

A PLS-SEM analysis of the mediation effects of unemployment on life satisfactions and the role of group-level unemployment

Group 4

Abstract

We document significant mediation effects of unemployment via trust, altruism and confidence in society. These effects are examined in an elaborate Partial Least Squares - Structural Equation Model (PLS-SEM) framework, allowing for an evaluation of the effects via the anatomy of subjective well-being. When using an self-reported group-level unemployment measure health and environmental satisfaction are the domains mainly affected by our mediators. Using IMF unemployment, financial satisfaction becomes important as well. Generally job satisfaction is non-negligible as one would expect. Using the IMF measure of unemployment, reduces the residual effect significantly.

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I. Introduction

In this paper, we estimate and examine the mediating effects of group unemployment on general wellbeing. We investigate three potential mediators of the effect of group unemployment on general well-being; altruism, trust and confidence in society. We construct a Partial Least Squares - Sequential Equation Model (PLS-SEM) framework to simultaneously construct overall and domain measures of life satisfaction and estimate the mediating effects. We find that

- there exists significant mediation effects through our three suggested constructs and they are all of the complementary kind irrespectively of the measure of group unemployment. Group-level unemployment reduces trust in others, the confidence in the government and altruism.
- Different domains of satisfaction are affected differently. The predominant effect is found on health and environmental satisfaction and job satisfaction is unsurprisingly non-negligible as well, when using the self-reported measure of unemployment. When using the IMF we confirm these results, but the measure of financial satisfaction becomes important as well.
- Our results are sensitive to the measure of unemployment. The largest total mediating effect comes from trust when we use the self-reported measure of group unemployment. Using the IMF measure of unemployment, it is instead confidence in government that provides the largest total mediator effect.
- There is a substantial residual effect, which indicates that further analysis with more granular data might reveal additional insights. Yet, when we use the IMF measure of unemployment, the residual effect reduces significantly.

In the happiness literature, the effect of group unemployment is found to be larger than what can be explained by the disutility experienced by those who are directly affected by a job loss. This empirical observation of a multiplier effect can be thought to affect general well-being through several mediator variables. In this paper we investigate the mediating effect of altruism, trust and general confidence in society. Altruism explains the multiplier effect by the fact that people's general well-being do not only depend on their own life situation, but

also the lifesituation and well-being of other's. Confidence in society provides the explanation that higher levels of unemployment might lead people to loose faith in the government. Trust could be another potential explanation if people regard unemployed people as 'free-riders' that cannot be trusted which in itself be associated with lower overall well-being. Our PLS-SEM framework allows us to handle measurement error in the mediators by modelling them as latent variables measured by several indicators in the EVS survey which OLS cannot. Further, PLS-SEM can simultaneously handle several domans of overall well-being. We exploit that and let general well-being consists of the subdomains: Job Satisfaction, Health Satisfaction, Environmental Satisfaction, Financial Satisfaction and House Satisfaction. Furthermore, we have the methodological advantage that our PLS-SEM model does not rely on any distributional assumptions but is a nonparametric explorative method.

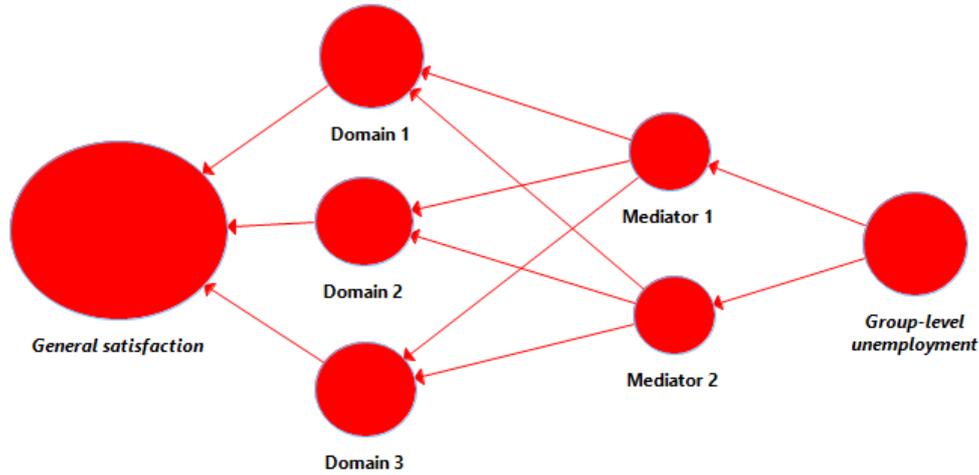
In Section II we operationalise the mediator effect of unemployment on both general satisfaction and domain level using a PLS-SEM framework as well as delineating hypothesis testing procedure. Section III present our choice of candidate mediators in the data set, our employed anatomy of general satisfaction level and our choice of control variables. Section IV briefly discusses main attributes of the data and presents our measure of life satisfaction and unemployment metrics. In Section V empirically examine the mediation effects, both on general and domain level, to answer the main question. We also discuss the impact of using an externally obtained measure of group-level unemployment form the IMF databases associated with the World Economic Outlook. We thus answer the follow-up questions 1 and 2 explicitly in this section. The last follow-up question is answered in a separate discussion in Section VI. We conclude in Section ??.

II. Operationalising mediation effects

In this section, we operationalise the mediation from the unemployment of others and show its measurement and how to test its presence. We construct a PLS-SEM framework,¹ which may be most easily understood by the following visualisation.

¹Details on the specific estimation procedures of the PLS-SEM are left out in the interest space and time constrains. We provide only the necessary information understanding the estimation and prefer to explain the benefits and intuition of the framework.

Figure 1: A PLS-SEM framework for subjective well-being



The intuition goes as follows. Group-level unemployment is understood to affect the general satisfaction level of individuals besides the direct effect streaming from the aggregation of individuals' direct loss in utility caused by being unemployed. This is also what empirically is called the 'multiplier effect'. The impact on the general satisfaction level goes through its domains, e.g. job satisfaction, health satisfaction, financial satisfaction etc. Essentially, general satisfaction level is a weighted combination of its domains. The effect from the group-level unemployment to the general satisfaction is thus a weighted average of the impact on domain-level satisfaction. Our main interest, are the mechanisms via which the effects of unemployment on the wellbeing of others occur. Before discussing the role of the mediators in more detail, it is worthwhile noting that we consider general well-being as a latent variable measured by several survey measures or indicators of this general latent construct 'general well-being'. The PLS-SEM component of our framework allows us to identify the various satisfaction components via responses to the survey questions posed in the EVS. For instance, general satisfaction is identified through responses to *both* the question of life satisfaction and question of happiness provided. A similar approach holds true for the domains. We estimate the weights attached to each domain. That is, if U_{ig} denotes the (latent) general satisfaction level of the i 'th individual in the g 'th

group, this relationship may simply be expressed formally by

$$U_{ig} = \omega' S_{ig} + \epsilon_{ig}, \quad (1)$$

where S_{ig} is the k -dimensional vector of (latent) domain satisfactions levels, weighted by their average relation to the general satisfaction level, ω , and an error term, ϵ . The PLS-SEM framework allows for the estimation of the factors as well as the weights.

It is through the just described relationship, group-level unemployment impacts the general satisfaction level. The mediation effect is operationalised as the component through which group-level unemployment impacts the domain and then, eventually, general satisfaction. For instance, group-level unemployment may impact job satisfaction through a loss of colleagues and uncertainty about future job prospect and anxiety of possible future job loss. Another potential mechanism could be that higher unemployment lead to an increase in crime which again create negative spill-over effects for those not directly affected by a job loss. The structure we employ, as depicted in Figure 1, facilitates a clear and straightforward operationalising of the mediation effect. Specifically, our PLS-SEM estimation procedure estimates the impact of the group-level unemployment to the different mediator effects and, successively, from the mediators to the domain satisfaction. The impact on the general satisfaction level is then simply weighted by the domain satisfaction share of general satisfaction. These relationships constitute the SEM structure of our framework.

A final component of this structure is the control variables which constitute variables we think of as predetermined. Those affect the general satisfaction level directly and need be chosen very carefully to correctly identify the mediation effects. We discuss this in the model selection below.

A. Inferences on mediation effects

As already mentioned, we obtained estimates for each node the Figure 1 above. Before specifying the concrete testing procedure, we note that we may think of several aspects of mediation. Let the direct nonmediation effect of group

unemployment be given by the effect from group-level unemployment directly on the domain satisfaction level (and then possibly onwards to general satisfaction). The we may define

- **Direct nonmediation:** The direct effect from group-level unemployment is significant, but the effect the mediator is not.
- **No-effect nonmediation:** Neither the direct effect nor the effect from the mediator is significant.
- **Complementary mediation:** Both the direct effect and the mediator effect are significant and points to the same direction.
- **Competitive mediation:** Both the direct and the mediator effect are significant, but the point in opposite directions.
- **Indirect-only mediation** Only the mediator effect is significant.

The loadings on each node in Figure 1 is estimated via OLS, and allows for inferences on mediation effects. Specifically, all five different mediation effects may be identified simply by constructing a conventional t-statistic on those loads, using appropriate standard errors. In the empirical section below, we employ a bias-corrected and accelerated bootstrapping technique (Hall, 1988) to ensure proper inferences. To clarify, suppose also that the load on the node from group-level unemployment to mediator 1 is significant and is, say, positive, and the load from the mediator is negative and significant. Suppose, intuitively, that the direct effect is negative and significant (insignificant), leading to the conclusion that there is a complementary (indirect-only) mediation effect from mediator one. If the load on the node from mediator 1 to domain satisfactions was positive, we would have obtained competitive mediation effect. We use these definitions in the empirical section below.

B. Relationship with conventional methods

Using a PLS-SEM framework has several advantages over conventional OLS estimation. First of all, when using survey data that contains measurement error, a SEM framework allows us to handle measurement error better than OLS. Using a SEM model allows us to handle measurement error by measuring the potential

mediators as latent construct measured by several indicators in the EVS, while OLS model use the survey response directly. Second of all, we are allowed to simultaneously handle several domains of overall well-being. Generally, the PLS-SEM model does not rely on distributional assumptions but is a nonparametric method, which is also a clear benefit of this methodology. The method is also often used explorative as is the case in this paper.

III. Model selection: Mediation effects, life satisfaction domains and controls

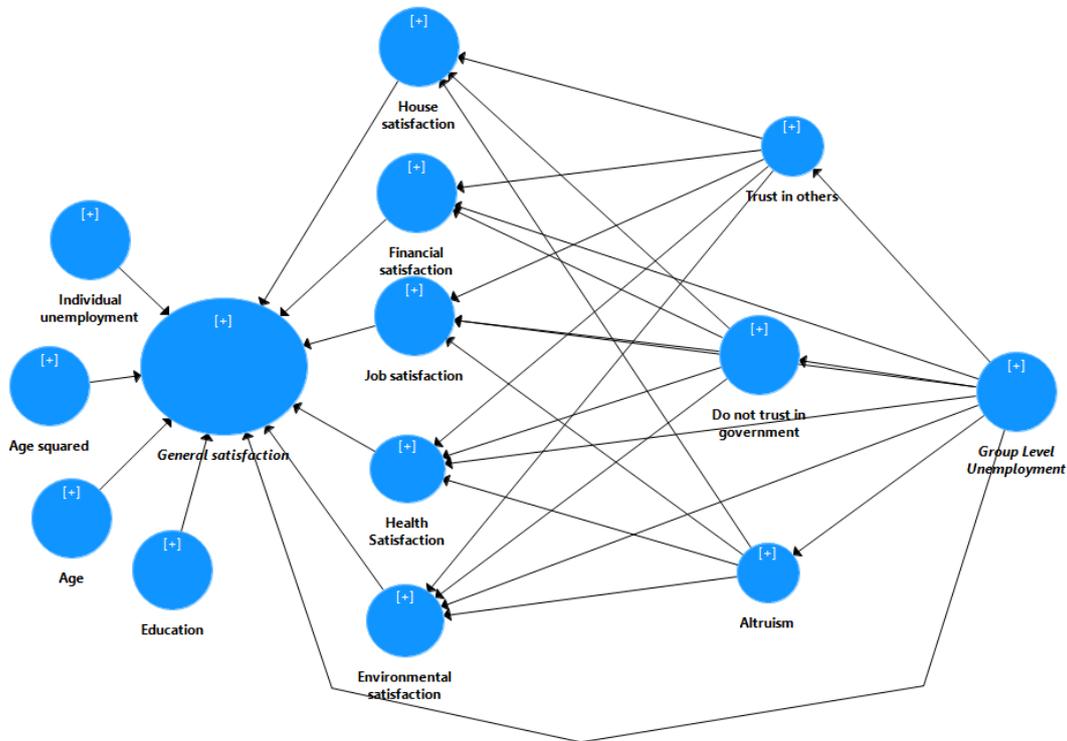
In this section, we delineate our approach to the former three questions, i.e. to the choice of controls, to potential mediation effects and to associated variables that represent those, and to the choice of variables used for identifying the domains of life satisfaction.

A. Anatomy of subjective well-being: Domains of general satisfaction

As already conveyed above, we treat general satisfaction of the individuals and its subcomponents as intrinsically latent constructs.² We consider the following anatomy of general satisfaction (which is partly driven by data availability), depicted in the figure below (we explain below the occurrence of this exact specification):

²We acknowledge that, given the data provided, some of domains are defined only by a single survey question. This renders the given domain observed rather than latent. This has no effect on the structure proposed above - it can simply be seen as a special case of our more general model.

Figure 2: A PLS-SEM framework for subjective well-being



We acknowledge that additional domains not included in the above decomposition may be relevant, e.g. leisure satisfaction.³ Given limited data availability, we are restricted to the proposed anatomy, but account for this by measuring the "residual" effect from group-level unemployment on general satisfaction directly, when controlling for the effects of the other domains. This measures the residual (or leftover) effect from group-level unemployment on general satisfaction, which does not go through the domains of our model. The outer line from group-level unemployment to general satisfaction indicates this relation. More granular data would allow both for the identification of additional domains and, consequently, additional mediation effects.

The general satisfactions and domain are identified in the PLS-SEM through the following questions:

- **General satisfaction:** *a170*: All things considered, how satisfied are you

³See e.g. the seminal paper by Van Praag and Ferrer-i Carbonell (2003).

with your life as a whole these days?, scale 1-10 and *a008*: 'Taking all things together, would you say you are very happy, quite happy, not very happy, not at all happy?', scale 1-4.

- **Job satisfaction:** *c033*: 'Overall, how satisfied are you with your job?', scale 1-10.
- **Health satisfaction:** *a009* 'All in all, as how well would you describe your health these days?', scale 1-4.
- **Environmental satisfaction:** *E110*: 'On the whole, are you very satisfied, rather satisfied, not very satisfied or not at all satisfied with the way democracy is developing in our country?', scale 1-4 and *E111*: 'People have different views about the system for governing this country. Here is a scale for rating how well things are going.', scale 1-10.
- **Financial satisfaction:** *c006*: 'How satisfied are you with the financial situation of your household?', scale 1-10.
- **House satisfaction:** *d002*: 'Overall, how satisfied or dissatisfied are you with your home life?', scale 1-10.

We expect aggregate unemployment to be negatively related to job satisfaction. This is an established result in the literature. For instance, [Clark, Knabe, and Ratzel \(2010\)](#) show a negative relation between aggregate unemployment and happiness, but argue that the mechanism of the effect is not only to be explained through the social stigma of the unemployed but through a negative effect on the happiness of those with weak labour-market security. We furthermore expect a negative relationship between aggregate unemployment and health, mainly through effects on mental health. The intuition is that given aggregate unemployment is negatively related to happiness, and under the assumption that it is in the human nature to respond sensitively and reciprocal to one's own social environment, the sign of the association between aggregate unemployment and individual mental health should be negative. Our intuition for environmental satisfaction is similar to health. Equity is an important concern in most societies included in our sample. Even if unemployment is not experienced in a peer group, we expect people not to be indifferent to the unhappiness of people outside of

their peer group. Therefore, we expect environmental satisfaction to be negatively related to aggregate unemployment.

B. Candidate mediation effects

We construct a set of candidate mediation effects and present below our main intuition why we chose them as candidate mediation effects. We also classify the candidate mediation effects into two groups; *SES* (socio-economic status) and *psychological* (PSY). The selected variables and associated intuitions are summarized below:

- *Altruism*. Variables included: *E160 E162₀₁ E153 E154 E158* . This set of variables incorporates information on whether a survey participant contributes through e.g. unpaid voluntary work, his/her reasons for voluntary work, and several survey question on social groups the respondent cares about. (PSY). Intuition: Caring about others' happiness leads to direct losses in utility when others suffer.
- *Trust*. Variables included: *A165 A168₀₁ A168A* . The variables included incorporate information on e.g. the survey respondents assessment of the trustworthiness of others.(PSY/SES). Intuition: Higher unemployment of others might foster the belief that those unemployed do not contribute to society. This might lead to lower levels of trust, which itself we associate with lower levels of happiness.
- *Confidence in Society*. Variables included: *e069₀₅ e069₀₉ e069₁₁ e069₁₂ e069₁₃ e069₁₈ e069₁₇*. The incorporated variables are expressions of trust level of the survey respondents towards several institution. (PSY). Intuition: Higher unemployment might be associated with failures in public policy. The worse perception of institutions to tackle unemployment might decrease confidence in tackling problems in other policy areas that the survey respondent cares about.

It is clear that we do have some prior intuition on which subdomain of satisfaction we expected the mediation effects (if it exists) to have an impact. Still, one of the main benefits of our PLS-SEM procedure below is that we let the data speak. As will become clear later, we conduct an iterative model selection procedure which

identifies not only the potential presence of a mediation effect, but also at which domain the meditation affects satisfaction.

C. Control variables

In the first case of the competition, our paper investigated, among other things, the role and selection of relevant controls to estimate the multiplier effect of unemployment on happiness. By employing a double-selection procedure using LASSO - see e.g. [Belloni and Hansen \(2017\)](#) - we found a moderate overlap between conventional controls used in classical papers, see e.g. [Di Tella and Oswald \(2003\)](#). For our implementation of the PLS-SEM framework, we pre-determine a set of control variables based on these findings. Specifically, we use a subset of the intersection of these variables. We need to be careful in choosing a precise set of controls, because the effects from group-level unemployment may go through common choices as income and even GDP and inflation (through, e.g. price pressures from wages). Our set of controls is defined as

$$x_{ig} = (age_{ig}, age_{ig}^2, educ_{ig}, gender_{ig}, unempl_{ig})', \quad (2)$$

for $i = 1, \dots, N$ and g denotes the country-level indicator. We include the individual-level unemployment situation as control in order to capture the effect from group-level unemployment and not the total effect of unemployment, as that defined by the sum of the individual-level unemployment effect and the group-level effect. This was extensively discussed in our main-case paper.

IV. Data

In this section, we briefly present our data and associated measures of well-being and unemployment.

We will focus on a sample of individuals in the age span of 21-60 who are part of the labour force at the time of the survey to be comparable to e.g. [Clark et al. \(2010\)](#) who defined their sample in a similar way. Given our interest in the employment multiplier, this is a natural choice. We also sample national unemployment rates from all included countries in EVS except from Kosovo and Northern Cyprus

(who constitute a limited share of the total sample) to create an alternative measure of group unemployment. Therefore the observations from Kosovo and Northern Cyprus is disregarded in the analyses that employs this alternative group unemployment measure. The collected national unemployment rates is obtained from the IMF database associated with the World Economic Outlook. Generally, we standardize all of our variables in order to facilitate interpretation since the scales of the original variables differ.

A. Measure of unemployment

We define our group unemployment rate, u_g , as the share of unemployed in group g out of the total labour force in group g , where the labour force is defined to be the sum of the unemployed, the self-employed and the employed, both full-time and part time. This is the same definition used by OECD and the ILO. We will consider g as the groups of countries. In addition to the group unemployment rates based on the provided data, we sampled unemployment rates from all included countries in EVS (except Kosovo and Northern Cyprus) from the IMF database associated with the World Economic Outlook. Due to the omission of Kosovo and Northern Cyprus observations from these areas (who constitute a limited share of the total sample) will be discarded in the analyses that use this alternative measure⁴. This new unemployment measure also facilitates comparisons of the self-reported measure of unemployment that might contain measurement error. We compared the distributions of the imputed values to the non-imputed values and found no discernible differences.

B. Missing data

The EVS data set contains a non-negligible amount of missing values, both for the dependent variable, our well-being measure, and for the independent variables. We tested under the null hypothesis that the data was missing completely at random (MCAR) and rejected this hypothesis for almost all variables going into our analysis. Based on this we ideally would choose to use multiple imputation

⁴Ideally, we would rerun our models only using data from the EVS on the exact same sample as the one used in the analysis of the alternative group unemployment measure. In interest of space and the time constraint, we refrain from this. Further, we do not expect our estimates in the first part of the analysis would differ much if we excluded Kosovo and Northern Cyprus, since the two countries constitute a limited share of the total sample

by chained equations, that allows us to handle continuous and discrete variables separately for imputing missing values for the independent variables, see e.g. [Azur, Stuart, Frangakis, and Leaf \(2011\)](#) for details, which we did in the main case. Yet, due to the additional amount of data and the timeconstraint, missing values⁵ are imputed by mean values.

V. Empirical results: Mediation effects on life satisfaction and its domains

In this section, we estimate our SEM-PLS model and investigate how the effects of unemployment of one person on others are mediated. We discuss how different domains of satisfaction are affected. All our results are weighted according to the weighting variable provided in EVS. We present results for the aggregated self-reported unemployment measure, and compare our findings to that using the external IMF measure of country-level unemployment.

A. Model diagnostics

In order to establish that the latent variables are reliable and validly measured, we begin by analyzing the outer model. Notice that this is only relevant for the constructs measured by multiple questions (and the consistency and reliability of single item measured are assumed). Based on the wording of the questions included in the analysis, we have assumed a reflective measurement model. Theoretically, this means that a change in the the construct would have an effect on the indicator. E.g. if a persons general well being is increased, this will be reflected in the way he answers on the question "All things considered, how satisfied are you with your life as a whole these days".

First we establish internal consistency reliability, by using cronbachs alpha and composite reliability. Satisfactory ranges are normally between 0.7 and 0.9, where cronbachs alpha normally underestimates the true reliability, and composite reliability in general overestimates it. We find reliability measures in the satisfactory ranges for all constructs (the one with the a score that is closest to the boundaries

⁵Includes all the categories of 'Missing/Unknown', 'Not asked in the survey', 'Not applicable', 'No answer', and 'Don't know'

is "Altruism" which has a cronbachs alpha of 0.669 and composite reliability of 0.75).

To investigate the convergent validity we check the outer loadings (the correlation between the latent variables and the indicators) and the average variance extracted. The outer loadings are normally considered as acceptable if they are found to be above 0.7. Loadings between 0.4-0.7 should be investigated further (and we do not have any loadings below 0.4, which would give rise to a deletion of the indicator). The construct that give rise to the mediocre loadings are "Altruism" and "Do not trust in government". By inspecting the effects on the reliability measures and the average extracted variances, we choose to delete the variable $A_{concern_{Human}}$, $A_{concern_{fam}}$ and $DNTrust_{unions}$ (notice after each modification to the model, the previous steps of validation is reiterated). The average variance extracted of all constructs is also above the rule of thumb of 0.5.

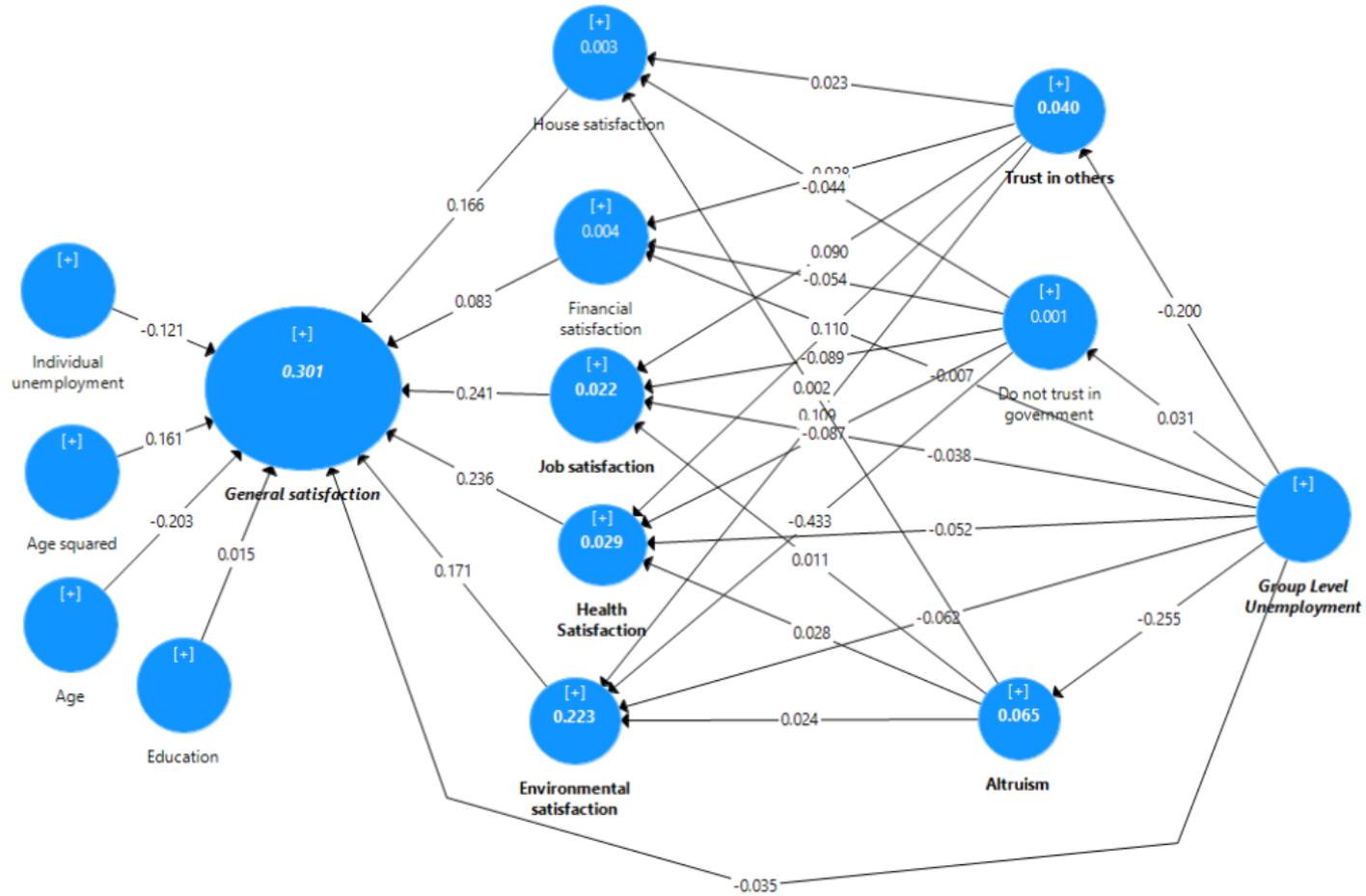
To investigate if the latent constructs are distinct from each others, that is, if we are actually measuring conceptually distinct entities, we checked the Hetero-treat-monotrait ratio. This is an estimate of what the true correlation would be if the constructs were perfectly measured. A rule of thumb for the hetero-treat-monotrait ratio is that it should be below 0.9. This is the case for all constructs in the model (both the single and multi-measured ones).

Arriving at a measurement model that satisfies all the heuristics, we can proceed to look at the structural/inner model. Before we go on to interpreting and significance testing of the coefficients, we check for collinearity issues in the inner model, by investigating the variance inflation factor, and find that this is at most 1.17 (with the age controls as one exception).

A.1. Illuminating the mediation effects

We obtain the following final model specification by above procedure, which is depicted in Figure 3 below. Note that due to the exploratory procedure in the former section all depicted relations are statistically significant.

Figure 3: A PLS-SEM framework for subjective well-being



The model is elaborate on the relationships, and we summarise its impact in the following to conclude on mediation effects. First, there exists significant mediation effects through our three suggested variables. Moreover, they are all of the complementary mediation kind (cf. the definition in Section II) We note that group-level unemployment reduces trust in others, the confidence in the government and altruism. This is highly intuitive. We next comment on each mediator. The trust in others loads positively all domain satisfaction levels. This means together with the negative load from the group-level unemployment that it *reduces* satisfaction on all domains. Since data is standardised, we may compare loads directly within each layer of the model. It stands out that the mediation effect from the trust in others is greatest on job, health and environmental satisfaction. The confidence in government also functions as complementary mediator, with its primary effect affect (by far), unsurprisingly, on the environmental satisfaction. Altruism is a complementary mediator primarily via health and environmental satisfaction, and does not statistically significantly impact financial satisfaction.

The share of the (negative) total effect of group-level unemployment from the three mediators and the residual effect is reported in Table 1

Ta-

ble 1: Total effects of group-level unemployment on general satisfaction

This table reports the group-level unemployment mediator effects and the leftover effect defined above in shares of the total effect.

Mediator	Total effect (self-reported)	Total effect (IMF)
Altruism	6.27 (-)	6.78 (-)
Confidence in government	6.97 (-)	60.1 (-)
Trust in others	25.29 (-)	8.08 (-)
Residual effect	61.47 (-)	24.9(-)

It appears that the dominating mediation effect goes through trust in others when using the selfreported unemployment measure but when we use the IMF measure of unemployment the mediating effect shifts to confidence in government and the direct effect is almost halved. There is a substantial residual affect, which indicates that further analysis with more granular data might reveal additional insights.

Table 2 reports the effect of group-level unemployment, via mediators, on each domain satisfaction.

Table 2: Effects from group-level unemployment on domain satisfactions
 This table reports the group-level unemployment effects on each satisfaction domain in shares of total effects..

Mediator	Effect (self-reported)	Effect (IMF)
Environmental satisfaction	38.4	27.6
Financial satisfaction	5.2	17.2
Health satisfaction	31.0	33.1
House satisfaction	2.6	1.1
Job satisfaction	22.8	20.7

When using the self-reported measure we see that group-level unemployment has the largest effect on environmental satisfaction and health satisfaction. This is highly interesting. At first glance, one might be tempted to think that the effect would be primarily through the financial and health domain. For our set of mediators, this is strongly not the cases. Rather, the group-level unemployment tend to affect the general environmental satisfaction by the most, possibly via a fear effect as elaborated on in the Main case. We note that much may be left for the residual effect such that additional mediators not included in our set of candidates (partly due to data availability) might illuminate on additional aspects. When we shift our measure to the unemployment measure obtained from IMF, we see that health satisfaction and environmental satisfaction is now the largest. it is interesting that shifting to this more objective measure changes the effect rather profoundly with a strong shift to financial satisfaction.

A.2. Segmentation

The nice feature of our setup is that it allows for understanding grouping effects as well. We could easily decompose above findings in e.g. the on men and women, which is examined before in the literature. Time constraints did not allow for this investigation.

VI. Discussion and causal interpretation

In our paper from the main case we argued that causal interpretation of our estimates should be undertaken with great caution. Even though we controlled for a large battery of fixed effect and the LASSO covariate-choice procedure should alleviate endogeneity concerns, most classical endogeneity problems still arise, as sorting/selection on unobservables and the problem of simultaneity – overall happiness affects individual happiness and vice versa. Without exogenous variation in the data (or theoretically motivated exclusion restrictions), we concluded that it was impossible to make a statement about the direction of causation. The same caveats hold for the estimation of our SEM model. The reported coefficients of our estimation have, in general, no causal interpretation due to a lack of clear exogenous variation.

As it is true that there is no causal identification without convincing exogenous variation, the ladder is only a necessary condition in a convincing identification strategy. In observational studies, it is of crucial important that the researcher has a theoretical foundation that leads to the assumption that treatment d_i does indeed have a causal effect on the outcome variable (thus that the set of potential outcomes is not a singleton). We believe that the estimation results from our SEM model cannot be given a causal interpretation, but we believe that we have worked out a framework of potential causal effects that might guide future research on the effect of aggregate unemployment on subdomains of life satisfaction (as e.g. health or job satisfaction) and might allow to theorize in particular on the interactions of mediating effects of aggregate unemployment on happiness.

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A. Appendix