensions. This aggregation process can be used either in a social welfare approach (Bourguignon & Chakravarty, 2003, 2009; Tsui, 2002) or in a counting approach (Alkire & Foster, 2009; Expert group on poverty statistics Rio Group, 2006; Streeten, Burki, Haq, Hicks, & Stewart, 1981).

Generally, the counting approach is based on the counting principle (arithmetically). Since the 1970's (Alkire et al., 2015) this approach is used by scholars conducting poverty research to identify the poor because most poverty data available are categorical or ordinal. Following that, Alkire and Foster (2009) introduced a specific poverty measurement methodology based on the counting approach. Their methodology offers several measures of multidimensional deprivation (M_α) based on the Foster-Greer-Thorbecke (FGT) class of measures (1984), which is one of the most commonly and widely used monetary (e.g. income) poverty measures – more specifically, it also allows to measure intensity and severity. Overall, AF methodology provides a flexible way of measuring deprivation in a multidimensional framework, notably in ordinal data case and enables decomposability (e.g. by gender, region) – which can be useful to measure specific policy targets. Moreover, the AF approach is easy to calculate and its use is very intuitive.

In accordance with the counting principle, the AF methodology provides several measures of deprivation M_α (with $\alpha=0$: adjusted headcount ratio; $\alpha=1$: adjusted deprivation gap; and $\alpha=2$: adjusted squared deprivation gap) by following the two successive phases of identification and aggregation.

For the identification of the individuals suffering from multiple deprivations, a dual cutoff system is used with z being the first cutoff, and k the second one. In the first step, if we let Y , an achievement matrix of size $n \times d$ with n the number of persons and d the number of achievements (achievement can be considered as a possession of goods, accessibility to goods and services, life satisfaction) and z_j the first cut off (threshold level) below which a person is considered to be deprived in achievement j , and we apply z_j to Y , we then obtain a deprivation matrix g^0 with ones and zeros identifying the deprived and non-deprived persons on each achievement. Once g^0 obtained, by summing the elements of each row, we obtain C a vector column of size $n \times 1$ containing the number of deprivations (number of deprived achievement) for each individual i . Therefore, $g^0 = g^0_{ij} = 1$ if $y_{ij} < z_j$; otherwise equal to zero for $j = 1, \dots, d$, and for $i = 1, \dots, n$.

In the first step, we have identified the number of deprivations for an individual; in the second step, the second cutoff k_i allows us to identify people suffering from multiple deprivations. Following the first cutoff, second cutoff level can be chosen between two values defined in one extremity by the union method (i.e., deprived in at least one achievement) and to the other extremity by the intersection method (i.e., deprived in all achievement), thus k ranged between 1 and d . Consecutively, we obtain an identification function $\rho_k(y; z)$ which is equal to

one when $c_i \geq k$ and 0 when $c_i < k$. This identification function identifies multi-dimensionally deprived people.

Having identified a person as suffering from multiple deprivations, the next step is to compute $g^0(k)$, $g^1(k)$ (normalized gap matrix) and $g^2(k)$ (squared gap matrix), three censored matrices containing only information for the deprived units, where $g^\alpha(k) = \left(\frac{z_j - y_{ij}}{z_j}\right)^\alpha$ if $y_{ij} < z_j$ and $c_i \geq k$, otherwise 0. The normalized gap matrix gives a picture of the depth of deprivation for each statistical unit in each dimension and the square of the normalized gap (squared gap matrix) highlights larger deprivations.

The headcount ratio (H) is the incidence of multidimensional deprivation. It is obtained by dividing the number of multi-dimensionally deprived people (q with $l = 1, \dots, q$) by the total number of people in the population (n).

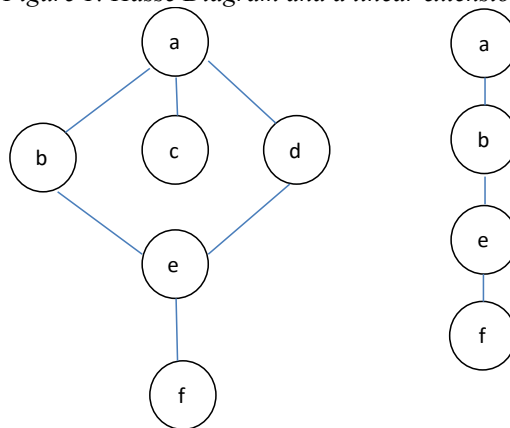
3.2 POSET

The posetic (partially ordered set) approach offers a practical tool for ranking analysis in different scientific disciplines such as sociology and environmental sciences (e.g. Annoni & Brüggemann, 2009; Brüggemann & Carlsen, 2006; Fattore, Maggino, & Colombo, 2012; Patil & Taillie, 2004). Based on partial order theory; it puts in evidence the binary relationship between two objects in a set which can be ordered (decreasing or increasing) or not (incomparable objects)³.

The Hasse diagram (Figure 1, left) allows to visualize the partial order set; where each object is in a node (circle), and edges are placed between two comparable objects. To draw it, two rules have to be followed: (i) if x and $y \in X$ (set), and x inferior or equal to y ; then the node of y should be above those of x ; and (ii) if y covers x then an edge should be inserted between the nodes of x and y (Fattore, 2014). In Figure 1 (left), we can see that objects $a, b, e,$ and f are comparable objects (a decreasing order from a to f), and that the object c and d are incomparable (they are not connected to each other with an edge).

The partial order has three axioms: reflexivity, anti-symmetry and transitivity. We suppose that three objects a, b, c form a finite set X where $X = \{a, b, c\}$. To show the binary relationship between two objects, we use the symbol \leq . According to reflexivity, $a \in X: a \leq a$; according to anti-symmetry, if $a \leq b$ and $b \leq a$ then $a = b$; and according to transitivity, if $a \leq b$ and $b \leq c$ then $a \leq c$. Therefore, objects fulfilling these axioms are called *comparable* and form a *chain* (on the contrary, when they are incomparable, they form an *anti-chain*).

Figure 1: Hasse Diagram and a linear extension



³ Objects are therefore called *partially ordered*.

Based on partial order theory, Fattore and his colleagues (Fattore, 2015; Fattore et al., 2012) have developed a new posetic approach with a specific *evaluation* process (for technical details see Fattore, 2015). This evaluation process is particularly suitable for ordinal data because it allows both to produce linear extension l from chain and anti-chain and to analyze the multiple deprivations based on profile by establishing the individual deprivation degree for each (achievement) profile. Technically, linear extension reflects a linear order (Figure 1, right side) with all l forming an *extension of poset* \mathbf{P} , and a (achievement) profile⁴ is the sequence of a unit's indicators' scores. Therefore, all profiles construct an achievement poset Π . The total number of profiles is equal to the product of the number of modalities of each indicator. A profile p can be worse than another profile q if and only if all of her (p) indicators' scores are lower than those of q ; and conversely.

As in traditional multiple deprivation studies, deprivation lines are also defined here and they are computed using an AF methodology (dual-cutoff process for identifying the multidimensional deprived units, i.e. multidimensional deprived profiles). Profiles are evaluated according to deprivation lines (DL) also called as threshold profiles: those of which are on DL or under DL correspond to the profiles "totally deprived", and the rest of the profiles is divided into two groups, the "totally non-deprived" individuals and the "partially deprived" individuals. Each profile is assessed with a deprivation degree (between 0 and 1) as a result of the identification function $\text{idn}: \Pi \rightarrow [0, 1]$: (i) order consistent: if a profile q covers¹ a profile p then this implies that $\text{idn}(q) \leq \text{idn}(p)$; (ii) threshold consistent: each single threshold profile has a score 1 (deprivation degree).

In \mathbf{P} , the distance of each profile to DL can be obtained. Fattore's method yields a binary classifier $\text{idn}_l(\cdot)$ to assign 0 or 1 to each profile p in each linear extension l in \mathbf{P} . If a profile is located at the thresholds, or under the thresholds in \mathbf{P} , then the profile is identified as 1; otherwise as 0. Therefore, a deprivation degree for each profile is the number of cases in \mathbf{P} , where a profile is on DL or is under DL, divided by the total number of linear extensions (for example if there are three linear extensions and a profile p is under the threshold twice, the deprivation degree for that profile is 2/3). The identification function can be described as follows:

$$\text{idn}(p) = 1 / (|\Omega(\Pi)|) * \sum_{l \in \Omega(\Pi)} \text{idn}_l(p)$$

4. Data and models

In this section, we first present the data and variables used to operationalize our theoretical framework, and the variables used to test the construct validity, i.e. the relationship between measures of well-being and variables of the field. Second, we present the statistical analyses and the different models constructed in each approach.

4.1 Data

In order to measure multidimensional well-being according to our theoretical framework, we used the Swiss Household Panel (SHP) dataset. SHP is a longitudinal survey of households and persons living in Switzerland. It has been conducted on a yearly basis since 1999. In 1999, 5,074 households were randomly selected, which represents 12,931 household members (7,799 of these members passed an individual interview (SHPI)). These individuals get interviewed each year. In 2004, a second sample (SHPII) of 2,538 households (6,569 household members) was added to the first one and in 2013, a third one (SHPIII) of 4,093 households (9,945 household members).

⁴ Each statistical measurement unit (e.g. individual) is associated with an achievement profile.

In order to test the three methodologies mentioned earlier, we selected the active household members (defined as active occupied under working status) aged between 18 and 65 years in the year 2013⁵ from SHPI and SHPII. A total of 3,823 active people answered the twelve interview questions used to operationalize the theoretical framework. Three supplementary CI were computed in order to test the construct validity.

The theoretical framework defines well-being as a multidimensional concept with four dimensions. Each dimension is operationalized through one to six variables (depending on the methodology and on the models tested). For more details on the questions asked and on the answers' modalities see Appendix 1.

The four dimensions are defined as follows. Dimension 1: *Conciliation professional/private life* composed by Interference work/private activities, Exhausted after work, Difficult to disconnect from work. Dimension 2: *Financial situation of Household (HH)* composed by Satisfaction with financial situation, Assessment of income and expenses, Arrears of payments, Financial situation manageable, Material deprivation, Household income. Dimension 3: *Employment situation* composed by Job security, Risk of unemployment, Satisfaction with work conditions. Dimension 4: *Educational and occupational position* composed by Education, Swiss socio-professional category of main job (CSP).

4.2 Statistical analyses

Before presenting the different synthetic indicators computed with the two methodological approaches, we have to validate the theoretical framework of the first domain of the SSR. Therefore, we will first present in this section the analysis used for the validation process, then the indicators computed with the AF approach and finally the indicators computed with the POSET approach.

4.2.1 Validation of the theoretical framework

To validate our theoretical, we will run a confirmatory factor analysis (CFA) on the 14 selected variables. CFA is a multivariate statistical method used to confirm or reject a measurement theory by testing if the data fit the hypothesized measurement theory. It estimates the common factors (latent variable) and specific factors (specific to each question) through the shared variance, thus reducing the measurement error.

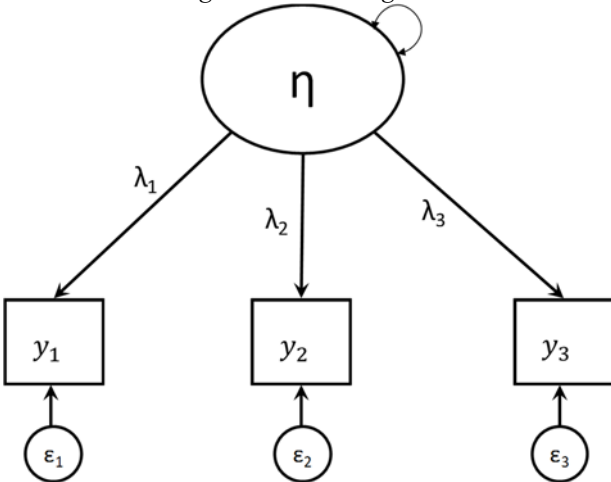
For p continuous manifest variables \mathbf{Y} , the model can be written as: $\mathbf{Y} = \mathbf{\Lambda}\boldsymbol{\eta} + \boldsymbol{\epsilon}$, where $\boldsymbol{\eta}$ is the latent variable (the true score) of size $q \times 1$, with q the number of latent variables), $\boldsymbol{\epsilon}$ the measurement error (of size $p \times 1$) and $\mathbf{\Lambda}$ the factor loadings (of size $p \times q$). By assumption ϵ_j , $j = 1, \dots, p$, have zero mean and are uncorrelated with each other and with the latent variables, and $\boldsymbol{\eta}$ and ϵ_j are normally distributed.

Figure 2 shows a path diagram of a latent variable (represented by circles) with three manifest variables (represented by rectangles). The unidirectional arrows represent linear relationships and the bi-directional arrows represent either the variances or covariances, depending on the fact of having both ends on the same element of the diagram or not. Furthermore, when we want to measure a concept, such as well-being, each manifest variable is not necessarily represented equally within the concept, but by different weight named loadings (λ_j). As

⁵ The individual survey was administrated to SHPIII's participants only from 2014 onwards.

mentioned above, ϵ_j represents the measurement error, but it also constitutes the unique part (or the uniqueness) of the manifest variable.

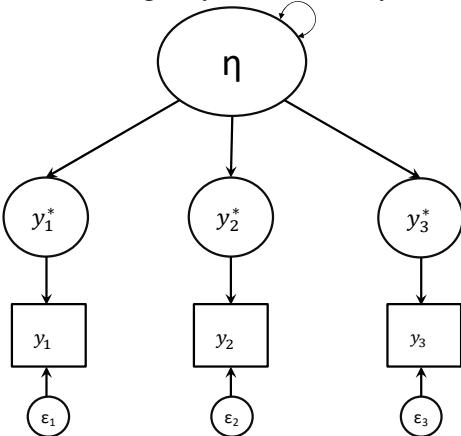
Figure 2: Path diagram



In a CFA, researchers will develop hypotheses based on her/his theoretical framework about which latent variable underlies which manifest variable and therefore constrains some elements of Λ (λ_j) to be equal to 0. The free λ_j and the constraints λ_j will represent the expected theoretical link (under the null hypothesis) and the data will be confronted with the theoretical constrained model. The model will then give us back measure of goodness of fit (GoF) that will inform us to which extent the data fit the theoretical model. But as we want to stay under the null hypothesis, a good fit does not mean that the model is the right one or even that it explains a large percentage of variance within the data. A “good model fit” only indicates that the model is plausible (Schermelleh-Engel, Moosbrugger, & Müller, 2003).

In the case of well-being measurement, the manifest variables are often measured on ordinal scales. In this case, as shown by Muthén (1984) and others (e.g. Holgado-Tello, Chacón-Moscoso, Barbero–García, & Vila–Abad, 2010; Jöreskog & Sörbom, 1996) working with a polychoric correlation matrix instead of a Pearson correlation matrix yields more robust and consistent estimators. Furthermore, in the ordinal case, we have to make the assumption that the variables y_j^* , underlying the categorical variables y_j , are jointly normally distributed continuous variables and that the CFA model is $y_j^* = \Lambda\eta + \epsilon_j$ (e.g. Jöreskog, 1970; Lee, Poon, & Bentler, 1990; Muthén, 1984). This assumption can be schematically represented by a new path diagram (see Figure 3).

Figure 3: Path diagram for ordinal manifest variables



The latent response variables are related to the observed categorical responses via a threshold relationship (Forero, 2009): $y_j = k$ if $\tau_{j,k} < y_j^* < \tau_{j,k+1}$ where $\tau_{j,0} = -\infty$ and $\tau_{j,m-1} = +\infty$ with m response alternatives and $k = 0, \dots, m - 1$. An individual i with a latent value between $\tau_{j,k}$ and $\tau_{j,k+1}$ will choose the response k . This implies that distribution of y_j^* is only determined up to a monotonic transformation (Luo, 2011).

We run a CFA based on the polychoric correlation matrix (weighted least squares estimation method (WLSMV) (L. K. Muthén & Muthén, 2010)) with Mplus 7. In order to test our theoretical framework, each manifest variable is related only to one latent variable, the other loadings being constrained to be equal to 0.

We tested the GoF of our model using the Root Mean Square Error of Approximation (RMSEA) and Weighted Root Mean Square Residual (WRMR, recommended for ordinal data (Yu & Muthén, 2002)). They were checked jointly because of the sensitivity to miss-specified factor loading for the RMSEA (Hu & Bentler, 1998). The Tucker Lewis index (TLI) and the Comparative Fit Index (CFI) were also presented since they are less affected by sample size (Hu & Bentler, 1995, 1998, 1999; Marsh, Balla, & McDonald, 1988).

Models were considered to present “good fit” if the RMSEA was <0.05 , [28], WRMR <1.00 (Yu & Muthén, 2002), TLI >0.97 and CFI >0.97 (Schermelleh-Engel et al., 2003). Models were considered to have “acceptable fit” if RMSEA were between 0.05 and 0.08 and TLI and CFI between 0.95 and 0.97.

We obtained four synthetic measures, i.e. four latent factors measuring respectively *Conciliation professional/private life*, *Financial situation of HH*, *Employment situation*, and *Educational and occupational position* with a standard normal distribution.

4.2.2 AF

We constructed 6 indicators (model 1 to 6). The first cutoff is defined in Table 1 and represents the deprived modalities for each variable.

Table 1: First cutoff (for AF and POSET methodologies)

Dimensions	Variables	Deprived modalities
Dim 1	<i>Interference work/private activities</i>	6-10
	<i>Exhausted after work</i>	6-10
	<i>Difficult to disconnect from work</i>	6-10
Dim 2	<i>Job security</i>	a bit insecure or very insecure
	<i>Risk of unemployment</i>	5-10
	<i>Satisfaction with work conditions</i>	0-5
Dim 3	<i>Satisfaction with financial situation</i>	0-5
	<i>Assessment of income and expenses</i>	HH eats into its assets and savings, or HH gets into debts
	<i>Arrears of payments</i>	Yes
	<i>Financial situation manageable</i>	0-5
	<i>Material Deprivation</i>	2 and more privation
Dim 4	<i>Household income</i>	Relative monetary poverty
	<i>Educational level</i>	incomplete compulsory school, compulsory school, elementary vocational training, domestic science course, 1-year school of commerce, and general training school
	<i>Occupational status</i>	unqualified non-manual and manual workers

See appendix 2 for operationalization of dimensions

In order to follow the principle of parsimony suggested by the OECD (2008) only one indicator per dimension was taken into consideration for the three first models. Since the different indicators by dimension are expected to operationalize the same construct, they can be seen as somewhat interchangeable. Therefore, we selected three models out of the 108 possible models corresponding to our theoretical framework with one indicator per dimension. The first model is defined by the following variables: Interference work/private activities, Job security, Assessment of income and expenses and Educational level; the model 2 by the following variables: Difficult to disconnect from work, Risk of unemployment, Satisfaction with financial situation and Occupational level; and the model 3 by the following variables: Difficult to disconnect from work, Risk of unemployment, Household income and Occupational level. The second cutoff for the three for the three first model is defined at 2/4.

Table 2: Variables recoding for POSET models (second cutoff 2/4)

Dimensions	Variables	Regrouping modalities
Model 1		
<i>Dim 1</i>	<i>Interference work/private activities</i>	1) 6-10, 2) 5, and 3) 0-4
<i>Dim 2</i>	<i>Job security</i>	1) very insecure, 2) a bit insecure, 3) quite secure, and 4) very secure
<i>Dim 3</i>	<i>Assessment of income and expenses</i>	1) HH eats into its assets and savings, HH gets into debts, 2) HH spends what it earns, and 3) HH saves money
<i>Dim 4</i>	<i>Educational level</i>	1) incomplete compulsory school, compulsory school, elementary vocational training, domestic science course, 1 year school of commerce, and general training school, 2) apprenticeship (CFC, EFZ), full-time vocational school, bachelor-maturity, vocational high school with master certificate, federal certificate, technical or vocational school, and vocational high school ETS, HTL etc., 3) university, academic high school, HEP, PH, HES, FH
Model 2		
<i>Dim 1</i>	<i>Difficult to disconnect from work</i>	1) 6-10, 2) 5, and 3) 0-4
<i>Dim 2</i>	<i>Risk of unemployment</i>	1) 6-10, 2) 5, 3) 1-4, and 4) 0
<i>Dim 3</i>	<i>Satisfaction with financial situation</i>	1) 0-5, 2) 6-7, and 3) 8-10
<i>Dim 4</i>	<i>Occupational level</i>	1) unqualified non-manual and manual workers, 2) qualified non-manual professions and manual professions, and, 3) top management, liberal professions, other self-employed, academic professions and senior management, intermediate professions.
Model 3		
<i>Dim 1</i>	<i>Difficult to disconnect from work</i>	1) 6-10, 2) 5, and 3) 0-4
<i>Dim 2</i>	<i>Risk of unemployment</i>	1) 6-10, 2) 5, 3) 1-4, and 4) 0
<i>Dim 3</i>	<i>Household income</i>	1) Relative monetary poverty, 2) At risk of relative monetary poverty, and 3) middle income class and upper income class
<i>Dim 4</i>	<i>Occupational level</i>	1) unqualified non-manual and manual workers, 2) qualified non-manual professions and manual professions, and, 3) top management, liberal professions, other self-employed, academic professions and senior management, intermediate professions.
Model 4		
<i>Dim 3</i>	<i>Household income</i>	1) Relative monetary poverty, 2) At risk of relative monetary poverty, and 3) middle income class and upper income class
	<i>Deprivation</i>	1) 2-9, 2) 1, and 3) 0

The model 4, only contains the economic dimension of well-being in order to compare multidimensional subjective measures to an economic uni-dimensional measure of well-being. It contains the following variables: Household income and material deprivation with a second cutoff defined at 1/2.

The last two models (model 5 and 6) are based on the 14 variables of our theoretical framework, but, additionally, we tested two different second cutoff. These two models were computed to compare parsimonious models to more reliable models that used several measures by dimension. The second cutoff of model 5 is defined at 7/14 and for model 6 at 5/14.

4.2.3 POSET

To measure multidimensional well-being by using partial order theory, we employed Fattore's posetic approach (2015). Until now, Fattore's posetic approach is suitable for a limited number of variables and modalities because of computational reasons. This issue restricted the amount of information that could be introduced into the model. Therefore, in order to be able to use this methodology to construct a multidimensional well-being measure, we only will use the models 1 to 4 define for the AF approach.

Based on the 4 models defined, we recoded the four sets of variables as defined in Table 2. In the three first models, the 4 variables have respectively 3, 4, 3, and 3 modalities, which corresponds to 108 possible profiles; with the most disadvantaged profile being 1/1/1/1 and the most advantaged profile being 3/4/3/3 (the highest scores in each recoded variable). The first cutoffs correspond to those defined for AF, and the second cutoff corresponds to 2/4. The model 4 is only composed by 2 variables with 3 modalities, which corresponds to 9 possible profiles; with the most disadvantaged profile being 1/1 and the most advantaged profile being 3/3. The first cutoffs correspond to those defined for AF, and the second cutoff corresponds to 1/2. The R package PARSEC was used to compute the POSET indicators.

5. Results

In this section, we first present descriptive statistics of the variables operationalizing the theoretical framework (appendix 4) and the psychometric properties (GoF) of our theoretical framework. In a second time, we present the headcount ratio for the 6 models of AF and their association with the four dimensions of the theoretical framework, and third, we present the deprivation degree for the four models of POSET and their association with the four dimensions of the theoretical framework.

5.1. Descriptive statistics and CFA results

Descriptive statistics for each variable operationalizing the theoretical framework are presented in Table 3.

Results regarding the CFA are presented in Table 4. It can be seen that the four dimensions' model of well-being have an acceptable GoF. The loadings of the model are quite high (in absolute values): 0.63 to 0.75 for the first dimension measuring the difficulty to conciliate the professional and private life, 0.58 to 0.70 for the second dimension measuring the (negative) employment situation, 0.46 to 0.90 for the third dimension measuring the (positive) financial situation of households, and 0.71 to 0.93 for the fourth dimension measuring the educational and occupational position.

Table 3: Descriptive statistics of the original data

Variables	Median [25%;75%] or %	Deprived* (%)
<i>Interference work/private activities</i>	4 [2; 6]	29.3
<i>Exhausted after work</i>	5 [3; 6]	35.4
<i>Difficult to disconnect from work</i>	3 [1; 5]	20.5
<i>Job security</i>	Quite secure [very secure; quite secure]	9.1
<i>Risk of unemployment</i>	1 [0; 3]	17.1
<i>Satisfaction with work conditions</i>	8 [7; 9]	9.0
<i>Satisfaction with financial situation</i>	8 [7; 9]	14.4
<i>Assessment of income and expenses</i>	Save money [save money; spends what it earns]	5.8
<i>Arrears of payments (yes)</i>	9.2%	9.2
<i>Financial situation manageable</i>	8 [7; 9]	16.5
<i>Material deprivation</i>	0 [0; 0]	6.8
<i>Household income</i>	3 [3; 3]	5.41
<i>Educational level</i>	Bachelor/maturity [apprenticeship (CFC, EFZ); vocational high school ETS, HTL]	11.0
<i>Occupational status</i>	intermediate professions [academic professions and senior management; qualified non-manual professions]	7.9

*Unidimensionally deprived based on the first threshold of AF and POSET approaches.
Source: Swiss Household Panel 2013.

Table 4: Four dimension of well-being: CFA Results

Items	Well-being			
	Dim 1: Conciliation professional / private life	Dim 2: Employment Situation	Dim 3: Financial situation of household	Dim 4: Educational and occupational position
Interference on work cond. on private activities	0.704	--	--	--
Exhaustion after work	0.760	--	--	--
Difficulty to disconnect after work	0.634	--	--	--
Employment stability	--	0.660	--	--
Risk of unemployment	--	0.700	--	--
Satisfaction with work conditions (cond.)	--	-0.577	--	--
Satisfaction with HH financial situation	--	--	0.843	--
HH saving economic situation	--	--	-0.722	--
Financial situation manageable	--	--	0.901	--
Payment delay	--	--	0.695	--
Household income	--	--	0.464	--
Material deprivation	--	--	-0.726	--
Education level	--	--	--	0.933
Occupational status	--	--	--	-0.708
N	3823			
RMSEA	0.078			
CFI	0.951			
TLI	0.937			

RMSEA: Root Mean Square Error of Approximation, CFI: Comparative Fit Index; TLI: The Tucker Lewis index
Good Goodness of fit (GoF): RMSEA < 0.05, CFI > 0.97; TLII > 0.97; And acceptable GoF: RMSEA < 0.08, CFI > 0.95, TLI > 0.95.
Source: Swiss Household Panel 2013.

5.2. AF results

Concerning the AF approach, we report the number of deprived persons (in %) in Table 5.

Table 5: Distribution of deprivation by models (AF)

Levels of deprivation	Deprivation degree (%)					
	Model 1	Model 2	Model 3	Model 4	Model5	Model6
Deprived	8.7	12.8	9.4	10.6	3.3	10.4

Model 1: Interference work/private activities, Job security, Assessment of income and expenses, and Educational level; Model 2: Difficult to disconnect from work, Risk of unemployment, Satisfaction with financial situation, and Occupational level; Model 3: Difficult to disconnect from work, Risk of unemployment, Household income, Occupational level; Model 4: Household income, Material deprivation; Model 5: 14 variables with second cutoff defined at 7/14; Model 6: 14 variables with second cutoff defined at 5/14.

Furthermore, the items selection and the number of items in the models seem to affect the contribution of each dimension to the identification of the multidimensionally deprived people (Table 6). In the first model, 80% of the multidimensional deprived people are deprived in the first dimension, and only one third are deprived in the household financial situation dimension. In the second model, the deprived persons are equally deprived on the first three dimensions. In the third model, the contribution is more related to the first two dimensions. As the fourth model is only constituted by the variables of the third dimension, 100% of the deprived persons are deprived in the financial dimension. For the model 5 and 6, cutoff does not much affect the contributions of dimensions and in the model 3, the first three dimensions are the main important dimensions in terms of contribution to multidimensional deprivation.

Table 6: Contribution to deprivation by dimension

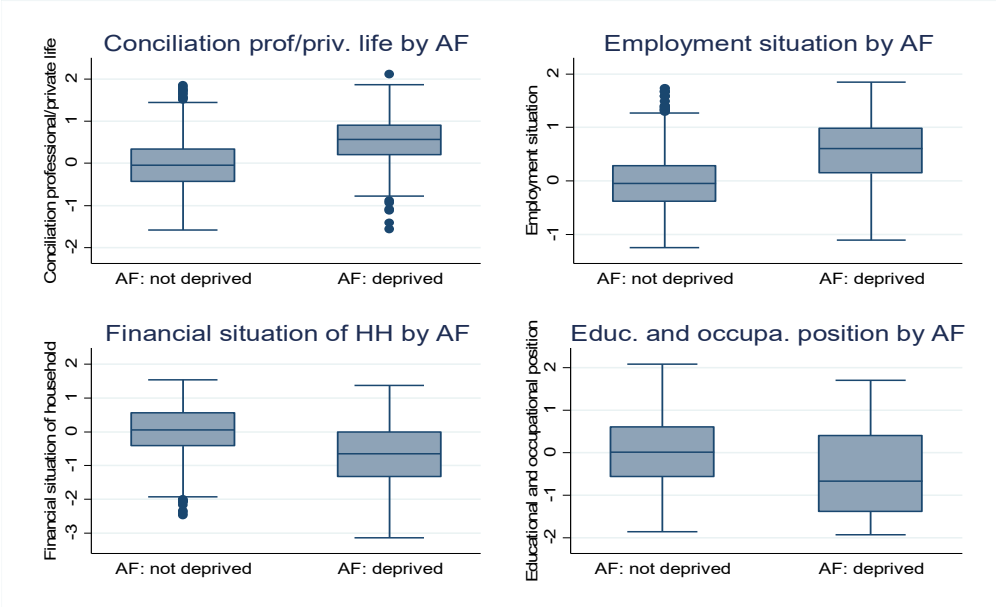
	Model 1	Model 2	Model 3	Model 4	Model5	Model6
Dim 1	80.66%	61.51%	71.31%	0%	88.19%	83.63%
Dim 2	49.55%	69.25%	78.83%	0%	77.17%	71.28%
Dim 3	35.05%	57.43%	28.41%	100%	100%	85.64%
Dim 4	45.92%	28.51%	30.92%	0%	47.24%	31.49%

Furthermore, when computing an AF with 14 variables and with the second cutoff at 5 of 14, people deprived regarding five indicators of financial situation of HH are found suffering from multiple deprivations (even if only one dimension is concerned). On the contrary, with a second cutoff at 7 of 14, a person deprived in regarding the variables of educational and occupational situation (2 variables) and variables of employment situation (3 variables), have a deprivation score of 5/12, which is not enough to be considered as a multi-dimensionally deprived, even if two of four dimensions are fully affected. This finding suggests that only one indicator per dimension should be taken into consideration as recommended by the OECD (2008). In particular, there might be a risk of double counting when all indicators of a dimension are expected to be highly correlated – like in our study. Thus, the number of variables per dimension and correlation among them should be taken into account in order to avoid a potential spurious contribution of a dimension and also to avoid a double counting.

Another problematic result arises from the fact that the different AF models do not identify the same persons as deprived, even if the same theoretical framework and the same pool of variables are used. Thus, the first three models are composed by one “expected interchangeable” variables per dimension with the same second cut off and they identified in the best case 2/3 of the same deprived person and in the worse case 1/3 (for details see Appendix 1). When comparing the model 4 (the income-based indicator) to models 1 to 3, the situation worsened and the common identified deprived persons dropping until 1/5.

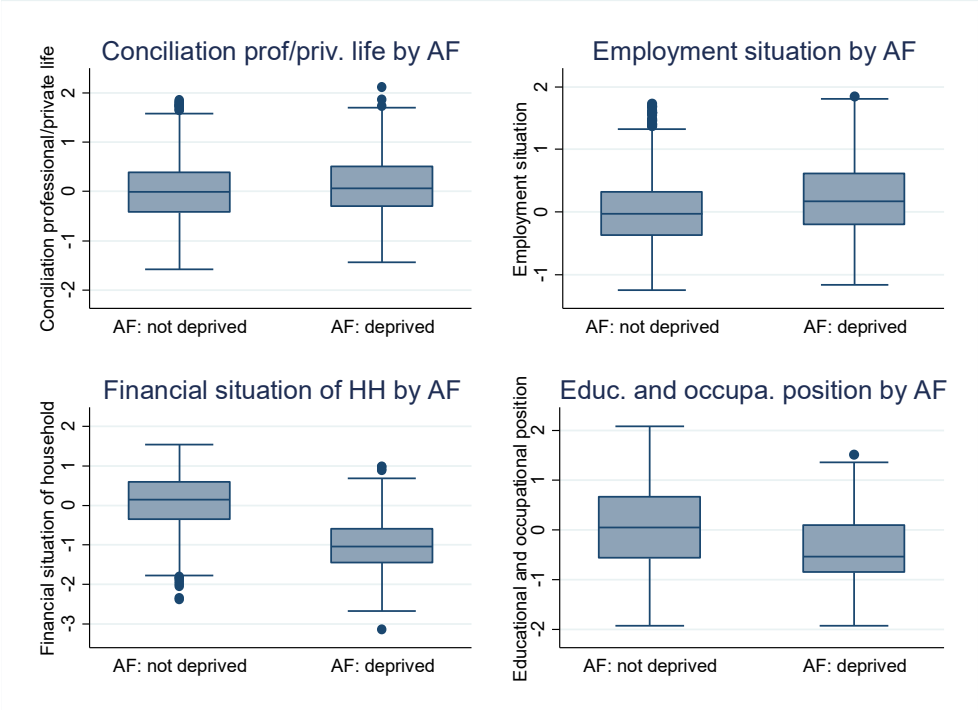
As expected those deprived in model 5 are also found deprived in model 6 as we only changed the second cutoff. When comparing model 6 to models 1 to 4 (with the same second cut-off, i.e., half of the variables), we see that the models 1 to 4 share, at least, 50% of the deprived persons which are identified deprived by model 6 (for details, see Appendix 1).

Figure 4: Distribution of latent factors by level of deprivation in AF model1



Source: Swiss Household Panel 2013.

Figure 5: Distribution of latent factors by level of deprivation in AF model4



Source: Swiss Household Panel 2013.

Figure 4 represents the distribution of four synthetic measures of CFA for two groups of deprived persons regarding the AF approach (for the first model): non-deprived versus deprived persons. As expected, we found a significantly higher level of well-being based on CFA approach associated with a lower level of deprivation in AF (same pattern for other AF

models). Indeed, two positive latent factors of well-being (financial situation of HH and educational and occupational level) show a significantly lower mean for deprived people, and two negative latent factors of well-being (difficulty of conciliation between professional/private life and negative employment situation) have a significantly higher mean for deprived people. The difference between deprived and not deprived regarding to educational level and occupational situation is smaller than the differences between two groups for other synthetic measures of CFA (see Appendix 3).

Figure 5 represents the distribution of four synthetic measures of CFA by deprived persons of model 4. As the model 4 include, only, the variables of household financial situation; the dimensions 1, 2 and 4 of the CFA are not varied as much regarding of the level of deprivation of model 4.

5.3. POSET results

Table 7 presents the breakdown of the POSET models by six deprivation groups: not deprived (score = 0), four groups of “in-between” deprivation (scores:]0;0.25[, [0.25;0.5[, [0.5;0.75[, and [0.75;1[) and fully deprived (score =1). The group of fully deprived persons varies between 8.8% and 13.3%, whereas it varies between 18.5% and 70.6% for people not deprived at all. The POSET models – as noted for the AF models above – do not identify the same persons as deprived (for details see Appendix 4).

Table 7: Distribution of deprivation degree (POSET)

Levels of deprivation	Deprivation degree (%)			
	Model 1	Model 2	Model 3	Model 4
0	18.47	20.80	40.78	70.57
]0 ;0.25[	30.84	42.06	28.83	16.17
[0.25 ;0.5[	22.60	14.52	13.71	0
[0.5;0.75[	0	0	0	2.64
[0.75;1[	19.30	9.34	7.01	0
1	8.79	13.29	9.68	10.62

Model 1: Interference work/private activities, Job security, Assessment of income and expenses, and Educational level; Model 2: Difficult to disconnect from work, Risk of unemployment, Satisfaction with financial situation, and Occupational level; ; Model 3: Difficult to disconnect from work, Risk of unemployment, Household income, Occupational level; Model 4: Household income, Material deprivation;
Source: Swiss Household Panel 2013.

Surprisingly there are a number of “in between” deprivation profiles (modell1: 1/3/2/2, 2/1/2/2; model 2: 1/3/2/2, 2/1/2/2, 2/3/1/2, 2/3/2/1; model 3: 2/1/2/2, 2/3/2/1) considered as multi-dimensionally deprived, even if it does not reach the threshold of being deprived regarding at least in 2 indicators. These profiles are the most disadvantaged profiles among the non-deprived and it is just below the deprived profiles. Therefore, we expected their deprivation degree to be close to 1, but not equal to 1. According to Fattore and Arcagni (2014), this problem is due to the identification function which is smooth.

The POSET approach permits to identify “in-between” deprivation situations, i.e. those who are neither not deprived at all, nor multi-dimensionally deprived. These “in-between” situations are quite well-spread, concerning between 20 to 70% depending on the model. However, about half of them have a rather low deprivation degree (< 0.125), which is close to the most favorable profile and constitutes, therefore, a very low deprivation risk. On the other hand, one 10 to 20% of the “in-between” persons show a high level of deprivation (>0.90), which has to be considered as a substantial risk of multidimensional deprivation.

Furthermore, the items selection and the number of items in models seems to affect the contribution of each dimension when identifying deprived persons. In the first model, 80% of the multidimensional deprived people are deprived in the first dimension, and only one third are deprived regarding the dimension of the financial situation of household. In the second model, the deprived persons are found equally deprived on the first three dimensions. In the third model, the contribution is more related to the first two dimensions. As the fourth model is only constituted by the variables of third dimension, 100% of the deprived persons are deprived in the financial dimension. For the models 5 and 6, the cutoff does not much affect the contributions of dimensions and as for the model 3, here also the first three dimensions contributed mainly to the deprivation.

Table 8: Contribution to deprivation by dimension

	Model 1	Model 2	Model 3	Model 4
Dim 1	79.46%	61.61%	69.19%	0%
Dim 2	50.30%	67.72%	78.38%	0%
Dim 3	34.52%	55.51%	28.38%	100%
Dim 4	45.24%	27.95%	30.27%	0%

Figure 6 represents the distribution of the four synthetic measures of CFA for six groups of persons identified by the POSET approach (for the first model). As expected, we found a significantly higher level of well-being based on the CFA approach associated with a lower level of deprivation in POSET (same pattern 2 and 3, for details see Appendix 5). Indeed, the two positive latent factors of well-being (financial situation of HH and educational and occupational level) show a significantly lower mean for deprived people, and the two negative latent factors of well-being (difficulty of conciliation between professional/private life and negative employment situation) have a significantly higher mean for deprived people. These results can also be reflected through a correlation level from medium high, between the different CFA and POSET deprivation degrees for models 1 to 3 (correlation between $|0,26|$ and $|0,57|$). The model 4, contains, only, the indicator of dimension 3 (the financial situation of household), therefore the correlation with the dimension 3 is found high ($|0,52|$) and the correlation with other three CFA dimensions are found to be null to medium ($|0,05|$ and $|0,22|$).

Figure 6: Distribution of latent factors by level of deprivation in POSET model1

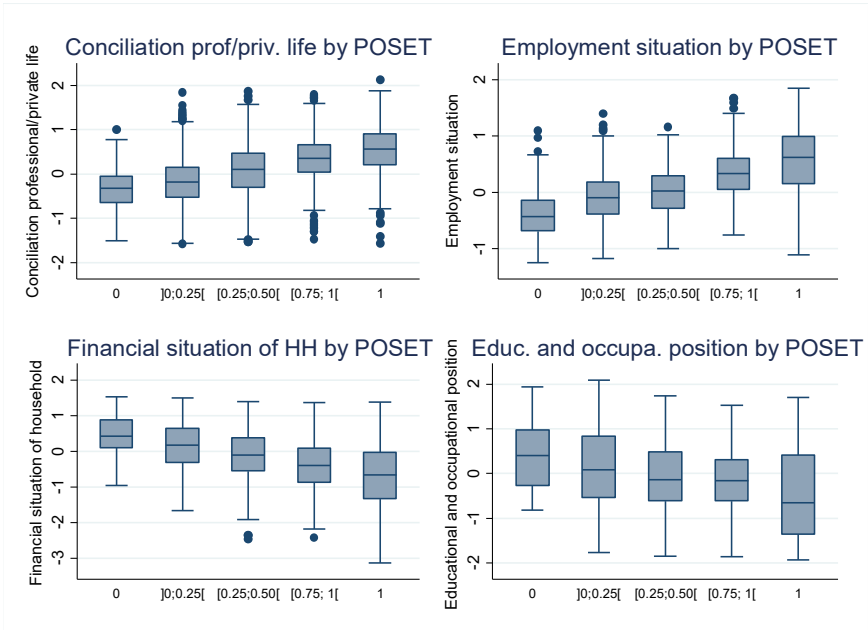


Figure 7: Distribution of latent factors by level of deprivation in POSET model4

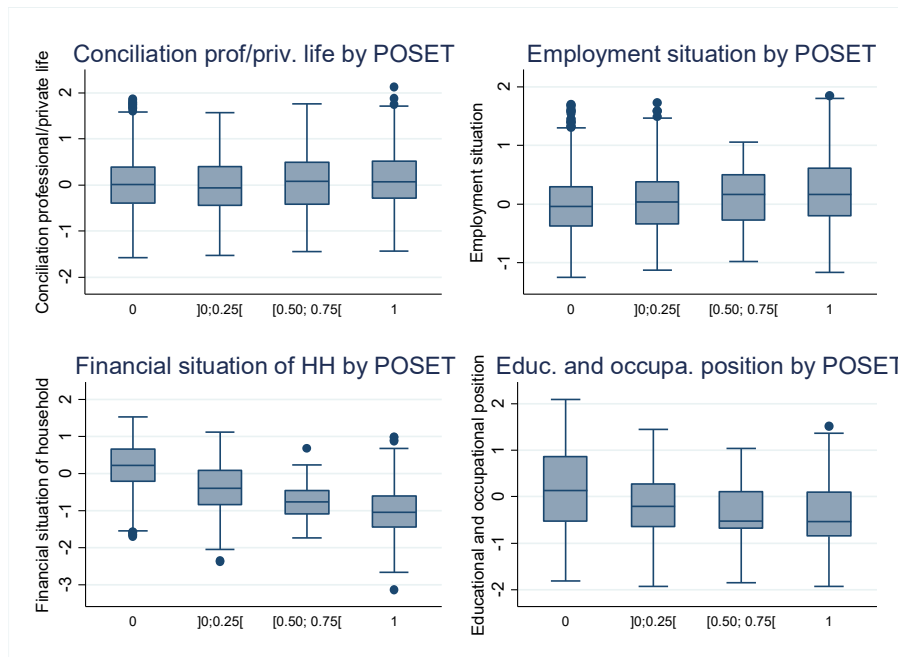


Figure 7 represents the distribution of the four synthetic measures of CFA by deprived persons regarding model 4. As the model 4 only includes the variables of household financial situation, dimensions 1, 2 and 4 of the CFA are not varied as much depending of the level of deprivation of model 4.

5.4. Comparisons between methodologies

The posetic approach identifies the deprived units based on dual cutoff of AF methodology. Therefore, when applying both methodologies on the same variables, we expect that AF and POSET identify the same persons as deprived (score=1) and all non-deprived persons found in POSET being non-deprived also in AF. In first model, our results confirm these results except for two POSET profiles (1/3/2/2 and 2/1/2/2) which are identified as deprived despite the fact that this profile is not multidimensionally deprived regarding to AF dual cutoff. Same problem happened in model 2 and model 3 as well. In model 2, four profiles (1/3/2/2, 2/1/2/2, 2/3/1/2, 2/3/2/1) are identified as deprived in POSET but in fact they are not regarding to AF. These profiles are very close to the threshold. The AF approach dichotomizes the reality (deprived or not-deprived) and then computes the number of multidimensionally deprived people. In the posetic approach, we also identify these two groups of persons, but this approach allows to better analyze the “in-between” persons, especially for those who are close to the deprivation line – those “at risk” of deprivation –, a population group that should be of great interest for policy makers. As the POSET synthetic measures are quantitative, it is also possible to test their levels with the category deprived and non-deprived in AF. We found lower level of POSET measures for non-deprived persons in AF and higher level of POSET measures for deprived persons in AF, as it was expected. Until now, all these results have been related to the comparison between two approaches based on the same models. If we compare these two approaches with different models (constituted of different set of variables), then they will not identify the same persons as deprived. For example, when comparing the AF synthetic measure on four variables with the POSET synthetic measure on four other variables, then more than 50% of the deprived persons in the AF approach are not found

deprived in the POSET approach and more than 50% of the deprived persons in the posetic approach are not identified as deprived regarding AF approach.

6. Concluding discussion

6.1. Uni or multidimensional

Well-being is a multi-dimensional concept that cannot be reduce only to the economic dimension of well-being. The contribution of the financial dimension to the identification of the multidimensionally deprived persons in model 1 to 3 is lower than the other dimensions. And even if the financial situation of the household is expected to be related to the other three dimensions in the theoretical framework, the indicator obtained is moderately or not correlated to the other dimensions.

6.2. Objective or subjective measures

We found that the number of multidimensional deprived persons is not specifically due to the objective or subjective nature of the variables but it is more a question of item selection. However, the number of deprived people depends on the question of multi-dimensionality, selection of the items, and the number of the items. From one model to another, the number of deprived people from multidimensional perspective can vary. Combining both objective and subjective indicators help to extend the vision towards deprivation and put in evidence different types of profiles.

6.3. AF-POSET

The main issue with AF is the loss of information through the system of deprivation thresholds (Fattore, 2015); loss of information that the posetic approach enables us to avoid. The posetic approach of Fattore can also potentially be criticized, as it defines individuals as multidimensional deprived persons although they do not reach the corresponding thresholds (which can also be an issue with the AF when there are several measures for each dimension).

The AF results are quite easily understandable, therefore, they have a good communicative power regarding dissemination of multidimensionally deprivation to a broader (non-academic) public and to policymakers. The AF methodology enables us to identify the persons (or households) suffering from multiple deprivation and to show how their situation changes over time. So this methodology can identify the group of persons already affected by deprivation. However, in order to develop preventive measures, policymakers are also highly interested in identifying the social groups which are at risk of multidimensional deprivation, i.e., those who are not (yet) deprived but may eventually become deprived. The AF methodology, however, is not sensitive enough to this issue and reduces the complex information on “in-between” and ambivalent configurations to a (simplistic) “either-or” situation.

The POSET approach provides the same information as the AF methodology since it is based on the same dual cutoff, but it can also identify the “in-between” positions, i.e., those groups that are potentially “at risk” of multidimensional deprivation. This approach, therefore, has great potential for supporting the planning and the implementation of preventive policies. However, due to its complexity the POSET approach is less suitable for addressing a non-academic audience. Overall, the AF approach seems to have the greater communicative power, whereas the POSET approach is more suitable for specialists in charge of planning and developing social programs.

By way of conclusion, when we consider the quality of the indicators and the information that they can provide, the issue does not seem to be related to the choice of a particular methodology or of the use of subjective or objective measures. It is, however, crucial to deal with several theoretical and methodological questions: the definition of the theoretical framework, its operationalization, the choice of the selected items (implicit weights), the number of items, and the quality of data. In fact, when we used the same theoretical framework and the same methodology, but different thresholds, different items, and a different number of items by dimension, the indicators highlighted different groups of vulnerable people both in terms of the number and the individuals identified as multidimensionally deprived persons.

7. References

- Abbott, P., Wallace, C., & Sapsford, R. (2016). *The Decent Society: Planning for Social Quality*. New York: Routledge.
- Alkire, S., & Foster, J. (2009). *Counting and Multidimensional Poverty Measurement*. OPHI Working Papers, Vol.7, University of Oxford.
- Alkire, S., Foster, J., Seth, S., Santos, M. E., Roche, J. M., & Balton, P. (2015). *Multidimensional Poverty Measurement and Analysis*. New York: Oxford University Press.
- Alkire, S., & Santos, M. E. (2013). A Multidimensional Approach: Poverty Measurement and Beyond. *Social Indicators Research*, 112, 239–257.
- Annoni, P., & Brüggemann, R. (2009). Exploring partial order of European countries. *Social Indicators Research*, 92, 471–487.
- Boarini, R., & Mira d'Ercole, M. (2006). Measures of material deprivation in OECD Countries. *OECD Social, Employment and Migration Working Papers*. Paris: OECD Publishing.
- Booyesen, F. (2002). An Overview and Evolution of Composite Indices of Development. *Social Indicators Research*, (59), 115–151.
- Bourguignon, F., & Chakravarty, S. R. (2003). The measurement of multidimensional poverty. *Journal of Economic Inequality*, 1(1), 25–49.
- Bourguignon, F., & Chakravarty, S. R. (2009). Arguments for a Better World: Essays in Honor of Amartya Sen. In K. Basu & R. Kanbur (Eds.), *Volume I: Ethics, Welfare, and Measurement* (pp. 337–361). Oxford: Oxford University Press.
- Brüggemann, R., & Carlsen, L. (2006). *Partial order in environmental sciences and chemistry*. Berlin: Springer.
- Bühlmann, F., Schmid Botkine, C., Farago, P., Höpflinger, F., Joye, D., Levy, R., Perrig-Chiello, P., & Suter, C. (Eds.). (2013). *Swiss Social Report 2012: Generations in Perspective*. Zurich: Seismo.
- Eurostat. (2015, September). *Composite Indicators, Synthetic Indicators and Scoreboards: How far can we go?* Paper presented at the Conference of the Directors General of the National Statistical Institutes, Lisbon.
- Expert group on poverty statistics Rio Group (Ed.). (2006). *Compendium of best practices in poverty measurement*. Rio de Janeiro.
- Fattore, M. (2014). Partially ordered set. In A. C. Michalos (Ed.), *Encyclopedia of quality of life and well-being research* (pp. 4627–4631). Dordrecht: Springer.
- Fattore, M. (2015). Partially Ordered Sets and the Measurement of Multidimensional Ordinal Deprivation. *Social Indicators Research*, Forthcoming. DOI 10.1007/s11205-015-1059-6.
- Fattore, M., & Arcagni, A. (2014). PARSEC: An R Package for Poset-Based: Evaluation of Multidimensional Poverty. In R. Brüggemann, L. Carlsen, & J. Wittmann (Eds.), *Multi-indicator Systems and Modelling in Partial Order* (pp. 317–330). Springer.
- Fattore, M., Maggino, F., & Colombo, E. (2012). From Composite Indicators to Partial Orders: Evaluating Socio-Economic Phenomena Through Ordinal Data. In F. Maggino & G. Nuvolati (Eds.), *Quality of life in Italy: Research and reflections* (pp. 41–68). New York: Springer.

- Foster, J., Greer, J., & Thorbecke, E. (1984). A class of decomposable poverty. *Econometrica*, 52(3), 761–766.
- Glatzer, W., Camfield, L., Møller, V., & Rojas, M. (Eds.). (2015). *Global Handbook of Quality of Life: Exploration of Well-Being of Nations and Continents*. Springer.
- Holgado-Tello, F. P., Chacón-Moscoso, S., Barbero-García, I., & Vila-Abad, E. (2010). Polychoric versus Pearson correlations in exploratory and confirmatory factor analysis of ordinal variables. *Quality and Quantity*, 44, 153–166.
- Hu, L. T., & Bentler, P. M. (1995). Evaluation Model Fit. In R. H. Hoyle (Ed.), *Structural equation modelling, concepts, issues, and applications* (pp. 76-99). London: Sage.
- Hu, L. T., & Bentler, P. M. (1998). Fit indices in covariance structure modelling: Sensitivity to underparametrized model misspecification. *Psychological Methods*, 3, 424–453.
- Hu, L. T., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modelling*, 6, 1–55.
- Jöreskog, K. G. (1970). A general method for analysis of covariance structures. *Biometrika*, 57, 239–251.
- Jöreskog, K. G., & Sörbom, D. (1996). *LISREL 8: User's reference guide*. Scientific Software International, Chicago.
- Lee, S., Poon, W., & Bentler, P. M. (1990). Full maximum likelihood analysis of structural equation models with polytomous variables. *Statistics & Probability Letters*, 9(1), 91–97.
- Levy, R., Joye, D., Guye, O., & Kaufmann, V. (1997). *Tous égaux? De la stratification aux représentations*. Zürich: Seismo.
- Luo, H. (2011). *Some Aspects on Confirmatory Factor Analysis of Ordinal Variables and Generating Non-normal Data*. Uppsala Universitet.
- Maggino, F., & Fattore, M. (2011). *New tools for the construction of ranking and evaluation indicators in multidimensional systems of ordinal variables*. Presented at the Conference on “New Techniques and Technologies for Statistics” – EUROSTAT. Session “Construction of Indicators.”
- Marsh, H. W., Balla, J. R., & McDonald, R. P. (1988). Goodness-of-fit indexes in confirmatory factor analysis: The effect of sample size. *Psychological Bulletin*, 103, 391–410.
- Michalos, A. C. (Ed.). (2014). *Encyclopedia of quality of life and well-being research*. Springer.
- Michalos, A. C., Sharpe, A., & Muhajarine, N. (2010). *An approach to a Canadian Index of Wellbeing*. Toronto: Working Paper for the Atkinson Charitable Foundation.
- Muthén, B. (1984). A general structural equation model with dichotomous, ordered categorical, and continuous latent variable indicators. *Psychometrika*, 49(1), 115–132.
- Muthén, L. K., & Muthén, B. (2010). *Mplus user's guide* (Sixth edition). Los Angeles CA: Muthén & Muthén.
- OECD (Ed.). (2008). *Handbook on Constructing Composite Indicators*. OECD.
- OECD (Ed.). (2013). *OECD Guidelines on Measuring Subjective Well-being*. OECD.
- OECD (Ed.). (2015). *How's Life? 2015: Measuring Well-being*. OECD.
- Parsons, T. (1970). *The Social System*. London: Routledge & Kegan Paul Ltd.
- Patil, G. P., & Taillie, C. (2004). Multiple indicators, partial order sets, and linear extensions: Multicriterion ranking and prioritization. *Environmental and Ecological Statistics*, 11, 199–228.
- Saltelli, A. (2007). Composite indicators between analysis and advocacy. *Social Indicators Research*, 81, 65–77.
- Schermelleh-Engel, K., Moosbrugger, H., & Müller, H. (2003). Evaluating the fit of structural equation models: Tests of significance and descriptive goodness-of-fit measures. *Methods of Psychological Research Online*, 8, 23–74.
- Sen, A. K. (1976). Poverty: An Ordinal Approach to Measurement. *Econometrica*, 44(2), 219–31.
- Stamm, H., Lamprecht, M., Nef, R., Joye, D., & Suter, C. (2003). *Soziale Ungleichheit in der Schweiz. Strukturen und Wahrnehmungen*. Zürich: Seismo.

- Streeten, P., Burki, J. S., Haq, M. U., Hicks, N., & Stewart, F. (1981). *First Things First: Meeting Basic Human Needs in Developing Countries*. New York: Oxford University Press.
- Suter, C., Perrenoud, S., Levy, R., Kuhn, U., Joye, D., & Gazareth, P. (2009). *Swiss Social Report 2008: Switzerland Measured and Compared*. Zurich: Seismo.
- Townsend, P. (1979). *Poverty in the United Kingdom: A survey of household resources and standards of living*. London: Penguin.
- Tsui, K. Y. (2002). Multidimensional poverty indices. *Social Choice and Welfare*, 19(1), 69–93.
- Yu, C. Y., & Muthén, B. (2002). *Evaluation of model fit indices for latent variable models with categorical and continuous outcomes*. New Orleans, LA.

Appendix

Appendix 1: Variables operationalizing the theoretical framework

Dimension 1: Conciliation professional/private life composed by:

Interference work/private activities: How strongly does your work interfere with your private activities and family obligations, more than you would want this to be, if 0 means "not at all" and 10 "very strongly"?

Exhausted after work: How strongly are you exhausted after work to do things you would like to do, if 0 means "not at all" and 10 means "very strongly"?

Difficult to disconnect from work: How difficult do you find it to disconnect from work when the work day is over, if 0 means "not difficult at all" and 10 means "extremely difficult"?

Dimension 2: Financial situation of Household (HH) composed by:

Satisfaction with financial situation: Overall how satisfied are you with the financial situation of your household, if 0 means "not at all satisfied" and 10 "completely satisfied"?

Assessment of income and expenses: If you consider the total of your household's income and expenses, would you say that currently your household can save money, your household spends what it earns, your household eats into its assets and savings, or your household gets into debts?

Arrears of payments: Last 12 months: Since (month, year) have you experienced problems which resulted in arrears in payments of your household bills?

Financial situation manageable: How do you manage on your household's current income, 0 means "with great difficulty" and 10 "very easily"?

Material deprivation: It corresponds to the sum of followings items that persons do not have for financial reasons: 1) "Do you or any other member of your household save in a "3rd pillar" pension fund?"; 2) "Do you take at least one week's holidays away from home once a year with all members of your household?"; 3) "Do you have a meal out at a restaurant at least once a month with all members of your household?"; 4) "Are you or any other member of your household able to go to the dentist if needed?"; 5) "Do you have a computer at home?"; 6) "Do you have a colour TV?"; 7) "Do you have a car?"; 8) "Do you have a washing machine in your own accommodation or for your exclusive use?" 9) "Do you invite friends round for a meal at least once a month?"; 10) "Do you have a dishwasher?".

Household income: The equivalent gross household income was used. The neutral modality corresponds to the middle class defined by the Swiss Federal Statistical Office has earning between 70% and 150% of the median equivalent gross income (OFS, 2013). Two defavorable groups were defines: being monetarily poor with less than 50% of median equivalent gross income (threshold defined by the OCDE) and being at risk of relative monetary poverty with between 50 and 70% of the median equivalent gross income. The favorable group corresponds to the upper class with at least 150% of the median equivalent gross income.

Dimension 3: Employment situation composed by:

Job security: Would you say that your job is very secure, quite secure, a bit insecure or very insecure?

Risk of unemployment: Next 12 months: personally unemployed in the next 12 months, if 0 means "no risk at all" and 10 "a real risk"?

Satisfaction with work conditions: On a scale from 0 "not at all satisfied" to 10 "completely satisfied" can you indicate your degree of satisfaction for each of the following points?

Dimension 4: Educational and occupational position composed by:

Educat: Highest level of education achieved: 1) incomplete compulsory school, 2) compulsory school, elementary vocational training, 3) domestic science course, 1 year school of commerce, 4) general training school, 5) apprenticeship (CFC, EFZ), 6) full-time vocational school, 7) bachelor/maturity, 8) vocational high school with master certificate, federal certificate, 9) technical or vocational school, 10) vocational high school ETS, HTL etc., and 11) university, academic high school, HEP, PH, HES, FH.

CSP: Swiss socio-professional category of main job: 1) top management, 2) liberal professions, 3) other self-employed, 4) academic professions and senior management, 5) intermediate professions, 6) qualified non-manual professions, 7) qualified manual professions, and 8) unqualified non-manual and manual workers.

Appendix 2: Comparison within AF indicators

Distribution of AF deprivation between Model1 and Model 2

Model 1	Model 2		
	Not Deprived	Deprived	Total
Not Deprived	3157	335	3492
	90.41	9.59	100.00
	94.75	68.23	91.34
Deprived	175	156	331
	52.87	47.13	100.00
	5.25	31.77	8.66
Total	3332	491	3823
	87,16	12.84	100.00
	100.00	100.00	100.00

Notes: Numbers are respectively in number, percentage, percentage (from the up to down)

Source: Swiss Household Panel 2013.

Distribution of AF deprivation between Model1 and Model 3

Model 1	Model 3		
	Not Deprived	Deprived	Total
Not Deprived	3256	236	331
	93.24	6,76	100.00
	94.00	65.74	91.34
Deprived	208	123	331
	62.84	37.16	100.00
	6.00	34.26	8.66
Total	3464	359	3823
	90.61	9.39	100.00
	100.00	100.00	100.00

Notes: Numbers are respectively in number, percentage, percentage (from the up to down)

Source: Swiss Household Panel 2013.

Distribution of AF deprivation between Model1 and Model 4

Model 1	Model 4		
	Not Deprived	Deprived	Total
Not Deprived	3183	309	3492
	91.15	8.85	100.00
	93.15	76.11	91.34
Deprived	234	97	331
	70.69	29.31	100.00
	6.85	23.89	8.66
Total	3417	406	3823
	89.38	10.62	100.00
	100.00	100.00	100.00

Notes: Numbers are respectively in number, percentage, percentage (from the up to down)

Distribution of AF deprivation between Model2 and Model 3

	Model 3		
Model 2	Not Deprived	Deprived	Total
Not Deprived	3287	45	3332
	98.65	1.35	100.00
	94.89	12.53	87.16
Deprived	177	314	491
	36.05	63.95	100.00
	5,11	87.47	12.84
Total	3464	359	3823
	90.61	9.39	100.00
	100.00	100.00	100.00

*Notes: Numbers are respectively in number, percentage, percentage (from the up to down)
Source: Swiss Household Panel 2013.*

Distribution of AF deprivation between Model2 and Model 4

	Model 4		
Model 2	Not Deprived	Deprived	Total
Not Deprived	3061	271	3332
	91.87	8.13	100.00
	89.58	66.75	87.16
Deprived	356	135	491
	72.51	27.49	100.00
	10.42	33.25	12.84
Total	3417	406	3823
	89.38	10.62	100.00
	100.00	100.00	100.00

*Notes: Numbers are respectively in number, percentage, percentage (from the up to down)
Source: Swiss Household Panel 2013.*

Distribution of AF deprivation between Model3 and Model 4

	Model 4		
Model 3	Not Deprived	Deprived	Total
Not Deprived	3287	177	3464
	92.00	8.00	100.00
	93.27	68.23	90.61
Deprived	45	314	359
	64.07	35.93	100.00
	6.73	31.77	9.39
Total	3332	491	3823
	87.16	12.84	100.00
	100.00	100.00	100.00

*Notes: Numbers are respectively in number, percentage, percentage (from the up to down)
Source: Swiss Household Panel 2013.*

Distribution of AF deprivation between Model1 and Model 5

	Model 5		
Model 1	Not Deprived	Deprived	Total
Not Deprived	3459	33	3492
	99.05	0.95	100.00
	93.59	25.98	91.34
Deprived	237	94	331
	71.60	28.40	100.00
	6.41	74.02	8.66
Total	3696	127	3823
	96.68	3.32	100.00
	100.00	100.00	100.00

*Notes: Numbers are respectively in number, percentage, percentage (from the up to down)
Source: Swiss Household Panel 2013.*

Distribution of AF deprivation between Model2 and Model 5

	Model 5		
Model 2	Not Deprived	Deprived	Total
Not Deprived	3319	13	3332
	99.61	0.39	100.00
	89.80	10.24	87.16
Deprived	377	114	491
	76.78	23.22	100.00
	10.20	89.76	12.84
Total	3696	127	3823
	96.68	3.32	100.00
	100.00	100.00	100.00

*Notes: Numbers are respectively in number, percentage, percentage (from the up to down)
Source: Swiss Household Panel 2013.*

Distribution of AF deprivation between Model3 and Model 5

	Model 5		
Model 3	Not Deprived	Deprived	Total
Not Deprived	3417	47	3464
	98.64	1.36	100.00
	92.45	37.01	90.61
Deprived	279	80	359
	77.72	22.28	100.00
	7.55	62.99	9.39
Total	3696	127	3823
	96.68	3.32	100.00
	100.00	100.00	100.00

*Notes: Numbers are respectively in number, percentage, percentage (from the up to down)
Source: Swiss Household Panel 2013.*

Distribution of AF deprivation between Model4 and Model 5

	Model 5		
Model 4	Not Deprived	Deprived	Total
Not Deprived	3383	34	3417
	99.00	1.00	100.00
	91.53	26.77	89.38
Deprived	313	93	406
	77.09	22.91	100.00
	8.47	73.23	10.62
Total	3696	127	3823
	96.68	3.32	100.00
	100.00	100.00	100.00

*Notes: Numbers are respectively in number, percentage, percentage (from the up to down)
Source: Swiss Household Panel 2013.*

Distribution of AF deprivation between Model1 and Model 6

	Model 6		
Model 1	Not Deprived	Deprived	Total
Not Deprived	3305	187	3492
	94.64	5.36	100.00
	96.47	47.10	91.34
Deprived	121	210	331
	36.56	63.44	100.00
	3.53	52.90	8.66
Total	3426	397	3823
	89.62	10.38	100.00
	100.00	100.00	100.00

*Notes: Numbers are respectively in number, percentage, percentage (from the up to down)
Source: Swiss Household Panel 2013.*

Distribution of AF deprivation between Model2 and Model 6

	Model 6		
Model 2	Not Deprived	Deprived	Total
Not Deprived	3213	119	3332
	96.43	3.57	100.00
	93.78	29.97	87,16
Deprived	213	278	491
	43.38	56.62	100.00
	6.22	70.03	12.84
Total	3426	397	3823
	89.62	10.38	100.00
	100.00	100.00	100.00

*Notes: Numbers are respectively in number, percentage, percentage (from the up to down)
Source: Swiss Household Panel 2013.*

Distribution of AF deprivation between Model3 and Model 6

	Model 6		
Model 3	Not Deprived	Deprived	Total
Not Deprived	3260	204	3464
	94.11	5.89	100.00
	95.15	51.39	90.61
Deprived	166	193	359
	46.24	53.76	100.00
	4.85	48.61	9.39
Total	3426	397	3823
	89.62	10.38	100.00
	100.00	100.00	100.00

*Notes: Numbers are respectively in number, percentage, percentage (from the up to down)
Source: Swiss Household Panel 2013.*

Distribution of AF deprivation between Model4 and Model 6

	Model 6		
Model 4	Not Deprived	Deprived	Total
Not Deprived	3214	203	3417
	94.06	5.94	100.00
	93.81	51.13	89.38
Deprived	212	194	406
	52.22	47.78	100.00
	6.19	48.87	10.62
Total	3426	397	3823
	89.62	10.38	100.00
	100.00	100.00	100.00

*Notes: Numbers are respectively in number, percentage, percentage (from the up to down)
Source: Swiss Household Panel 2013.*

Distribution of AF deprivation between Model5 and Model 6

	Model 6		
Model 5	Not Deprived	Deprived	Total
Not Deprived	3426	270	3696
	92.69	7.31	100.00
	100.00	68.01	96.68
Deprived	0	127	127
	0	100.00	100.00
	0	31.99	3.32
Total	3426	397	3823
	89.62	10.38	100.00
	100.00	100.00	100.00

*Notes: Numbers are respectively in number, percentage, percentage (from the up to down)
Source: Swiss Household Panel 2013.*

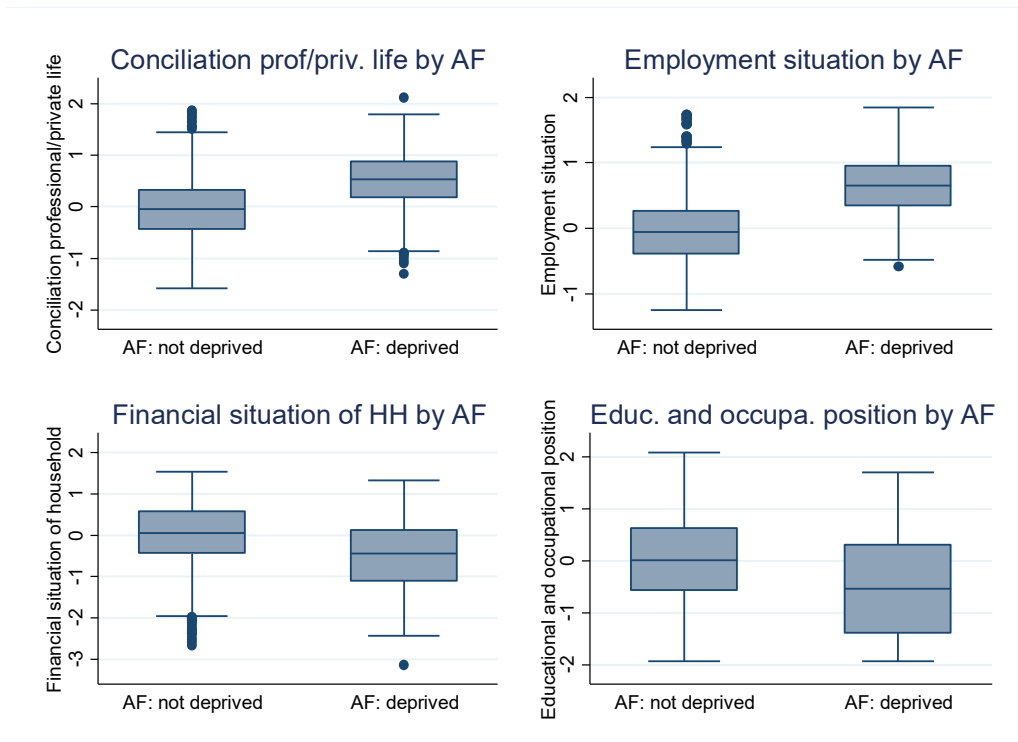
Appendix 3: Distribution of latent factors by level of deprivation in AF models

Distribution of latent factors by level of deprivation in AF model2



Source: Swiss Household Panel 2013.

Distribution of latent factors by level of deprivation in AF model3



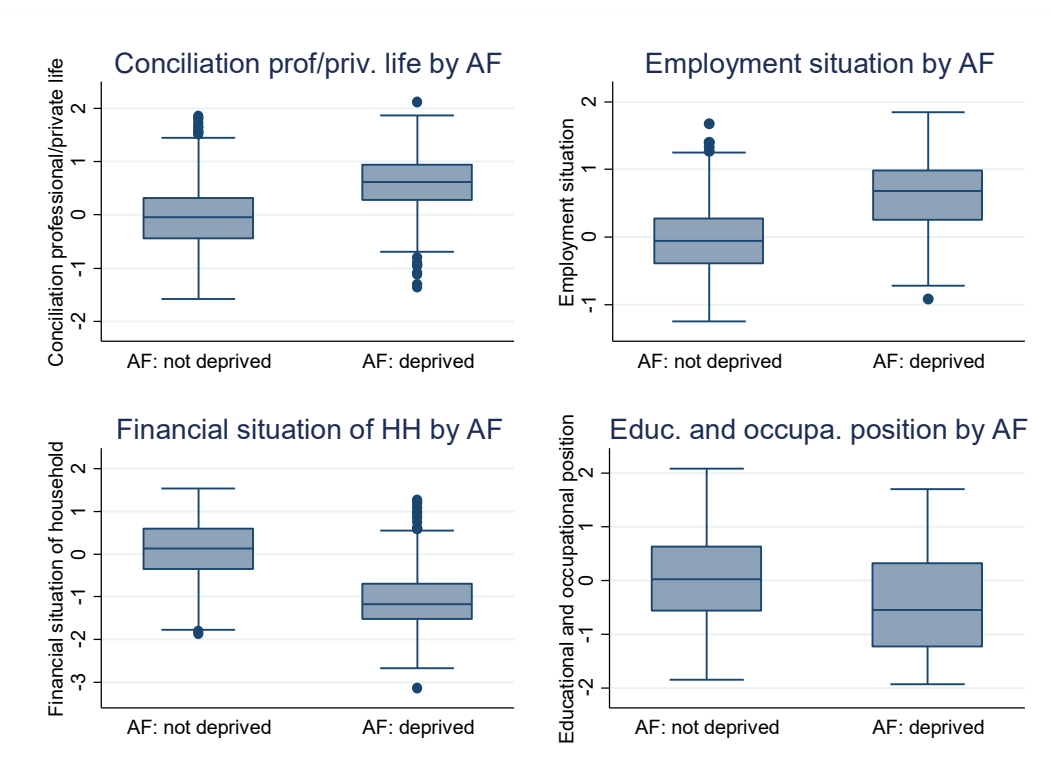
Source: Swiss Household Panel 2013.

Distribution of latent factors by level of deprivation in AF model5



Source: Swiss Household Panel 2013.

Distribution of latent factors by level of deprivation in AF model6



Source: Swiss Household Panel 2013.

Appendix 4: Comparison within POSET indicators

Distribution of POSET deprivation degrees between Model1 and Model 2

Model 1	Model2						Total
	0	]0 ;0.25[	[0.25 ;0.50[	[0.50 ;0.75[	[0.75 ; 1[	1	
0	306	305	64	0	18	13	706
	43.34	43.20	9.07	0	2.55	1.84	100.00
	38.49	18.97	11.53	0	5.04	2.56	18.47
]0 ;0.25[	251	636	148	0	91	53	1179
	21.29	53.94	12.55	0	7.72	4.50	100.00
	31.57	39.55	26.67	0	25.49	10.43	30.84
[0.25 ;0.50[	158	321	197	0	89	99	864
	18.29	37.15	22.80	0	10.30	11.46	100.00
	19.87	19.96	35.50	0	24.93	19.49	22.60
[0.50 ;0.75[	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
[0.75 ; 1[	62	263	113	0	117	183	738
	8.40	35.64	15.31	0	15.85	24.80	100.00
	7.80	16.36	20.36	0	32.77	36.02	19.30
1	18	83	33	0	42	160	336
	5.36	24.70	9.82	0	12.50	47.62	100.00
	2.26	5.16	5.95	0	11.76	31.50	8.79
Total	795	1608	555	0	357	508	3823
	20.80	42.06	14.52	0	9.34	13.29	100.00
	100.00	100.00	100.00	0	100.00	100.00	100.00

Note: Numbers are respectively in number, percentage, percentage (from the up to down)
Source: Swiss Household Panel 2013.

Distribution of POSET deprivation degrees between Model1 and Model 3

Model 1	Model3						Total
	0	]0 ;0.25[	[0.25 ;0.50[	[0.50 ;0.75[	[0.75 ; 1[	1	
0	481	149	58	0	12	6	706
	68.13	21.10	8.22	0	1.70	0.85	100.00
	30.85	13.52	11.07	0	4.48	1.62	18.47
]0 ;0.25[	563	380	135	0	57	44	1179
	47.75	32.23	11.45	0	4.83	3.73	100.00
	36.11	34.48	25.76	0	21.27	11.89	30.84
[0.25 ;0.50[	299	264	170	0	60	71	864
	34.61	30.56	19.68	0	6.94	8.22	100.00
	19.18	23.96	32.44	0	22.39	19.19	22.60
[0.50 ;0.75[	0	0	0	0	0	0	738
	0	0	0	0	0	0	100.00
	0	0	0	0	0	0	19.30
[0.75 ; 1[	171	230	113	0	99	125	336
	23.17	31.17	15.31	0	13.41	16.94	100.00
	10.97	20.87	21.56	0	36.94	33.78	8.79
1	45	79	48	0	40	124	3823
	13.39	23.51	14.29	0	11.90	36.90	100.00
	2.89	7.17	9.16	0	14.93	33.51	100.00
Total	1559	1102	524	0	268	370	3823
	40.78	28.83	13.71	0	7.01	9.68	100.00.
	100.00	100.00	100.00	0	100.00	100.00	100.00

Note: Numbers are respectively in number, percentage, percentage (from the up to down)
Source: Swiss Household Panel 2013.

Distribution of POSET deprivation degrees between Model1 and Model 4

Model 1	Model4						Total
	0	]0 ;0.25[	[0.25 ;0.50[	[0.50 ;0.75[	[0.75 ; 1[	1	
0	608 86.12 22.54	75 10.62 12.14	0 0 0	1 0.14 0.99	0 0 0	22 3.12 5.42	706 100.00 18.47
]0 ;0.25[	912 77.35 33.80	170 14.42 27.51	0 0 0	18 1.53 17.82	0 0 0	79 6.70 19.46	1179 100.00 30.84
[0.25 ;0.50[	594 68.75 22.02	159 18.40 25.73	0 0 0	32 3.70 31.68	0 0 0	79 9.14 19.46	864 100.00 22.60
[0.50 ;0.75[	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0
[0.75 ; 1[	422 57.18 15.64	149 20.19 24.11	0 0 0	39 5.28 38.61	0 0 0	128 17.34 31.53	738 100.00 19.30
1	162 48.21 6.00	65 19.35 10.52	0 0 0	11 3.27 10.89	0 0 0	98 29.17 24.14	336 100.00 8.79
Total	2698 70.57 100.00	618 16.17 100.00	0 0 0	101 2.64 100.00	0 0 0	406 10.62 100.00	3823 100.00 100.00

Note: Numbers are respectively in number, percentage, percentage (from the up to down)

Distribution of POSET deprivation degrees between Model2 and Model 3

Model 2	Model 3						Total
	0	]0 ;0.25[	[0.25 ;0.50[	[0.50 ;0.75[	[0.75 ; 1[	1	
0	729 91.70 46.76	59 7.42 5.35	7 0.88 1.34	0 0 0	0 0 0	0 0 0	795 100.00 20.80
]0 ;0.25[	792 49.25 50.80	708 44.03 64.25	80 4.98 15.27	0 0 0	19 1.18 7.09	9 0.56 2.43	1608 100.00 42.06
[0.25 ;0.50[	38 6.85 2.44	211 38.02 19.15	270 48.65 51.53	0 0 0	22 3.96 8.21	14 2.52 3.78	555 100.00 14.52
[0.50 ;0.75[	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0
[0.75 ; 1[	0 0 0	72 20.17 6.53	114 31.93 21.76	0 0 0	145 40.62 54.10	26 7.28 7.03	357 100.00 9.34
1	0 0 0	52 10.24 4.72	53 10.43 10.11	0 0 0	82 16.14 30.60	321 63.19 86.76	508 100.00 13.29
Total	1559 40.78 100.00	1102 28.83 100.00	524 13.71 100.00	0 0 0	268 7.01 100.00	370 9.68 100.00	3823 100.00 100.00

Note: Numbers are respectively in number, percentage, percentage (from the up to down)

Distribution of POSET deprivation degrees between Model2 and Model 4

	Model 4						
Model 2	0	]0 ;0.25[	[0.25 ;0.50[	[0.50 ;0.75[	[0.75 ; 1[	1	Total
0	613 77.11 22.72	113 14.21 18.28	0 0 0	14 1.76 13.86	0 0 0	55 6.92 13.55	795 100.00 20.80
]0 ;0.25[	1252 77.86 46.40	225 13.99 36.41	0 0 0	29 1.80 28.71	0 0 0	102 6.34 25.12	1608 100.00 42.06
[0.25 ;0.50[	373 67.21 13.83	113 20.36 18.28	0 0 0	18 3.24 17.82	0 0 0	51 9.19 12.56	555 100.00 14.52
[0.50 ;0.75[	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0
[0.75 ; 1[	225 63.03 8.34	57 15.97 9.22	0 0 0	14 3.92 13.86	0 0 0	61 17.09 15.02	357 100.00 9.34
1	235 46.26 8.71	110 21.65 17.80	0 0 0	26 5.12 25.74	0 0 0	137 26.97 33.74	508 100.00 13.29
Total	2698 70.57 100.00	618 16.17 100.00	0 0 0	101 2.64 100.00	0 0 0	406 10.62 100.00	3823 100.00 100.00

Note: Numbers are respectively in number, percentage, percentage (from the up to down)

Distribution of POSET deprivation degrees between Model3 and Model 4

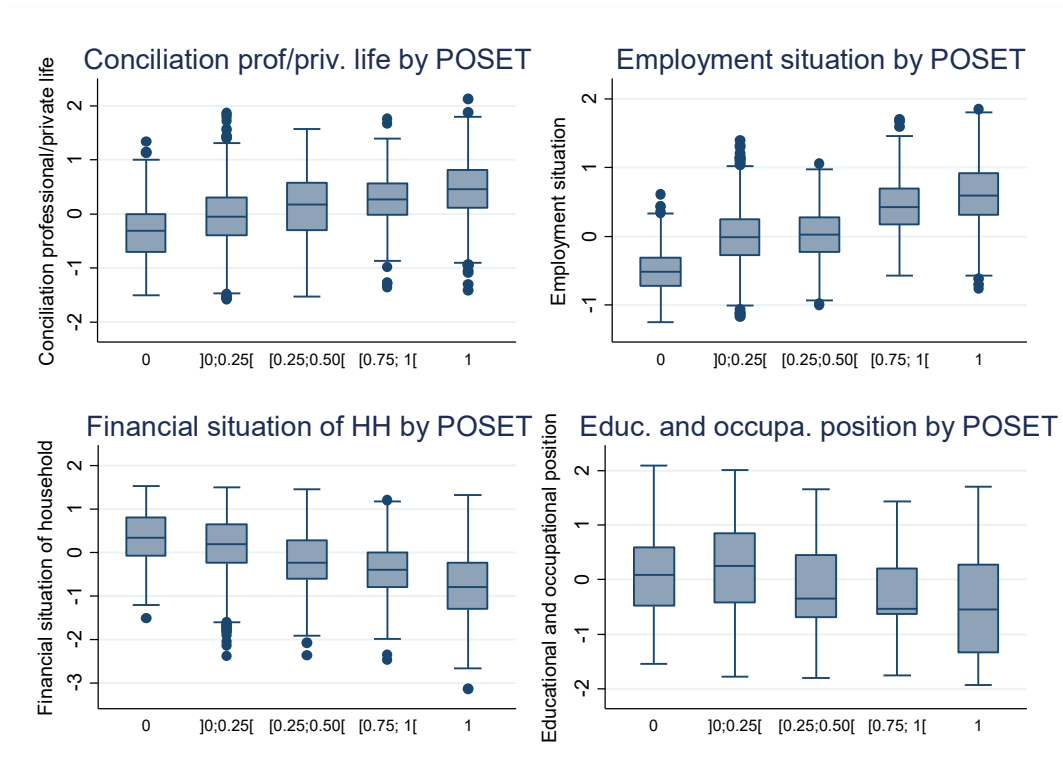
	Model 4						
Model 3	0	]0 ;0.25[	[0.25 ;0.50[	[0.50 ;0.75[	[0.75 ; 1[	1	Total
0	1329 85.25 49.26	167 10.71 27.02	0 0 0	16 1.03 15.84	0 0 0	47 3.01 11.58	1559 100.00 40.78
]0 ;0.25[	792 71.87 29.36	196 17.79 31.72	0 0 0	25 2.27 24.75	0 0 0	89 8.08 21.92	1102 100.00 40.78
[0.25 ;0.50[	297 56.68 11.01	123 23.47 19.90	0 0 0	24 4.58 23.76	0 0 0	80 15.27 19.70	524 100.00 13.71
[0.50 ;0.75[	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0
[0.75 ; 1[	108 40.30 4.00	78 29.10 12.62	0 0 0	25 9.33 24.75	0 0 0	57 21.27 14.04	268 100.00 7.01
1	172 46.49 6.38	54 14.59 8.74	0 0 0	11 2.97 10.89	0 0 0	133 35.95 32.76	370 100.00 9.68
Total	2698 70.57 100.00	618 16.17 100.00	0 0 0	101 2.64 100.00	0 0 0	406 10.62 100.00	3823 100.00 100.00

Note: Numbers are respectively in number, percentage, percentage (from the up to down).

Source: Swiss Household Panel 2013.

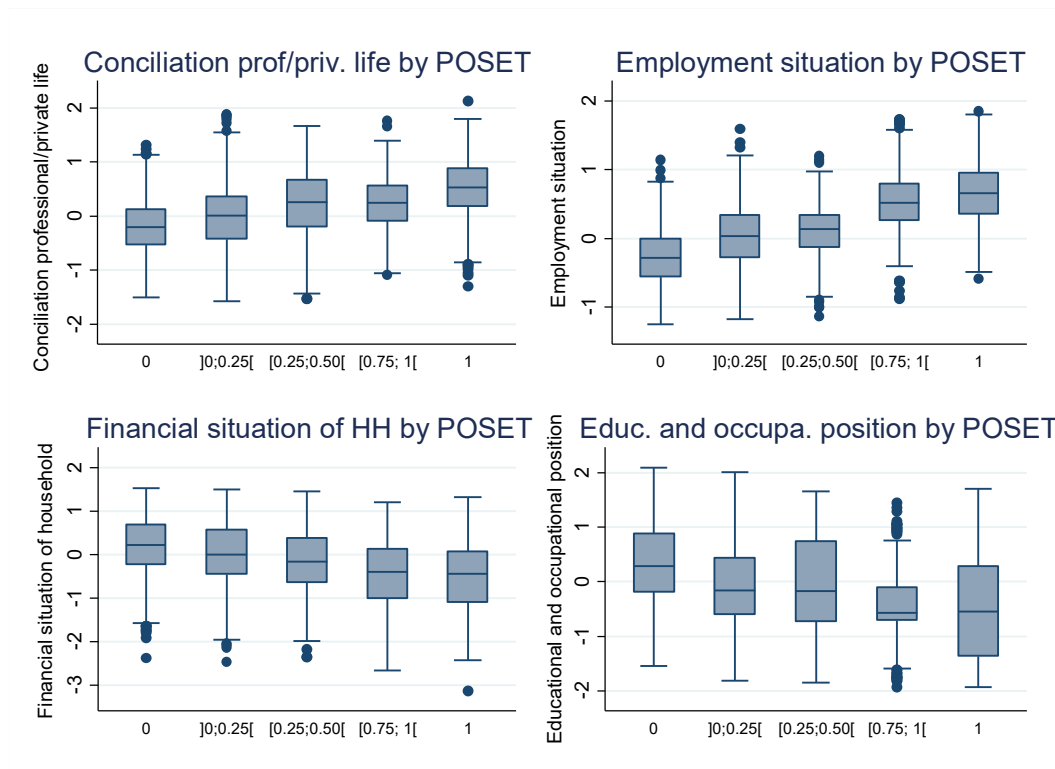
Appendix 5: Distribution of latent factors by level of deprivation in POSET models

Distribution of latent factors by level of deprivation in POSET model2



Source: Swiss Household Panel 2013.

Distribution of latent factors by level of deprivation in POSET model3



Source: Swiss Household Panel 2013.