

Do union formation and childbearing improve subjective well-being? An application of propensity score matching to a Bulgarian panel

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Abstract The link between childbearing, union formation and subjective well-being is still under-investigated. A key problem is disentangling causal effects, a challenge when the interplay between life course pathways and states of mind is investigated. Here we use propensity score matching estimates applied to panel data to demonstrate how the birth of a first child or entry into union increase individuals' psychological wellbeing and reduce disorientation in Bulgaria, a transition country with lowest-low fertility and postponement of union formation. Sensitivity analyses confirm the robustness of our findings to heterogeneous levels of hidden bias.

1 Introduction

After the fall of communism in 1989 and the subsequent economic crisis that spread in the former Iron Curtain, several changes in demographic behaviour arose as those countries became engaged in the difficult transition to a market economy.

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Bulgaria has been no exception to this scenario. The Total Fertility Rate (TFR) reached “lowest low” fertility levels, i.e. lower than 1.3. Moreover, the mean age at marriage has become higher than the mean age at first birth (Koytcheva, 2006), with an increase of out-of-wedlock births. Since the early 1980s, a decrease in the relative risks of marriage and a simultaneous increase of the rate of entry in cohabitation have modified the common patterns of union formation (Hoem and Kostova, 2004).

Given the crisis, one might ask with Kohler, Behrman and Skytthe (2005) “Why do individuals in developed countries continue to form union and have children?” Most studies discuss the costs and benefits of having children and entering partnerships. This approach assumes that individuals derive utility from life course events such as childbirths and marriages/cohabitation. The “utility” deriving from these events cannot be clearly expressed in monetary terms: a possible measure of the benefit associated to life course pathways and events is subjective wellbeing.

In fact, the demographic literature has also underlined how ideational dimensions (including proxies of subjective wellbeing) can produce a causal effect on individuals’ intentions and subsequent life course decisions. In particular, Philipov, Speder and Billari (2006) focus on *anomie* measures as determinants of childbearing decisions (the concept of *anomie* was developed by Durkheim (1893, 1897) and later by Merton (1968) to define the loss of prescriptive power of norms in a society). The weakened power of norms causes a state of uncertainty and disorientation on people’s state of mind that may affect happiness and subjective wellbeing. Under the influence of *anomie* people become indecisive, due to feelings such as disorientation, uncertainty and psychological discomfort. This situation is widespread in transitional societies like Bulgaria, where sudden changes can lead to rapid increases in material wellbeing as well as entry into poverty status.

2 Data

This study on Bulgaria is based on data from the recent survey “The Impact of Social Capital and Coping Strategies on Reproductive and Marital Behavior”, sponsored by the Max Planck Institute for Demographic Research in Rostock, Germany. The first wave of the survey was carried out in 2002. The sample includes 10,003 men and women aged 18-34. The second wave took place in the winter of 2005/06 and contains the interviews of 7,481 subjects already present in the first wave; one of the aims of the second wave is to capture changes in intentions, behaviours, values and social characteristics through a panel design.

The survey investigates *anomie* using several dimensions: powerlessness, lack of orientations (that are included in a unique factor named *disorientation*¹), loneliness (labelled as *psychological wellbeing*²). These dimensions are subject to a process of

¹ This variable is obtained after a principal factor analysis on three items that ask to respondents whether they agree or disagree to the following statements: “I have little influence over my fate”; “One can hardly find his/her orientation in life nowadays” and “No one cares what happens to other people”.

² This variable is obtained from a factor extracted from answers to two questions where respondents had to choose over a five-point scale ranked from Completely Disagree to Strongly Agree. The wording of the items was: “During the past month have you ever felt very lonely or remote from other people?” and “During the past month have you ever felt depressed or very unhappy?”

adaptation on new life course paths similarly to what happens for attitudes and value orientations. In this framework we follow Kohler, Behrman and Skytthe (2005) approach and test whether childbearing and marriage/cohabitation contribute to increase subjective wellbeing and to reduce individual anomie. In order to reach this purpose, it is pivotal define more precisely the outcome of the research as the variation in factor scores for each of the anomie dimensions analyzed.

The identification of a possible effect of life course events on subjective wellbeing shows statistical problems that are not present in Kohler *et al.*, who examine a sample of Danish twins. Indeed, estimates may easily be polluted by problems of selection bias. For example, the estimation of a positive effect of childbearing on individuals' subjective wellbeing may be polluted by the presence of external confounders like economic wellbeing, age, pre-pregnancy level of satisfaction towards his/her own life. These factors may affect both the probability of having a child and post-childbirth subjective wellbeing, with the effect of overestimating the positive effect of childbearing. An analogous phenomenon might arise for union formation.

3 Estimation Strategy

The aim of our empirical analysis is two-folded. First, we want to investigate the causal effect of bearing a first child on individuals' measures of anomie. Second, the purpose is to detect the effect of the entry into union on anomie for individuals that were not in union after the first wave. To measure the impact of childbearing or union formation, we are interested in the difference of the outcomes in the presence of childbearing/union or not between the two waves. Because of the binary typology (yes/no) of these life course events, the problem can be analyzed in a treatment evaluation setting. Rosenbaum and Rubin (1983) suggested to focus on the quantity $E[Y_{i1} - Y_{i0} | T_i = 1]$, defined as the Average Treatment Effect on Treated (ATT). Here, Y_{i1} is the outcome for individuals who experienced a union and/or childbearing ("treatments") between the waves; conversely Y_{i0} is the potential outcome for individuals who did not experience any union formation or fertility event ("controls").

Many problems deal with the identification of ATT. The first is that only one among the potential outcomes is observed for each individual, making a direct comparison impossible; consequently, in order to estimate ATT one needs to identify the quantity $E[Y_{i0} | T_i = 1]$. This is impossible, because the outcome in the case of absence of pregnancy/union for an individual that has indeed had a child or started a union instead is not observable. A possible solution to overcome the problem is to use an estimator of $E[Y_{i0} | T_i = 0]$ for $E[Y_{i0} | T_i = 1]$. Simple estimators are biased in presence of observable confounders. A possible solution is conditioning on pre-treatment covariates X : $ATT(X_i) = E[Y_{i1} - Y_{i0} | T_i = 1, X_i]$

Identification of ATT is feasible if imposing mean independence i.e.

$$Y_{i1}, Y_{i0} \perp T_i | X_i \quad (1)$$

A second problem dealing with ATT estimates consists in the difficulty to find individuals with identical values in the vector X , when the number of covariates is high or when some of them are continuous.

Rosenbaum and Rubin (1983) proposed matching based on propensity score, which is the conditional probability of receiving the treatment given X ,

$$p(\mathbf{X}_i) = \Pr[T_i = 1 | \mathbf{X}_i] \quad (2)$$

Rosenbaum and Rubin (1983) demonstrated that matching individuals with the same propensity score is equivalent to compare them on the basis of X with the advantage that an estimate of propensity score is easy to obtain thanks to a simple logistic regression. This result reduces the dimensionality of the problem of computing the conditional expectation, as we only need to condition on a one dimensional variable and ATT can be formalized as:

$$ATT = E_{p(\mathbf{X}_i)}[ATT(\mathbf{X}_i)] = E_{p(\mathbf{X}_i)}[E[Y_{i1} - Y_{i0} | T_i = 1, p(\mathbf{X}_i)]] = E_{p(\mathbf{X}_i)}[E[Y_{i1} | T_i = 1, p(\mathbf{X}_i)] - E[Y_{i0} | T_i = 0, p(\mathbf{X}_i)] | T_i = 1] \quad (3)$$

Several matching algorithms can be used to estimate (3); in such case we will have that

$$\hat{ATT} = \frac{1}{N_1} \sum_{i \in [T_i=1]} \left[Y_{i1} - \sum_{j \in [T_j=0]} w_{ij} Y_{0j} \right] \quad (4)$$

where N_1 indicates the number of units that experienced childbearing or union formation in the considered time interval; w_{ij} represents a sample weight for control units used in matching procedure. In this framework, it is useful to implement nearest neighbour within caliper matching, consisting in matching each treated unit i with the closest control unit in terms of propensity score. More in detail, treated and controls are matched within a tolerance level that is settled at 0.05 in terms of propensity score. The use of a fairly strict caliper requires a high degree of observational similarity between treatment and control cases.

Propensity score matching (PSM) presents a strong disadvantage: its estimates give robust results when individuals are matched on observables but fail in presence of unobservable confounding factors. When in presence of unobservables affecting both assignment into treatment and the outcome variable simultaneously, hidden bias might arise. In this work, in order to preserve estimates from irregular assignment to treatment in logistic regression caused by hidden bias, we implement different strategies. First, the nature of our survey allows us for adding variables related to possible ideational factors that are correlated to unobservable dimensions such as religiosity and social capital. These variables limit the influence of omitted or unobservable variables and are proxies for individuals' religiosity, attitudes and family values.

Secondly, the presence of a longitudinal design for data gives us the opportunity of measuring the outcome both before and after the treatment. This allows comparing the mean change of anomie from the first wave t and the second wave $t + \Delta t$. After replacing the expected values with the sample means, the so-called difference in difference estimator can be obtained for the quantity:

$$ATT_{DD} = E_{p(\mathbf{X}_i)}\{E[\Delta_{1i} | p(\mathbf{X}_i), T_i = 1] - E[\Delta_{0i} | p(\mathbf{X}_i), T_i = 0]\} \quad (5)$$

where Δ_{i} represents the difference in factor scores for the individual i between the waves. An estimator of (5) is called combined PSM-DD estimator.

An important advantage of DD estimator is that controls for selection due to unobservables that are supposed to be time invariant. Thus, it is possible to combine DD with propensity score matching estimator, summing the advantages of two approaches. Obviously, even this assumption might be violated, if some time varying

confounders exist. In such case, we have to implement a sensitivity analysis in the next section in order to quantify the effect determined by unobservable sources of bias.

Rosenbaum (2002) developed a bound method for sensitivity analysis with the aim to assess the effect of unobservable factors on the computation of hypothesis test from the family of sign-score statistics that includes the nonparametric statistics Wilcoxon's signed rank test used in presence of continuous outcomes. In the line below we offer a summary of the theoretical procedure as formulated by Di Prete and Gangl (2005) and Guo and Fraser (2010).

Suppose there is an unobservable source of bias U_i that varies across individuals and that affects the assignment to treatment. Let p_i be the probability that the i -th unit is treated, then the treatment assignment rule is described as follows:

$$\ln \left[\frac{p_i}{1-p_i} \right] = f(X_i) + \gamma U_i \quad (6)$$

Rosenbaum proved that a transformation of (6) implies that the ratio of the odds for treated and untreated units considered in each of the N_1 pairs of treated and untreated units is bounded:

$$\frac{1}{\Gamma} \leq \frac{p_{i1}(1-p_{i2})}{p_{i2}(1-p_{i1})} \leq \Gamma \quad (7)$$

where $\Gamma = e^\gamma$, p_{i1} is the probability that treated unit i receives the treatment, whereas p_{i2} is the probability that the control unit matched to i receives also a treatment. The sensitivity analysis goes further to assume that this odds ratio for units with the same value of propensity score was at most some number $\Gamma \geq 1$. By the above definitions, if $\Gamma = 1$ then $p_{i1} = p_{i2}$, so the study would be free of hidden bias and the odds ratio of receiving a treatment for matched individual with identical values for propensity score computed with observable covariates is obviously equal to one, i.e. $\gamma = 0$. For example, if $\Gamma = 2$, then the two units, that appear with closest value of propensity score, could differ in their odds ratio of receiving the treatment by as much as a factor of 2, so one unit might be twice as likely as the other to receive treatment. In other words, as Rosenbaum (2002) pointed out, Γ is a measure of the degree of departure from a study that is free of hidden bias. Sensitivity analysis consists in evaluating the sensitivity of estimates of *ATT* for different values of Γ ; from the equation (7) Γ represents the bound for the odd ratio that units $i1$ (the treated) and $i2$ (the control) might be selected to form a matched pair (Guo and Fraser, 2010). Rosenbaum (2002) developed a procedure that uses the distribution of the Wilcoxon's signed-rank statistic (see Di Prete and Gangl, 2005 for analytical aspects) under the null hypothesis that *ATT* is zero: the distribution of the Wilcoxon's signed-rank is function of Γ , i.e. of the odds ratio explained in (7). If *ATT* maintains significant for high values of Γ , it means that there exists a significant causal effect of treatment also in presence of hidden sources of bias. Our table gives the critical value for the odds ratio of receiving the treatment Γ for matched and control pairs for that the confidence interval for *ATT* at 90% starts to include the 0. Literature has not discussed in detail critical Γ for considering causal effects robust to hidden bias. However, Di Prete and Gangl (2005) stated that an optimal level depends on the research question, even if a value of Γ close to 1.5 would represent a rather reliable threshold to not question the significance of *ATT*.

4 Results

The empirical analysis is carried using the Stata module written by Leuven and Sianesi (2003) and is divided in two parts. In the first part we address the effect of the birth of the first child on anomy. In the second part we analyze the effect of marriage or cohabitation on the same dimensions.

Table 1: Causal Effect of first child on Anomie

		<i>N. of treated</i>	<i>ATT</i>	<i>t stat</i>	Γ <i>critical</i>
<i>Psychological</i>	<i>Men</i>	254	-.004	-.04	1
<i>Wellbeing</i>	<i>Women</i>	288	.254**	2.24	1.3
<i>Disorientation</i>	<i>Men</i>	253	.037	.45	1
	<i>Women</i>	279	.048	.58	1

*** $p < 0.01$; ** $p < 0.05$ * $p < 0.1$.

According to the results in Table 1, childbearing increases psychological wellbeing for women, whereas no effect appears for men. Results are consistent with the ones obtained by Kohler *et al.* (2005), who show how the birth of first child increases subjective wellbeing in a sample of Danish twins. Focusing now on disorientation, childbearing seems to have no effect for both women and men. However, the combined *PSM-DD* estimator is reliable only in presence of time-invariant sources of bias. As we mentioned above, we implemented a sensitivity analysis, using Rosenbaum's (2002) procedure for bounding the treatment effect estimates in previous tables. Results are displayed in the last column of Table 1. This procedure provides evidence for the robustness of estimates at the maximum-tolerated level of hidden bias expressed in terms of the odd ratio of differential treatment assignment due to an unobservable covariate. In the case of the impact of a first child on females' psychological wellbeing, the positive effect is questioned in presence of an unobservable covariate with odds ratios of differential treatment assignment of about 1.3.

Table 2: Causal Effect of union formation on Anomie

		<i>N. of treated</i>	<i>ATT</i>	<i>t stat</i>	Γ <i>critical</i>
<i>Psychological</i>	<i>Men</i>	230	.368***	3.56	>1.5
<i>Wellbeing</i>	<i>Women</i>	241	.320***	2.92	1.45
<i>Disorientation</i>	<i>Men</i>	230	-.061	-.74	1
	<i>Women</i>	240	-.134*	-1.69	1.1

*** $p < 0.01$; ** $p < 0.05$ * $p < 0.1$.

Table 2 shows how psychological wellbeing increases after marriage or cohabitation: estimates are higher for men, confirming findings from Kohler *et al.* (2005), but they are also significantly positive for women. Rosenbaum bound checks suggest that selection due to unobservables would have to attain level larger than 1.4 for odds ratio of receiving the treatment for treated units and controls to undermine the significance of treatment effect estimates, confirming the results as relatively robust to hidden bias, in the approach of Di Prete and Gangl (2005). Rosenbaum bounds approach does not

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allow for returning significant results for estimates that were initially not significant with Γ equal to one: indeed, for any value of Γ , confidence interval estimates for *ATT* still include 0 for the cases of men's psychological wellbeing and disorientation in Table 1 and for only men's disorientation in Table 2.

5 Matching Details and Robustness Checks

The choice of the variables used for estimating the propensity score applied in Table 1-2 is based on both statistical and demographic reasons. Following Heckman, Ichimura and Todd (1997), omitting important variables can increase bias in matching results. Event though Rubin and Thomas (1996) are in favour of parsimony in choosing the regressors, the response is unanimous in suggesting the inclusion of covariates that are supposed to be correlated with the treatment and the outcome. Previous demographic surveys such as Philipov, Speder and Billari (2006) identified possible determinants for the intention of having children between the two waves of the same interview: age of respondents, number of siblings, number of children at first wave, marital status, household income, labour market position (working in private or state market), respondents' and parents' education (primary, secondary or higher education), religiosity, social capital are included in this survey as significant regressors for the treatment. Also economic theory (see for example Easterlin, 2001) gives to a subset of the previous variables a central role in affecting the subjective wellbeing that represents the outcome of our research. The previous reasons justify this set of covariates in propensity score specification. The list of PSM confounders includes also positive and negative attitudes towards childbearing as estimated in Billari, Philipov and Testa (2009) and that are significantly connected to the life course events we have analyzed. Finally, as suggested in literature, PSM results are more robust adding also the starting levels of anomie indicators (Disorientation and Psychological Wellbeing), that represents the outcome of our analysis. The quality of matching depends also on the satisfaction of the assumption of the balance property and of the reduction of average absolute standardized bias according to the thresholds suggested in literature (Caliendo and Koepinig, 2005): all the covariates described above are not different in means in treated and untreated groups at 1%, 5% and 10% levels without the need to introduce interaction between covariates and higher order polynomial terms. Therefore, treatments and controls are sufficiently homogeneous and can be successfully compared in order to reduce selection bias due to observables. The goodness of matching estimates depends also on the matching method implemented in the analyses. Nearest neighbour matching results are compared with those obtained via radius and kernel matching, joining very close results in terms of causal effect estimates.

6 Conclusions

Our results confirm the presence of a process of anomie reduction in presence of childbearing and new partnerships. In particular, the loneliness dimension of anomie is summarized by the psychological wellbeing factor and seems to be more sensitive to a

process of adaptation, especially for women, who increase wellbeing when they start a new cohabitation or when they bear a child. Disorientation dimension of anomie shows a more controversial result since it has a positive effect of partnership only on females' psychological wellbeing.

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