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PHD IN STATISTICS
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ATTITUDE AND ANOMIE MEASURES: SELECTION AND ADAPTATION. AN APPLICATION OF PROPENSITY SCORE MATCHING TO THE BULGARIAN FAMILY CONTEXT

By

EMILIANO SIRONI

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1. Introduction

1.1. The demographic background

Starting from the 1960s, a transformation took place in the pattern of household formation and reproduction in Europe: the age at the first marriage and divorces rates started to increase. In the same years there were other changes in family behaviours such as an increase of premarital cohabitation and an increase in the fertility of such informal unions. Moreover it was a postponement of fertility. These events characterize the so-called *Second demographic transition* (SDT). The term *Second demographic transition* was introduced by Lesthaeghe and Van de Kaa, (1986) in contrast to the concept of *First Demographic Transition* (FDT).

The FDT refers to the historical declines in mortality and fertility, as observed from the 18th Century onward in several European populations: its end point was supposed to be an older stationary population with replacement fertility (i.e. about 2.1 children per woman), zero population growth, and life expectancies higher than about 70 years. Conversely, SDT induced further changes in European family patterns, bringing *sustained sub-replacement fertility, a multitude of living arrangements other than marriage, the disconnection between marriage and procreation, and no stationary population.* Hence, populations would face declining sizes if not complemented by new migrants. As Lesthaeghe pointed out, the consequence of the process is still the further growth of "multicultural societies". In addition, the SDT spreads new social challenges, including those associated with integration of immigrants, lower stability of households, and higher levels of poverty or exclusion among certain household types (e.g. single persons of all ages, lone mothers).

The discontinuity between the FDT and the SDT is caused by the role given of ideational factors in the dynamic of population change. The SDT-theory fully recognizes the effects of macro-level structural changes, micro-level economic calculus but also the key role played by changes in value orientations and subjective wellbeing, that may affect individuals' behaviour. More in details, the demographic changes that are summarized above are linked to drastic transformations in society and habits of the individuals as:

- An accentuation of the autonomy in ethical and moral spheres;
- An augmenting rejection of all form of institutional controls,

- The rise of self-actualisation;

After 1990, also in Central and Eastern Europe there was a postponement of marriage and childbearing associated to a fall in the national *Total Fertility Rate* (Sobotka *et al.*, 2003).

The reasons of the change of marital behaviours can be found in the difficulties caused by the economic transition after the communist era but also in changes in individuals' ideational factors: indeed by the 1990s, younger generations had different aspirations compared with those of older cohorts; the pattern of value differentiation may reflect some of the characteristics of the SDT.

Many studies have documented statistical associations between ideational factors of individuals and the choices they make with respect to the unfolding of their life course. However, few studies document in the same work the recursive, two way influence between ideational factors and subsequent life course decisions and between life course events and subsequent factors' adaptation. In this sense Lesthaeghe (2002) edited a volume entitled "Meaning and choice: value orientations and life course decisions", which addressed the double causal relationship between value orientations and individual behaviour. The volume focused its analysis on attitudes and value orientations, using panel data and collecting several chapters from different authors on different socio-demographic contexts. The purpose of this thesis is to reconsider the sociological models of the duality of the process of selection-adaptation with respect to attitudes and value orientations and to apply them to the Bulgarian context (this is the aim of the first two papers that are included in the thesis). In addition, the thesis investigates further ideational variables, like anomie measures that are also subjected to a process of selection and adaptation (this is the aim of the third paper).

In order to address the relationship between ideational factors and demographic behaviour, we use data from a recent survey in Bulgaria entitled *The Impact of Social Capital and Coping Strategies on Reproductive and Marital Behavior*. The survey has a panel design and distinguished in two waves. The first wave of the survey was carried out in 2002 with the aim of studying family formation and childbearing. The sample includes 10,003 men and women aged 18-34. The second wave took place in the winter of 2005/06 to 7,481 subjects of the first wave that have been re-interviewed. Further details are included later in the text.

The thesis is organized as follows: in the following section of Chapter 1 we provide an introduction of the statistical methodology used to analyse the data with a central role for Propensity Score (Rosenbaum and Rubin, 1983, Rosenbaum, 2002). Then I present three chapters where I use propensity score matching to study the recursive causal interdependence between ideational factors and demographic behaviour.

1.2. A short introduction to propensity score matching

The aim of the thesis is two-folded:

- On the one hand, we want to identify whether ideational factors have any effects on demographic behaviour;
- On the other hand, the aim is to test if previous life course events readjust value orientations and subjective wellbeing measures.

When we try to determine the causal effect of an ideational variable or of a life course event on a outcome, we deal with a classical statistical problem of causal inference. Several models have been developed in statistical literature concerning the inference of a causal connection between a variable and its likely outcome. In this framework we refer to propensity score matching, initially proposed by Rosenbaum and Rubin (1983), commonly used in the program evaluation literature and representing a powerful instrument to assess causal impact.

Applications of this kind are spreading in the economics literature (see, among others, Blundell *et al.* 2005; Lechner, 2002; Dehejia and Wahba, 1999, 2002). Recently, propensity score matching algorithms have been introduced also in studies of demographic behaviour (see Mazzuco 2002, Aassve *et al.* 2007, Aassve and Lappegård, 2008, Arpino and Aassve 2007).

The analyses led in the following chapters require a short excursus, to summarize some key-concepts about propensity score matching and the potential outcome approach.

Suppose we have a sample of individuals, each of them indexed by the subscript $i=1,2,..,n$ and suppose to define a treatment variable T_i assuming value 1 if the individual i is treated and 0 otherwise. In this setting, we define also an outcome variable Y that is defined as a discrete or continuous variable. The goal of our analysis is to identify if there is a causal effect of T_i on Y and, possibly, to estimate the magnitude of the causal effect.

We define two potential outcomes for individual *i*: Y_{i1} is the outcome in the case the subject is treated and Y_{i0} is the outcome in the case the same individual is untreated. In the case individual *i* is treated Y_{i0} or conversely Y_{i1} in case of untreated status, is defined as *counterfactual*[1].

The treatment effect is given by the difference between the two potential outcomes for every unit:

$$\Delta_i = Y_{i1} - Y_{i0} \quad (1)$$

A key problem dealing with this measure is that only one of the two potential outcomes is observed in a sample. The observed outcome is given by the following formula:

$$Y_i = Y_{i1}T_i + Y_{i0}(1 - T_i) \quad (2)$$

Moreover, because Δ_i is a random variable, that is to say individual specific, the distribution of each potential outcome should be known. Therefore, Rubin (1978) and Rosenbaum and Rubin (1983) suggested to focus on the quantity called *average treatment effect*,

$$ATE = E[Y_1 - Y_0] \quad (3)$$

ATE is the expected effect of treatment on a person randomly drawn from the population. In literature, this measure has been criticized, because it seems not to be relevant for policy purposes, including also individuals who would never be eligible for treatment. A second quantity of interest, and one that has received much recent attention, is the *average treatment effect on treated*, which we denote with the acronym ATET:

$$ATET = E[Y_1 - Y_0 \mid T = 1] = E[Y_1 \mid T = 1] - E[Y_0 \mid T = 1] \quad (4)$$

In order to estimate ATET we need to identify $E[Y_0 \mid T = 1]$, which is an unobservable parameter. An easy solution to the problem is to use an estimator of ATET consisting of the observed difference between treated and not treated groups, as follows:

$$ATET = E[Y_1 - Y_0 \mid T = 1] = E[Y_1 \mid T = 1] - E[Y_0 \mid T = 0] \quad (5)$$

---

[1] We require also the SUTVA (Stable unit treatment value assumption condition), which states that potential outcomes for any unit do not vary with the treatment assignment to any other units and that there are not hidden versions of treatment (Wooldridge, 2002).

The right-hand side is easily estimated by a difference in sample means: the sample average of y_i for treated units minus the sample mean of the outcome for untreated units would be the correct solution if the assignment to the treatment T_i is random and not influenced by external factors i.e. if

$$Y_1, Y_0 \perp T \tag{6}$$

Randomization requires that the treatment assignment is unrelated to the potential outcome and that there is no difference in characteristics of treated and control units. If condition (6) fails, the variation of the potential outcome cannot be attributed to the difference in value scores between treated and untreated: individuals may differ in other observed or unobserved variables that could influence the realization of T: there is a problem of selection bias that makes the treated and control units qualitatively different.

Among observational studies and in presence of a binary treatment one way to reduce the bias is to select individuals with similar observable characteristics (summarized by a vector of exogenous covariates ***X***) and make a comparison between treated and untreated units with equal or similar values in observables ***X***. This strategy requires *ignorability of treatment assumption*:

$$Y_1, Y_0 \perp T \mid \mathbf{X}^{2} \tag{7}$$

Conditional on ***X***, Y_1, Y_0 and T are independent. Assumption (7) states that we are confident that all relevant variables influencing selection and the outcome are observed. To identify *ATET* it is enough to assume ignorability in a *conditional mean independence*:

$$\begin{aligned} E[Y_0 \mid T, \mathbf{X}] &= E[Y_0 \mid \mathbf{X}] \\ E[Y_1 \mid T, \mathbf{X}] &= E[Y_1 \mid \mathbf{X}] \end{aligned} \tag{8}$$

In this case the average treatment effect on treated is defined as follows

$$ATET(\mathbf{X}) = E[Y_1 - Y_0 \mid T = 1, \mathbf{X}] \tag{9}$$

and can be estimated using the sample means for the treated and untreated subsamples:

$$\begin{aligned} \hat{ATET}(\mathbf{X}_i) &= \hat{E}[Y_1 \mid T = 1, \mathbf{X}] - \hat{E}[Y_0 \mid T = 1, \mathbf{X}] = \\ &= \hat{E}[Y_1 \mid T = 1, \mathbf{X}] - \hat{E}[Y_0 \mid T = 0, \mathbf{X}] \end{aligned} \tag{10}$$

---

[2] In our framework, in order to estimate $ATET$, we could specify a less-restrictive ignorability of treatment condition, involving only the control units: $Y_0 \perp T \mid \mathbf{X}$.

$$\hat{ATET} = \left[\sum_{i=1}^{n} t_i\right]^{-1}\left[\sum_{i=1}^{n} t_i\left(\hat{r}_1(\mathbf{x}_i) - \hat{r}_0(\mathbf{x}_i)\right)\right] \quad (11)$$

where $\hat{r}_1(\mathbf{x}_i) = \hat{E}[Y_i \mid T_i = 1, \mathbf{X}_i]$ is a consistent estimator of $E[Y_i \mid T_i = 1, \mathbf{X}_i]$ and $\hat{r}_0(\mathbf{x}_i) = \hat{E}[Y_i \mid T_i = 0, \mathbf{X}_i]$ is the consistent estimator of $E[Y_i \mid T_i = 1, \mathbf{X}_i]$.

The main problem in this framework is when ***X*** is high dimensional. In this case, we deal with a relevant problem: we could not find individuals from both units and control groups with the same value of vector ***X***, in order to implement matching.

Rosenbaum and Rubin (1983) use the *ignorability of treatment assumption* in equation (7) in an innovative point of view, showing that *ATE* and *ATET* can both be alternatively estimated by modelling:

$$p(\mathbf{X}) = \Pr[T = 1 \mid \mathbf{X}] \quad (12)$$

that is the probability of observing a high level in score value given the set of covariates. Equation (12) is simply the conditional probability of receiving the treatment and can be easily estimated through a probit or a logit model, where the dependent variable is the treatment and the covariates are the confounders that are supposed to affect both the treatment and the outcome.

Formally, Rosenbaum and Rubin (1983) proved the following theorems, which are here presented in the formulation offered by Becker and Ichino (2002):

Lemma 1 Balancing pre-treatment covariates given the propensity score.

If $p(\mathbf{X})$ *is the propensity score, then*

$$T \perp \mathbf{X} \mid p(\mathbf{X}) \quad (13)$$

Lemma 2 Unconfoundness given the propensity score.

If assignment to treatment is unconfounded, given the covariates, i.e.

$$Y_1, Y_0 \perp T \mid \mathbf{X} \quad (14)$$

Then assignment to treatment is uncounfounded, given the propensity score:

$$Y_1, Y_0 \perp T \mid p(\mathbf{X}) \quad (15)$$

Hence the *average treatment effect on treated* in ***X*** can be easily written as follows:

$$ATET(\mathbf{X}) = E[Y_1 - Y_0 \mid T = 1, \mathbf{X}] = E[Y_1 - Y_0 \mid T = 1, p(\mathbf{X})] \quad (16)$$

and leaving out $\boldsymbol{X}$,

$$ATET = E_{p(X)}\left[ATET(\mathbf{X}_i)\right] = E_{p(X)}\left[E\left[Y_1 - Y_0 \mid T=1, p(\mathbf{X})\right]\right] = E_{p(X)}\left[E\left[Y_1 \mid T=1, p(\mathbf{X})\right] - E_{p(X)}\left[Y_0 \mid T=0, p(\mathbf{X})\right] \mid T=1\right] \quad (17)$$

If the condition stated by *Lemma 1* is satisfied, observations with the same value of propensity score must have the same distribution of observables, independently of treatment status.

Lemma 2 is the central point of this section, states that if there is a random assignment of treatment for individuals with the same value of $\boldsymbol{X}$, then it is the same for individuals with identical values of the propensity score. Consequently, the multidimensional vector $\boldsymbol{X}$ is reduced in terms of information to a scalar taking values from 0 to 1, and we are able to make a comparison between treated and untreated units with a similar value of the estimated propensity score. Matching techniques can be used as forms of stratification and weighting methods; firstly one estimates propensity scores, then one compares the means of treated and control individuals. In order to obtain estimates, we should remember we need to make a feasible comparison between two groups for every level of estimated propensity score, *i.e.* we require that

$$0 < \Pr\left[T_i = 1 \mid \mathbf{X}_i\right] < 1^3, \text{ for each } i \quad (18)$$

Now the question is: how can we estimate equation (17)? In other words, we could ask: how could we implement in practice propensity score matching in order to obtain an estimate of the *average treatment effect on treated*?

Indeed, an estimate of the propensity is not sufficient to obtain the *ATET* of interest. Since $p(\mathbf{X})$ is a continuous variable, it is almost impossible to find observations belonging to both treated and control units with the same exact value of the propensity score. Different methods are proposed in literature to overcome the problem. The most used in statistical literature are: *nearest neighbour matching, radius matching, kernel matching and stratification method.*

[3] The previous equation states that we must observe both treated and untreated for every level of the propensity score, even if it is enough to require $\Pr\left[T_i = 1 \mid \mathbf{X}_i\right] < 1$ for the identification of the *average effect of treatment on treated*, such as we require only $Y_0 \perp T \mid \mathbf{X}$ instead of the stronger formulation in equation (7).

Nearest neighbour matching consists in considering all the treated units and matching each of them with the control unit with the closest propensity score.

Let $C(i)$ be the set of control units matched to the treated unit *i* with an estimated value of the propensity score of p_i, the nearest neighbour matching sets are given by:

$$C(i) = \min_j \left\| p_i - p_j \right\| \tag{19}$$

This is a single unit unless there are several control units with the same propensity score[4]. This methodology presents some advantages and some limits: the advantage is that every treated unit is matched with the most similar control unit; Nevertheless, this procedure does not use all the information contained in the sample; *radius matching* compares every treated unit with all control case falling in a predefined neighbourhood of the propensity score of the treated unit.

So in radius matching

$$C(i) = \left\{ p_j \mid \left\| p_i - p_j \right\| < r \right\} \tag{20}$$

where *r* indicates the radius of the Eucledian neighbourhood.

In both neighbour and radius matching the *ATET* estimates are computed as follows:

$$\hat{ATET} = \left[\sum_{i=1}^{n} T_i \right]^{-1} \sum_{i}^{n} T_i \left[Y_i - \sum_{j \in C(i)} w_{ij} Y_j \right] \tag{21}$$

where w_{ij} is a weight coefficient that assumes value $\frac{1}{N_i^C}$ [5] if $j \in C(i)$ and 0 otherwise.

Radius matching presents some problematic aspects. It permits to calibrate the dimension of the neighbourhood, choosing the length of the radius; on one hand, if the dimension of the radius is set to be very small, it is possible that some treated units are not matched because the neighbourhood is empty. On the other hand, the smaller the size of the radius the better is the quality of matching. Another problematic aspect of this method is that an equal weight is assigned to all the controls included in the neighbourhood, even if they are placed on the bound of it.

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[4] In the analysis we have checked results also using nearest neighbour with caliper, which drop out pairs with a dissimilarity larger than the value of a fixed radius.

[5] N_i^C is the number of control units in the neighbourhood associated to unit *i*.

Kernel matching compares all treated with a weighted average of all controls with weights that are inversely proportional to the distance between the propensity score of treated and untreated (Becker and Ichino, 2002). The kernel matching estimator is given by:

$$\hat{ATET} = \left[\sum_{i=1}^{n} T_i\right]^{-1} \sum_{i}^{n} T_i \left[Y_i - \frac{\sum_{j \in C} Y_j^C G\left(\frac{p_j - p_i}{h_n}\right)}{\sum_{k \in C} Y_j^C G\left(\frac{p_k - p_i}{h_n}\right)} \right] \tag{22}$$

Where $G(\cdot)$ is a kernel function and h_n is a bandwitch parameter. In this setting the selected kernel is a Gaussian density.

Finally, the simplest method is the so-called *stratification method*: this method consists in dividing the range of the propensity score in several intervals, each of them characterized by an estimated propensity score that is not statistically significant for the treated and controls contained in the interval. Then the *ATET* of interest can be estimated as a weighted average of the *ATETs* estimated in every block. In the block *t* the estimated ATET is computed in the following way:

$$\hat{ATET}_t = \left[\sum_{i=1}^{n_t} T_i\right]^{-1} \sum_{i=1}^{n_t} T_i \cdot Y_i - \left[1 - \sum_{i=1}^{n_t} T_i\right]^{-1} \sum_{i=1}^{n_t} (1 - T_i) \cdot Y_i \,^{6} \tag{23}$$

The overall estimated ATET is then:

$$\hat{ATET} = \sum_{t=1}^{S} \hat{ATET}_t \frac{\sum_{i=1}^{n_t} T_i}{\sum_{i=1}^{n} T_i}.$$

It should also be remembered that in empirical analyses we will impose the common support restriction, i.e. we will only focus on the observation falling in a propensity score interval where we can find both treated and control units. This option is strongly recommended in literature in presence of large samples when the sample is not significantly reduced.

Several statistical packages were implement for STATA, in order to give estimations of *ATET* using the propensity score as described above. The more commons are *pscore* by

[6] *S* is the total number of blocks, whereas $i = 1,...,n_t$ is the index of observations in each block.

Becker and Ichino (2002)[7] used in the work of Dehejia and Wahba (2002), *psmatch2* by Leuven and Sianesi (2003) and *nnmatch* by Abadie *et al.* (2004). In the next chapters we will provide estimates obtained with *psmatch2* comparing the estimates obtained by a selection of the methods described above.

[7] The theoretical discussion about the different methods involving the *ATET* estimation deals with this application module.

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2. Estimating the causal effects of attitudes and value orientations on fertility in Bulgaria[8]

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SECTIONS: 2.1. Introduction. – 2.1.1. Bulgaria in the context of former Iron Curtain countries. – 2.1.2. The role of attitudes and value orientations in life course decisions. – 2.2.1. Data.– 2.2.2. Attitudes and value orientations towards parenthood and family. – 2.3.1. Statistical methodology. – 2.4.1. Empirical results, attitudes. – 2.4.2. Empirical results, value orientations. – 2.5. Discussion. Appendix 2.A: Factor Analysis. – Appendix 2.B: Balance property in propensity score estimates – Appendix 2.C: Sensitivity analysis to different cut-points for treatment. – *Bibliography*.

ABSTRACT

If the Second Demographic Transition is spreading to the countries of the former Iron Curtain, one should be able to find effects of attitudes hold by individuals on fertility choices. The diffusion of post-materialistic values and an increasing tendency towards self-realization are considered to be responsible for a drop in fertility rates jointly with economic factors. Propensity score matching algorithms applied to panel data allow to identify a causal effect of attitudes and values, controlling for observable heterogeneity and additional problems of selection bias. We find a causal relationship between attitudes towards parenthood and behaviour; conversely the effect of value orientations is uncertain and weaker; traditional values seem to increase the probability to have children.

[8] The author thanks the Max Planck Institute for Demographic Research (Rostock, Germany) for the data.

2.1. Introduction

The demographic changes in North-Western Europe since the 1960s have been linked to drastic transformations as an accentuation of autonomy in ethical and moral spheres, an augmenting rejection of all form of institutional controls and the rise of the exigency of any form of self-actualisation (Inglehart, 1970). This connection between demographic changes and values transformation characterizes the so called "Second Demographic Transition", SDT, as defined by Lesthaeghe and van de Kaa (1986) in their seminal work.

After 1990, also in Central and Eastern Europe the postponent of marriage and childbearing started to emerge, with an unexpected decline in total fertility rates (from now onwards TFRs). The reasons for this change in marital behaviours can be found in the difficulties caused by the sharp economic transition after the Communist era with a decline in the state's planning of individuals' life and the transformation of individuals' values and attitudes. Indeed, by the 1990s the youngest generations had different aspirations compared with those of older cohorts; the pattern of value orientations and its consequences on individual life course decisions, that is to say postponement of marriage and of the first birth reflect the characteristics of the so-called Second Demographic Transition as pointed out by Lesthaeghe and Moors (2000). Explanations for fertility changes can be divided into two major streams with respect to European Eastern countries (Sobotka, 2004): someone states that fertility decline is mostly related to the social and economic crisis of the 1990s and the other perceives fertility changes as driven by complex social, including also ideational factors (Thornton and Philipov, 2009). This distinction has important theoretical consequences: if economic factors are predominant, we could expect a rise of the TFRs after the end of the crisis. Conversely, changes may be permanent if ideational factors are prominent: in particular, if demographic behaviours are caused only by economic determinants, we may question about the presence of traces of the Second Demographic Transition. Otherwise, a relatively strong effect of ideational factors would confirm that changes in beliefs, norms and values in an anti-traditional direction may lead to behaviours in alignment or in opposition to those described by SDT theories. Kohler, Billari and Ortega (2002) proposed the term "lowest-low fertility" to underline the uniqueness of the situation that was visible during the early 1990s in Southern, Central and Eastern Europe, where

TFRs reached levels of 1.3 or below in opposition to Western and Northern Europe countries characterized by higher levels in TFRs. In this framework the difficulties in determining a common path for all European countries in fertility behaviour do not allow to identify if there is a predominance of an effect of ideational factors instead of economic ones.

Again, the theory of SDT is neither the unique explanation that tries to connect ideational factors and transformations in demographic behaviour. Recently, Newson and Richerson (2009) argued that fertility decline is the consequence of a uniform century-long process started in Western Europe in the XIX century that can be considered as a logical continuation of a unified process that follows the traits of the First Demographic Transition (FDT). In this perspective, less family-oriented values, which spread since the modernization process began, are consequences of a cultural evolutionary process initiated by the replacement of kin-based communities with social groups consisting of non-kin: new social networks characterized by less-family oriented values gradually replaced former social networks and caused changes in ideational factors and beliefs that are associated to new behaviours. Unlike most SDT theories, the emerging issue is not a discontinuity between older and younger cohorts, but a Darwinian mechanism that imposes a new pattern of values and behaviours affirming themselves as winning within the society.

In both the approaches, in favour or against the presence of a SDT, it is clear that scholars discovered an association between attitudes and behaviours, but it is often unclear whether attitudes cause behaviours or vice versa.

We propose to focus on the possible causal effect of attitudes on individual fertility decisions. Hence, the aim of this paper is to contribute to the debate on the diffusion or less of the Second Demographic Transition to Eastern Europe and, in particular, in Bulgaria, presenting empirical evidence concerning the effect of changes in attitudes and values on the individual choice to give birth or adopt a child or less.

A common problem dealing with causal inference is selection bias: individuals showing a particular attitude may be influenced in their behaviour by external confounding factors. For example, someone could show a higher propensity to have a child because he (or she) belongs to a rich family, or because he (or she) does not work. An important issue, to verify if there exists a net and significant causal effect of attitudes, is to reduce

the bias determined by external observable variables. In order to overcome this problem, we apply propensity score matching algorithms. Several advantages derive from the use of this approach with respect to standard regression models. In the first place, heterogeneous causal effects can vary across units. Moreover, propensity score matching is a non-parametric approach and does not necessarily postulate a linear relationship between outcomes, attitude indicators and covariates. This approach presents some limits. Firstly, it does work with binary treatment (whereas attitude and values proxies are latent variable supposed to be continuous). Secondly, propensity score matching fails in presence of unobservable confounders. The first problem is addressed dichotomizing attitude and values proxies. The second one is addressed defining unobservable heterogeneity as treatment, using proxies coming from attitudinal questionnaires.

In light of the discussion introduced above, the paper is organized as follows: to start, we give a short summary of Bulgarian socio-demographic background in the context of the crisis after 1989. Then, we define the concept of attitude and value orientation through an excursus in sociological literature. Section 2 presents the dataset characteristics, whereas section 3 describes the statistical methodology used in section 4 that illustrates the results of the empirical analysis. A sensitivity analysis of the statistical findings after a brief discussion concludes the work.

2.1.1 Bulgaria in the context of former Iron Curtain countries

The fall of the Iron Curtain generated a strong discontinuity in the demographic behaviour of the populations in the region. Fertility patterns, initially characterized by early and almost universal childbearing and by a strong attachment to the two-child family norm, changed rapidly over the 1990s. A substantial decline in fertility took place in all previously communist countries, forming the region of lowest fertility in the world, with TFRs between 1.1 and 1.4 children per woman in 2002.

The TFR and the mean age of women at first birth (MAFB) are likely to follow a similar transition characterized by four distinctive stages:

- *First stage*: High TFR1 and relatively low MAFB;
- *Onset of the postponement:* substantial decline in the TFR and parallel increase in the MAFB;

- *Continuing postponement*: TFR stabilized at a low level, while the mean age of first-time mothers goes on to grow;
- *Postponement stops*: the postponement gradually slows down and as a result the TFR increases again (Sobotka, 2004).

In Bulgaria, the proportion of first births on the total number of births has increased to 55-60%, implying a strong orientation towards the one-child family model. Empirical evidence demonstrated that most women want to have at least one child despite the difficult living conditions, but fewer women among those who had a first child are willing to have another one, reaching very low levels of fertility at the third and higher order.

Several factors mutually contributed to childbearing and family patterns changes in the former communist countries like postponement of childbearing: until the 1980s education had scarce influence on childbearing decisions, with a lack of career opportunities. The motivation for acquiring higher education was limited during the previous decades, since the effect of education on one's career was pretty small. The rapid growth of participation in secondary and university education is one of the most significant effects of the social changes during the 1990s. Changes in the economic system started to reshape the labour market with women in leading positions and chances of career development. This has had a strong effect on the proportion of women that reached the highest levels of education; in fact, nowadays, considerably more women than men are studying at university in Eastern countries. In Bulgaria, participation in education at age 20-24 is by 30% to 50% higher among women and the extension of education influences long-term fertility changes in several ways.

In the first place, the status of being enrolled in education is not compatible with childcare and family life. Young students usually lack time and resources, that is to say housing and money to have children. In the second place, access to education induces a cultural shift in younger cohorts; before 1989, the strong function of the family and the slow spread of modern contraception, that allowed undesired childbearing, contributed to maintain TFR close to reproductive level. After 1989, increasing, although delayed, use of the pill can viewed as the extension of women's autonomy and control, also associated with the broad behavioural changes leading to the Second Demographic Transition, affecting norms governing sexual and reproductive behaviour (Van De Kaa,

1994). This implied a drastic drop in the number of legal abortions that were used for a long time as the most popular method of control for births and family planning, partially comprising the effects of low level of contraceptive use.

At the same time the centrality of marriage in the life of young couples has also substantially decreased. In 2000 the mean age at first marriage reached levels of 28.1 for men and 24.1 for women, increasing by 3.4 and 2.4 years respectively (Koytcheva, 2006). Extramarital births have become more common, especially among young women below the age of 25, while older women are more likely to marry before having children. In Bulgaria, as in Scandinavian countries, the mean age of women at first marriage has surpassed their mean age at first childbirth, indicating the growing disconnection between formal marriage and parenthood: a limited choice of modern contraception, reported by only 42% of women, with higher percentage in young women according to Bulgarian data, a lack of sexual education that persists in small villages and that are linked to a decreased abortion rate, determined widespread childbearing among single women. Empirical evidence shows a relatively low prevalence of cohabitation, less than 15% in 2003, combined with a high proportion, over 40% of extramarital births in 2001.

Some of these traits seem to be in favour of the presence of traces of the SDT in Bulgaria, e. g. the drop of TFR, the postponement of marriage and the growing separation of formal marriage and parenthood.

Other aspects denounce a controversial and incomplete entrance into the SDT path: a delayed “contraceptive revolution” as well as “sexual revolution” have taken place during the 1990s. The increased use of contraceptives has reduced the number of unwanted pregnancies and consequently also of unplanned births in cities. Nevertheless, the spread of modern contraception is still limited in young cohorts and the number of abortions, although decreased, remains high in small villages also among younger people (Koytcheva, 2006).

Protracted education and contraception are only two aspects that are associated to postponement of family formation processes. Indeed, subjects adopt certain behaviour also under economic constraints: after 1989 the pro-natalist policies, that were promoted under socialist regimes, were drastically reduced, leaving the economic weight of parenthood more on the private resources of family members. In this setting a key

element to facilitate childbearing consists in an easy combination of career and childcare; the more difficult is the access to employment for potential parents, the higher is the probability of a postponement or a rejection of childbearing. In 2000, Bulgaria registered an unemployment rate above 15%, exceeding 30% among people aged 15-24. High unemployment rates in young cohorts make the reconciliation of work and motherhood difficult and this has happened in all "transitional societies". Although women have improved their role in the society, in the difficult context of economic crisis gender competition on the labour market has disfavoured female applicants and reduces their promotion chances (Lesthaeghe 1995). The legal protection of women against labour discrimination is weak; opportunities for part-time work are scarce and this could negatively reflect on childbearing decisions.

In conclusion, the potential acceleration of postponement of childbearing in the former Communist countries may bring about a further reduction of already very low fertility rates. Interpretations can be divided into two major streams: one proposes that fertility changes were driven mostly by the social and economic crisis of the 1990s and the other perceives fertility changes as stimulated predominantly by complex political, social, and cultural shifts. As it has been seen in the last section, it is often difficult to distinguish the effects of economic constraints from changes in ideational factors; in this framework it is also difficult to assess if there is a decisive influence of ideational and cultural forces. The theoretical debate is complex and opposite views around the effect of ideational factors still survives in literature.

2.1.2 The role of attitudes and value orientations in life course decisions

The definition of concepts such as attitudes and value orientations represents a difficult issue. The first step we need is to define the concepts of value orientations and attitudes with respect to demographic behaviour. In our setting we refer to Rokeach (1968, 1973), who defines "values" as *enduring beliefs that a specific mode of conduct is personally or socially preferable to an opposite or converse mode of conduct or end state of existence*. In other words, values are based on beliefs or choices relative to end-status such as "All men are equal", "Happiness is more important than wealth" (Lesthaeghe and Moors, 2002). More in detail, *Family values* are generally defined as modes for conducting sexual and family life. Family values consist in ideas about life

course choices that should guide the individual in making their own life choice decisions.

The term "attitudes" is used one step down on the abstraction ladder, i.e. when we consider *a disposition to respond favourably or unfavourably to an object, person, institution, or event* (Ajzen, 1991).

Similarities and difference between value orientations and attitudes involve several dimensions:

1. Attitudes and value orientations are both referred to individual level.
2. Value orientations are relatively abstract and latent, because they concern beliefs on very general statements around family, politics, religiousness and general spheres of individuals' life. On the contrary attitudes can be measured through questionnaires specifically related to a particular behaviour or event: following Rokeach (1973) *an attitude differs from a value in that an attitude refers to an organization of several beliefs around a specific object or situation.*
3. In theoretical literature (see for example Haas and Steiber, 2009), value orientations are supposed to be more stable over time with respect to attitudes that are seen as subject to a process of adaptation due to changes in material conditions and in life course events.

Because of the typology of data contained in our survey, we will focus on the effect of attitudes and value orientations on individual demographic behaviour.

The debate about the role of attitudes is complex and multifaced in sociological and economic literature: three different types of approaches towards the explanatory power of value orientations can be found in past literature: some scholars use to deny the role of attitudes and values in individual behaviour, according to the neoclassic economic paradigms (Becker and Stigler, 1977) and to the transaction cost approach (Ben Porath, 1980 and Pollack, 1985); in these cases the theory does not admit ideational factors in the structure of individual preferences or considers that this type of needs are not central points of attention. In particular, Gary Becker (1991) founded an economic theory of fertility based on considering children as a kind of capital goods. In this setting, children are considered durable assets that are able to produce a flow of services in time and that require initial gains and periodical expenditure. The choice of giving birth to a child depends on a material costs-benefits analysis. If inter-temporal benefits deriving from

services provided by children in the future are greater than costs, individuals are encouraged to start childbearing. Conversely, if expected advantages are not enough to cover initial gains, fertility rates decrease.

This approach was empirically refused by the evidence that in demographic transitions fertility drops with a rise of income. Becker reacted to this criticism introducing the concept of qualities of children; according to this theory, the "utility" of a child is given by the product of the number of children and the average quality of each child: in case of a rise of income, the demand of the quality of a child increases. However, the quality of a child is a function of time and represents a cost for the couple in terms of education and childcare, especially when the potential mothers have to renounce to career chances. In other words, the economic well-being could increase the cost-opportunity of having a child. In the Bulgarian context, the loss of state support for parenthood may have the effect of increasing the cost of high quality children, causing a preference for a single child family pattern.

Lesthaeghe and Moors (2002), Lesthaeghe (1995) and Van de Kaa (1987), although they recognize the importance of changes in economic structure and in institutions, give an important role to values in subsequent choices and actual behaviour, and attach to them a prominent role in driving demographic changes in general and in the SDT in particular. This is summarized in the following statement: *values produce a selection effect that associates individuals to a particular life course decision, sorting themselves over various paths of the life course* (Lesthaeghe and Moors, 2002). Thus, in the context of SDT the fall in total fertility rates can be connected to a change in individual values and attitudes on parenthood. In particular, Lesthaeghe and Meekers (1986) found a positive association between the number of children and measures of parenthood and familiarism, with a correlation between more traditional views of family life and the individual decision to become mother or father. At the individual level, Moors (1997) proved that in Germany women characterized by non-traditional family values report a lower propensity to pregnancy. Jansen and Kalmijin (2002) confirm that also the timing of childbirth depends on value orientations: religious and more traditional people have a child at an earlier stage in their relationship than non religious ones. This finding is related to Inglehart's post-materialistic theories: having a child requires sacrificing individual freedom and may be in contrast with the parents' self-realization. In this

setting, individuals characterized by more traditional values seem to be less likely to postpone childbearing. The old standards of behaviour are disappearing and are being replaced by individualistic lifestyles, where *people make their own choices about marriage or cohabitation, where they are free to have children in or outside marriage, to have them alone or with a partner, and where they can have them early or late in life* (Van De Kaa 1999).

Liefbroer and Fokkema (2008) recently addressed the relationship between attitudes and behaviour in Southern and Eastern Europe focusing on the spread of the Second Demographic Transition across the former communist countries. Even though there persists a strong geographical heterogeneity, the finding is that attitudes and values concerning the importance of parenthood and marriage in life are declining all over Europe. A surprising finding is that the drop in fertility rates, that is a common feature of the Second Demographic Transition, seems not to be related to a factor measuring *attitudes towards parenthood*. According to these findings, economic insecurity and unemployment are the prominent factors in explaining the low fertility in Eastern Europe.

Billari, Philipov and Testa (2009) apply the theory of planned behaviour in addressing an association between attitudes and fertility intentions in Bulgaria. The theoretical background dates back to works from Fishbein and Ajzen (1975) and Ajzen (1988), who elaborated the so-called theory of reasoned action. According to the theory, the intention to perform a specific behaviour is the antecedent of certain behaviour. The correlation between intention and behaviour depends on the type of behaviour and on the interval between intention and behaviour. Intentions are seen as directly dependent on attitudes towards the considered behaviour jointly with other several factors like subjective norms and perceived behavioural control; in other words, attitudes to a familiar behaviour predict intentions and intentions predict behaviour (Barber *et al.* 2002). Hence, positive attitudes towards childbearing affect the intentions to get pregnant and indirectly increase the likelihood of childbearing.

Billari *et al.* provide evidence that positive attitudes towards childbearing *(benefits)* are strongly connected to intentions of having children whereas negative attitudes *(costs)* discourage potential parents to start pregnancies. However, Speder (2009) argues that about 25-30% of men and women who had positive intentions could realize their

intentions within two years. These results seem to partially confirm the theory of planned behaviour in Bulgaria If attitudes predict intentions, intentions seem to be rather discordant with the behaviour in the short run.

Most studies designed to investigate the connection between attitudes and behaviour show only the existence of associations between the variables. We know that association does not imply causality. Correlation coefficients do not prove whether attitudes cause changes in behaviour or vice versa. In order to identify a possible causal effect of attitudes on childbearing we need some conditions. In the first place, we need a panel design for data, as argued by Lesthaeghe and Moors (2002), with attitudes and behaviour observed sequentially through time.

We propose to investigate if values and attitudes towards childbearing and family life have an influence on the probability to have a child, focusing on problems determined by reverse causality, considering also the selection bias determined by socio-economic background of each family in the estimates.

2.2.1. Data

We use data from the survey "The Impact of Social Capital and Coping Strategies on Reproductive and Marital Behaviour". The survey aims to explore the impact of significant economic, cultural, social, and institutional changes that have taken place in Bulgarian society during the transition period on leaving the parental home, family formation, and fertility. The survey investigates these impacts on the basis of economic, demographic, sociological, and psychological theories. It is a panel study and the first wave was carried out in 2002. A total of 10,009 persons were interviewed face to face, using a paper and pencil questionnaire. Of these, 5,765 were married or cohabiting and 4,244 were single, divorced, or widowed. Female respondents were born between 1966 and 1986, whereas male respondents were born between 1936 and 1986. The second wave took place in the winter of 2005/06. All in all, 7,481 respondents of the first wave were interviewed again. Female respondents were aged 18–34, male respondents aged 18–66 at the time of the first interview. As the aim of the paper is to identify the causal effects of attitudes and value orientations on the probability to have a child between the two waves of the interview, we focus only on women and men aged 18-34 at the time of

the first wave. To keep track of gender differences we conduct separate analyses for women and men.

2.2.2 Attitudes and value orientations towards childbearing and family

To identify different attitude indexes in order to build scales about the level of each indicator we use two groups of items that come from the questionnaires described in the previous section and that are all directly or indirectly connected to parenthood and family attitudes/value orientations. The first group investigates respondents' opinion on expectations of having children within two years from the first interview. Therefore, they are labelled *attitudes*.

The wording of these items is the following:

1) To have children (in the next two years) increases your economic difficulties;
2) To have children (in the next two years) decreases your chances in your working career and/or education;
3) To have children (in the next two years) increases your security that at old ages there is someone to care about you;
4) To have children (in the next two years) increases joy and satisfaction in your life;
5) To have children (in the next two years) increases worries and preoccupations in the course of daily life;
6) To have children (in the next two years) decreases the time you have to pursue personal interests or be with friends;
7) To have children (in the next two years) increases certainty in your life;
8) To have children (in the next two years) increases the closeness between you and your partner;
9) To have children (in the next two years) increases the closeness between you and your parents and relatives;
10) To have children (in the next two years) means that a part of you continues into the future.

Respondents could choose among five answers ranked from completely disagree to completely agree and that are showed to respondents as a quantitative five-points scale ordered from 1 to 5. Thus a high value for the item "to have children (in the next two

years) increases your security that at old ages there is someone to care about you" means that a person has a traditional point of view with respect to childbearing: potential parents that believe that children increase joy and satisfaction in your life or closeness with the partner denote a strong attitude to parenthood, whereas respondents who believe that children increase economic difficulties probably are more likely to postpone childbearing to an economic security.

As we can see from summary statistics, the items focus on young people's opinion concerning the importance of parenthood. In several cases, the majority of young adults agree or strongly agree to the items that are closest to the emotional characteristics of parenthood. These results are consistent to those obtained by Liefbroer and Fokkema (2008) for all the European countries[9]. The result changes in topics where childbearing is related with economic, working and educational individuals' status: it's the case of item 2).

Questions on attitude discussed so far deal with important features of the Second Demographic Transition but it is unclear whether some of these items, concerning different aspects of the family values, are related to each other.

[9] The results also depend on the formulation of the question: in Liefbroer and Fokkema (2008) the items on fertility are formulated in a rather extreme manner, leading in some cases to a relatively low percentage of people endorsing them: it's the case of the statement "childless leads empty life" that contrasts to the results obtained in the item "children greatest joy" that is similar to that included in our survey.

Table 1. Descriptive Statistics about 10 Items related to the Expectation of having a Child (within two years since the first interview)[10]

Items	*Completely Disagree %*	*Rather Disagree %*	*Neither Agree nor Disagree %*	*Rather Agree %*	*Strongly Agree %*
1) To have children increases your economic difficulties	3.75	6.14	8.69	37.05	44.38
2) To have children decreases your chances in your working career and/or education.	20.45	25.23	16.89	20.99	16.44
3) To have children increases your security that at old ages there is someone to care about you.	9.78	13.01	26.45	30.84	19.92
4) To have children increases joy and satisfaction in your life.	2.22	3.46	11.37	37.80	45.16
5) To have children increases worries and preoccupations in the course of daily life.	2.87	7.16	11.93	43.52	34.51
6) To have children decreases the time you have to pursue personal interests or be with friends.	4.07	9.98	15.82	41.10	29.02
7) To have children increases certainty in your life.	5.09	12.55	30.31	32.58	19.48
8) To have children increases the closeness between you and your partner.	4.18	7.00	23.04	36.28	29.50
9) To have children increases the closeness between you and your parents and relatives.	5.67	9.87	26.56	33.43	24.46
10) To have children means that a part of you continues into the future.	1.96	2.02	11.16	33.36	51.49

[10] To make the interpretation easier we have ordered the answers in the same direction (from completely disagree to strongly agree) and reduced the sample to the age interval [18,34] in order to allow a comparison.

We implement a factor analysis in order to reduce the multidimensionality of the vector of questions and to identify some latent attitudinal dimensions. The extraction is done with the principal components method and the results underline a two-factor solution[11] for both men and women[12]. In the following table we display the factor-loadings of the ten items based on a principal component analysis, followed by a varimax rotation; more details on the results of factor analyses implemented also separately for the two genders can be found in Appendix A.

Table 2. Results of a factor analysis on ten attitudinal items[13]

Items	*Factor 1 Benefits*	*Factor 2 Costs*	*Uniqueness*
1) To have children increases your economic difficulties.	-.1274	**.6177**	.6023
2) To have children decreases your chances in your working career and/or education.	-.2018	**.5343**	.6738
3) To have children increases your security that at old ages there is someone to care about you.	**.5967**	-.1013	.6337
4) To have children increases joy and satisfaction in your life.	**.6591**	.0927	.5571
5) To have children increases worries and preoccupations in the course of daily life.	.0368	**.7923**	.3709
6) To have children decreases the time you have to pursue personal interests or be with friends.	.0461	**.7772**	.3938
7) To have children increases certainty in your life.	**.7261**	-.1266	.4568
8) To have children increases the closeness between you and your partner.	**.8151**	-.0337	.3345
9) To have children increases the closeness between you and your parents and relatives.	**.7734**	-.0228	.4013
10) To have children means that a part of you continues into the future.	**.6946**	.1017	.5072

[11] As usual we selected the factors associated to an eigenvalue greater than one.

[12] Factor analyses performed for males and females separately gives analogous results; so we have used a unique factor analysis for the joint sample in order to allow a comparison between the two genders in subsequent analyses.

[13] In table 2 we report the value of rotated loadings. In bold we report loadings greater than 0.5.

The results for factor extraction are identical for both men and women: *Factor 1* and *Factor 2* are indiscriminately correlated with the same items in the case of the two genders.

The first factor can be interpreted as an emotional factor related to fertility and in particular to the *benefits* of childbearing. People scoring high for this factor attach high values to parenthood, whereas people scoring low for this factor attach relatively low values to it: agreement with the items linked to *Factor 1* indicates being in favour of attitudes that emphasize positive dimensions of attitudes towards childbirth like the increase in satisfaction in becoming a parent; indeed, *Factor 1* is positively correlated to items like the joy in childbirth and the closeness of the relationship between partners in presence of children. Furthermore, item 3) supports the traditional idea that children represent a long run investment for parents, in order to have someone that cares themselves at old ages. Furthermore, this factor principally underlines an immaterial dimension of the relationship between potential parents and children: items 8), 9) and describe as respondents that are strongly agree with these assessments assume an altruistic point of view towards the other components of the family, considering the child as a continuation of themselves in the future and considering childbearing a *benefit* in improving the relationship with the partner. In this setting, the closeness between partners and the joy to see the child growing up become central objectives that are positively related to a change of the role within the family of respondents that show high value for *Factor 1*. Conversely, childless determines a loss in partner relationship and a decline of happiness. For these reasons we have labelled the factor as a *"Benefits" factor*, following Billari *et al.* (2009).

In particular, the items related to economic and material wellbeing, which are also related to career opportunities of potential parents, have high loadings on the second factor and negligible ones on the first factor. More in detail, *Factor 2* is highly correlated also to items connected to the need of full relationships with people external to the family. The common trait of these items is the focus on individual personal development; this factor can be interpreted as representing the *negative attitudes* towards childbearing. People scoring a high value for this factor attach relatively great importance to their economic status, to their position in labour market and in relationship with friends and think that children cause a lose in opportunity in these

fields; a high value of *Factor 2* can be also read as a relative predominance of post-materialistic[14] attitudes especially in case of women: having a child reduces individual freedom and personal development; women with modern emancipated attitudes will probably score high value for this factor, due to a loss of opportunities in labour market and we expect this factor will postpone or even reject a pattern of family in the form of having a child (Barber *et al.*, 2002); therefore Billari *et al.* (2009) labelled this factor as a *"Costs" factor.*

Table 3 further considers five items that focus on family values. The first four items deal with the relationship between parents and children; the last one focuses on the opinion about union formation for respondents. The answers to the questions are ranked from *Completely Disagree* to *Strongly Agree* in a numeric five-points scale from 1 to 5, such as in Table 1. The wording of these items is:

1) Regardless of what the qualities and faults of one's parents are, one must always love and respect them;
2) Parent's duty is to do their best for their children even at the expense of their own well-being;
3) One does not have the duty to respect and love parents who have not earned it by their behaviour and attitudes;
4) Parents have a life of their own and should not be asked to sacrifice their own well-being for the sake of their children.
5) Official marriage is outdated.

Two main differences between items grouped in Table 1 and those presented here can be summarized in two statements:

a) Former items directly relate to personal experience of respondents. The latter express preferences that could be applied to everyone rather than to the individual her/himself. For this reason they are labelled *value orientations* in the following analyses instead of the former that were defined *attitudes*;

[14] As pointed out by Lesthaeghe post-materialistic values emerge once the basic material preoccupations are satisfied: further income growth and educational expansion jointly lead to the rising of more existential and expressive needs. In this point of view, childbearing in early ages and large size family may contrast against preferences towards self-realizations and individual autonomy.

b) Items included in Table 1 ask about the expectations of having children in a short run perspective (two years starting from the first interview), whereas the last items are based on beliefs expressed without temporal restrictions.

Due to these two explanations the latter items analyzed are proxy of attitudes strongly connected to the concept of value orientations, as defined in the works of Thomson (2002) and Lesthaeghe and Moors (2002). In particular, Moors (2002) states that values can be detected from a set of attitudinal scales that are combined to express more general orientations. We can affirm that factor analysis allows to discover general latent profiles under items responses, giving the chance to identify value orientations in general questions.

As we can see from Table 3, the majority of respondents are agreeing to three of the items listed below. Item 3) is almost the contrary of question 1) and this explains why individuals show an opposite pattern of answers.

In particular, Agreement with item 1) and disagreement with item 3) are a strong indication that young people would be willing to associate an idea of respect and unconditional love for parents. This finding shows an ideational heritage that older cohorts probably broadcasted to younger people and that survives again in Bulgaria that only recently has shown early traces of the second demographic transition.

Also, the percentage of agreement to statement 2) denotes an altruistic and traditional point of view, proving that majority of respondents remark the centrality of children in their life.

The SDT is characterized by the predominance of more existential and expressive needs than basic material worries. These are centred on three aspects: *self-actualization* in formulating goals, *individual autonomy* in choosing means, and claiming *recognition* for their realization. These issues partially emerge in responses obtained in item 4) that show traces of post-materialistic beliefs in Bulgarian participants in the survey: the percentage of individuals that do not contemplate to totally sacrifice their own well-being for children safety is about 50%. The concept of parent's wellbeing itself distinct from children's wellbeing is a post materialistic value that was unknown in the first demographic transition.

Table 3. Descriptive Statistics about four Items related to the role of parenthood.

Items	*Completely Disagree %*	*Rather Disagree %*	*Neither Agree nor Disagree %*	*Rather Agree %*	*Strongly Agree %*
1) Regardless of what the qualities and faults of one's parents are, one must always love and respect them.	2.18	4.39	7.03	43.13	43.28
2) Parent's duty is to do their best for their children even at the expense of their own well-being.	2.57	9.11	16.71	41.91	29.70
3) One does not have the duty to respect and love parents who have not earned it by their behaviour and attitudes.	18.99	40.84	20.12	13.89	6.15
4) Parents have a life of their own and should not be asked to sacrifice their own well-being for the sake of their children.	6.60	17.33	27.48	35.29	13.30
5) Official marriage is outdated.	13.55	17.77	18.50	29.50	20.68

To identify latent dimensions of the explored items, we perform a second factor analysis with the method of principal components. As mentioned before, results from exploratory factor analysis for the subsamples of males and females showed identical results. This allows to implement a unique model including both men and women in the same analysis.

Table 4. Results of a factor analysis on five generalized attitudes[15]

Items	*Factor 3* *Parental-role traditionalism*	*Factor 4* *Self actualization*	*Factor 5* *Alternative living arrangements*	*Uniqueness*
1) Regardless of what the qualities and faults of one's parents are, one must always love and respect them.	**.8819**	.0265	.0411	.2199
2) Parent's duty is to do their best for their children even at the expenses of their own well-being.	**.5280**	**-.5767**	.2303	.3355
3) One does not have the duty to respect and love parents who have not earned it by their behaviour and attitudes.	**-.6349**	-.0121	.4320	.4101
4) Parents have a life of their own and should not be asked to sacrifice their own well-being for the sake of their children.	.0722	**.8934**	.1460	.1753
5) Official marriage is outdated.	.0063	.0929	**.8852**	.2077

The analysis resulted in a three factor solution: *Factor 3*, that is named *parental-role traditionalism*, scores high for people attaching importance to the unconditional respect towards parents. Therefore, it can be interpreted as a dimension not connected to post-materialistic values. .

Factor 4 focuses also on parents' role within the family, but with respect to the idea of self-realization, coherently with the aspects of SDT mentioned above; this factor is

[15] The retention of two factors is associated to the number of eigenvalues greater than one, because these factors explain more variance than the average of the four items we introduced in the analysis.

linked to items 2) and 4), indicating propensity to *self actualization*. People scoring high value for *Factor 4* give relatively little importance to parenthood in comparison with the parents' individualistic well-being. *Factor 4* is also positively correlated to an alternative interpretation of the role of the parent in the family in terms of post-materialistic theories, underlined by the item 4): parents agreed to this statement are more oriented to self-realization than to sacrifice themselves for the children. Conversely disagreement with those items leads to a lower value for *Factor 4* and to a more traditional idea of both parenthood and family.

At the moment, this finding does not necessarily imply that individuals reporting a high score for *Factor 4* neglect childbearing; more in detail these people subordinate children to other aspects of their own life.

In conclusion, the previous two factors principally concern the importance of childbearing in the list of priorities and desires of individuals, whereas the fourth and fifth identified in Table 4 focus on the family-orientation of respondents and to the role interpretation within the family.

Factor 1 and *Factor 3* are ranked in direction of traditional orientations, whereas the greater the score of *Factor 2* and *4* the less traditional is the orientation towards childbearing.

Finally *Factor 5* is highly correlated to a unique item, asking whether marriage is or less outdated. We decide to include this last different item, because of two main reasons: firstly, the opinion about union formation plays a central role in SDT; secondly this item is always present in several studies that address the connection between values and family behaviour (childbearing and union formation) like Liefbroer and Fokkema (2008) and Lesthaeghe (2002) and it follows the set of the previous four items in the questionnaire setting: people scoring high for this factor, admit *alternative living arrangements*[16], like non marital cohabitation instead of traditional marriage.

The aim of the following sections is to verify whether there is a causal relationship between the value orientations found above and the decision of couples to give birth or adopt a child between the two waves of the interview: we expect that high scores for *Factor 2* and *Factor 4* will be connected to a general postponement of childbearing and

[16] The name chosen for the factor is *alternative living arrangements* like in the paper of Liefbroer and Fokkema (2008) that found a factor strongly related with the same item.

lowest levels of fertility that became very common in the last decade in Bulgaria, characterized by a single-child family pattern. Conversely high scores for *Factor 1* and *2* are supposed to be associated to a relatively high probability to have children.

An alternative hypothesis could be also formulated: *Factor 1 and Factor 2* could be directly associated to fertility intentions like shown by Billari, Philipov and Testa (2009) and are supposed to be significantly correlated to realization of intentions. Otherwise, *Factor 3 and Factor 4* are suspected to be indirectly related to fertility behaviour and could be uncorrelated with demographic behaviour in the short run.

The formulation of a hypothesis related to *Factor 5* is controversial. On one hand some countries like Italy show evidence of a strong positive correlation between the increase of non-marital cohabitation and the postponement of childbearing; on the other hand Scandinavian countries reveal an opposite behavioural pattern, showing higher fertility rates and a lower mean age at first birth also where non marital cohabitation is widely spread.

2.3.1. Statistical methodology

The aim of the next sections is two fold. On the one hand, we want to identify what are the characteristics of respondents that have a high score for each factor, implementing a simple logit regression and using a dichotomous definition for the attitudes from the previous section. In particular we define a binary variable that takes value 1 if an individual has a level for the correspondent factor greater than the median and 0 otherwise[17]. In fact we need binary transformation in order to implement propensity score matching.

Then, in estimating the effect of attitudes on the decision to give birth or to adopt a child, we deal with the problem of possible selection bias. Since in observational studies the estimated level of individuals' attitudes may be influenced by the existence of confounding factors, simple regression methods do not allow us to pointedly identify the causal effect of attitudes on subsequent fertility decisions. For example, the income of an individual, the gender, the level of education and other factors could influence his attitude to the parenthood. In order to reduce bias, Rosenbaum and Rubin (1983)

[17] In this case, Factor analysis has the property to generate factor with mean equal to zero. Consequently the treatment is one when the latent factor is positive and is equal to zero otherwise.

proposed propensity score matching in the estimation of causal effect with observational datasets. Applications of this kind are spreading in the economics literature (see, among others, Blundell *et al.* 2005; Lechner, 2002; Dehejia and Wahba, 1999). Recently, propensity score matching algorithms have been introduced also in studies of demographic behaviour (see Mazzuco 2002, Aassve *et al.* 2007, Aassve and Lappegård, 2008, Arpino and Aassve 2007).

The following analysis requires to summarize some key-concepts about propensity score matching and the potential outcome approach in econometrics.

Suppose we have a sample of individuals, each of them indexed by the subscript $i=1,2,..,n$ and suppose to define a treatment variable T_i assuming value 1 if the individual i is treated and 0 otherwise. In our case, T_i takes value 1 if the unit shows a score for an attitude indicator that is greater than the median observed all over the sample and takes value 0 if the individual is below the median. In this setting, we define also an outcome variable Y_i that is defined as a binary variable, which indicates if an individual, or his partner or his spouse, gave birth or adopted a child between the summer of 2002 and the moment of the second interview (2005). In view of the fact that attitudes are supposed to affect the decision to start pregnancy, we decided to drop out from the treated group pregnant women (or partners of pregnant women in males' subsample) at the time of first interview. The goal of our analysis is to identify if there is a possible and significant causal effect of a high score of attitude ana value indicators on the probability to have a child between the two waves and, possibly, to estimate the magnitude of the causal effect. So, pregnant women have just made the choice to give birth to a child before measuring attitudes. Moreover, current pregnancy could influence the level of respondents' attitudes, or that of their partners, at the first interview, introducing a risk of pollution in estimates. We decided to consider women pregnant at the time of second interview as treated instead, because they plan a childbirth in the period between the waves.

To measure treatment effect means that we are interested in the difference in the outcomes for a specific unit with and without treatment,

$$\Delta_i = Y_{i1} - Y_{i0} \qquad (1)$$

where individual *i* has two potential outcomes: Y_{i1} is the outcome in the case the subject shows a high level for each of the value score and Y_{i0} is the outcome in the case the same individual experiences a score for a specific factor below the median. In the case of a high value of a factor score Y_{i0} or conversely Y_{i1} in case of low level of the same indicator, is defined as *counterfactual*.

A key problem dealing with this measure is that only one of the two potential outcomes is observed in a sample.

Δ_i is an individual specific variable and each potential outcome should have a distribution. Therefore, Rubin (1978) and Rosenbaum and Rubin (1983) suggested to focus on the quantity called *average treatment effect*,

$$ATE = E[Y_{i1} - Y_{i0}] \quad (2)$$

ATE is the expected effect of treatment on a person randomly drawn from the population. In literature, this measure has been criticized, because it seems not to be relevant for policy purposes, including also individuals who would never be eligible for treatment. A second quantity of interest, and one that has received much recent attention, is the *average treatment effect on treated*, which we denote with the acronym ATET:

$$ATET = E[Y_{i1} - Y_{i0} \mid T_i = 1] = E[Y_{i1} \mid T_i = 1] - E[Y_{i0} \mid T_i = 1] \quad (3)$$

In order to estimate ATET we need to identify $E[Y_{i0} \mid T_i = 1]$, which is an unobservable parameter. An easy solution to the problem is to use an estimator of ATET consisting of the observed difference between treated and not treated groups, assuming:

$$ATET = E[Y_{i1} - Y_{i0} \mid T_i = 1] = E[Y_{i1} \mid T_i = 1] - E[Y_{i0} \mid T_i = 0] \quad (4)$$

The right-hand side is easily estimated by a difference in sample means: if

$$Y_{i1}, Y_{i0} \perp T_i \quad (5)$$

for every *i*. Randomization states that the treatment assignment is unrelated to the potential outcome and that there is no difference in characteristics of treated and control units. If condition (5) fails, the variation of the potential outcome cannot be attributed to the difference in value scores between treated and untreated. One way to reduce the bias is to select individuals with the same observable characteristics (summarized by a vector of exogenous covariates ***X***) and try to make a comparison between treated and untreated

units with equal or similar values in observables ***X***. In order to implement matching estimation strategy we need to formulate the *conditional independence assumption (CIA)* that is required onward:

$$Y_{i1}, Y_{i0} \perp T_i \mid \mathbf{X}_i \quad [18] \tag{6}$$

Assumption (6) states that we are confident that all relevant variable influencing selection and the outcome are here observed. If condition (6) holds we can write:

$$ATET(\mathbf{X}_i) = E\left[Y_{i1} - Y_{i0} \mid T_i = 1, \mathbf{X}_i\right] \tag{7}$$

That can be estimated using the sample means for the treated and untreated subsample:

$$\begin{aligned} \hat{ATET}(\mathbf{X}_i) &= \hat{E}\left[Y_{i1} \mid T_i = 1, \mathbf{X}_i\right] - \hat{E}\left[Y_{i0} \mid T_i = 1, \mathbf{X}_i\right] = \\ &= \hat{E}\left[Y_{i1} \mid T_i = 1, \mathbf{X}_i\right] - \hat{E}\left[Y_{i0} \mid T_i = 0, \mathbf{X}_i\right] \end{aligned} \tag{8}$$

The main problem in this framework is when ***X*** is high dimensional. In this case, we are in front of a computational problem: we could not find individuals from both units and control groups with the same value of vector ***X***, in order to implement matching.

Rosenbaum and Rubin (1983) use the *ignorability of treatment assumption* in equation (6) in an innovative point of view, showing that *ATE* and *ATET* can both be alternatively estimated by modelling:

$$p(\mathbf{X}_i) = \Pr\left[T_i = 1 \mid \mathbf{X}_i\right] \tag{9}$$

that is the probability of observing a high level in score value given the set of covariates, which in our case represents a vector of socio economic confounders like the level of the individual income, the age of the respondents, the education level and other external characteristics that are assumed to possibly influence the attitudes of an individual; propensity score need an additional condition to *CIA*: we need to make a feasible comparison between two groups for each unit, *i.e.* we require that

$$0 < \Pr\left[T_i = 1 \mid \mathbf{X}_i\right] < 1 \quad [19] \tag{10}$$

Hence, if *CIA* holds, the *average treatment effect on treated* can be easily written as follows:

---

[18] In our framework, in order to estimate $ATET$, we could specify a less-restrictive ignorability of treatment condition, involving only mean independence, i.e. $E\left[Y_{i0} \mid T_i = 1, \mathbf{X}_i\right] = E\left[Y_{i0} \mid T_i = 0, \mathbf{X}_i\right]$.

[19] The previous equation states that we must observe both treated and untreated for every level of the propensity score, even if it is enough to require $\Pr\left[T_i = 1 \mid \mathbf{X}_i\right] < 1$ for the identification of the *average effect of treatment on treated*.

$$ATET(\mathbf{X}_i) = E[Y_{i1} - Y_{i0} \mid T_i = 1, \mathbf{X}_i] = E[Y_{i1} - Y_{i0} \mid T_i = 1, p(\mathbf{X}_i)] \tag{11}$$

and leaving out $\boldsymbol{X}$,

$$ATET = E_{p(X_i)}[ATET(\mathbf{X}_i)] = E_{p(X_i)}[E[Y_{i1} - Y_{i0} \mid T_i = 1, p(\mathbf{X}_i)]] = E_{p(X_i)}[E[Y_{i1} \mid T_i = 1, p(\mathbf{X}_i)] - E[Y_{i0} \mid T_i = 0, p(\mathbf{X}_i)] \mid T_i = 1] \tag{12}$$

Therefore, matching individuals with the same level of propensity score is the same of comparing individuals with the same exact value of vector $\boldsymbol{X}$.

Consequently, we have reduced the multidimensional problem and we are able to make a comparison between treated and untreated units with a similar value of propensity score. Equation (9) can be easily estimated through a logit model where the dependent variable is the dichotomized score of each factor and the covariates are the socio-economic characteristics of the individual[20]. Nevertheless, it's almost impossible to find pairs of individuals with the same estimated propensity score: in order to overcome the problem we have to match individual with similar value of estimated propensity score to minimize bias. Several matching techniques help us to resolve the problem and to allow inexact matching, reducing the bias. Those used in our analysis are: *nearest neighbour matching (with replacement), radius matching and kernel matching*.

Nearest neighbour matching consists in considering all the treated units and matching each of them with the control unit with the closest propensity score.

Let $C(i)$ the set of control units matched to the treated unit *i* with an estimated value of the propensity score of p_i, the nearest neighbour matching sets are given by:

$$C(i) = \min_j \left\| p_i - p_j \right\| \tag{13}$$

This is a single unit unless there are several control units with the same propensity score[21]. In this framework we implement *nearest neighbour matching* with replacement, allowing a control unit to be paired with more than one treated. This methodology presents some advantages and some limits: the advantage is that every treated unit is matched with the most similar control unit; Nevertheless, this procedure does not use all the information contained in the sample; *radius matching* compares every treated unit

[20] In our framework the logit estimates of propensity score give us an explanation of the covariates that could somewhat influence the score of values for each individual.

[21] In the analysis we have checked results also using nearest neighbour with caliper, which drop out pairs with a dissimilarity larger than the value of a fixed radius.

with all control case falling in a predefined neighbourhood of the propensity score of the treated unit.

So in radius matching

$$C(i) = \left\{ p_j \mid \left\| p_i - p_j \right\| < r \right\} \tag{14}$$

where *r* indicates the radius of the Eucledian neighbourhood.

In both neighbour and radius matching the *ATET* estimates are computed as follows:

$$\hat{ATET} = \left[\sum_{i=1}^{n} T_i \right]^{-1} \sum_{i}^{n} T_i \left[Y_i - \sum_{j \in C(i)} w_{ij} Y_j \right] \tag{15}$$

where w_{ij} is a weight coefficient that assumes value $\frac{1}{N_i^C}$ [22] if $j \in C(i)$ and 0 otherwise.

Radius matching presents some problematic aspects. It permits to calibrate the dimension of the neighbourhood, choosing the length of the radius; on one hand, if the dimension of the radius is set to be very small, it is possible that some treated units are not matched because the neighbourhood is empty. On the other hand, the smaller the size of the radius the better is the quality of matching. Another problematic aspect of this method is that an equal weight is assigned to all the controls included in the neighbourhood, even if they are placed on the bound of it.

Kernel matching compares all treated with a weighted average of all controls with weights that are inversely proportional to the distance between the propensity score of treated and untreated (Becker and Ichino, 2002). The kernel matching estimator is given by:

$$\hat{ATET} = \left[\sum_{i=1}^{n} T_i \right]^{-1} \sum_{i}^{n} T_i \left[Y_i - \frac{\sum_{j \in C} Y_j^C G\left(\frac{p_j - p_i}{h_n} \right)}{\sum_{k \in C} Y_j^C G\left(\frac{p_k - p_i}{h_n} \right)} \right] \tag{16}$$

Where $G(\cdot)$ is a kernel function and h_n is a bandwitch parameter. In this setting the selected kernel is Gaussian density.

It should also remembered that in the following analyses we will impose the common support restriction, i.e. we will focus only on the observation falling in a propensity score interval where we can find both treated and control units. This option is strongly

[22] N_i^C is the number of control units in the neighbourhood associated to unit *i*.

recommended in literature when the number of treated and controls is high and when the sample is not significantly reduced.

Several critics are led against propensity score matching; the most striking one deals with the presence of unobservable or omitted covariates. If there are unobserved variables that simultaneously affect assignment into treatment and the outcome variable, a hidden bias might arise to which matching estimators are not robust (Rosenbaum, 2002).

We implement several strategies to preserve our results from hidden bias: firstly, we can include a large set of pre-treatment observable covariates, in order to reduce the probability of omitting relevant variables for treatment assignment. As pointed out by Rubin and Thomas (1996) a covariate should be excluded from the model only if we are sure that the variable is unrelated to the outcome. Hence, the larger is the set of pre-treatment covariates; the lower is the risk of misspecification of propensity score.

However, hidden bias more frequently deals with latent factors that cannot be captured by observable covariates; we refer to dimensions as psychological wellbeing, disorientation, attitudes and values. In our setting, given the nature of the survey, we exactly define proxies of unobservable characteristics as treatment: in such a way we try to model unobserved heterogeneity including itself in the model and addressing its effect on demographic behaviour as well. The inclusion of unobserved heterogeneity in propensity score estimates as treatment protects our estimates from hidden bias. The decision of modelling unobservable heterogeneity as treatment represents an innovative formulation of this causal framework with propensity score matching that is available for the particular survey design, including several attitudinal items that are used to measuring what is usually unobservable.

Several statistical packages were implemented for STATA, in order to give estimations for *ATET* using the propensity score as described above. The more common methods are *pscore* by Becker and Ichino (2002) used in the work of Dehejia and Wahba (2002), *psmatch2* by Leuven and Sianesi (2003) and *nnmatch* by Abadie *et al.* (2004).

In the next section we will provide treatment effect results, using the stata module *psmatch2* and we compared the estimates obtained by a selection of the methods mentioned above.

2.4.1 Empirical results, attitudes

The first table contained in the paragraph presents results from logit models for determinants of attitudes. It is a specification of the model used to estimate propensity score of each attitude indicator for males and females that are splitted in light of differences in gender determinants od attitudes (see for example Thornton *et al.*, 1983). The estimates in Table 5 are expressed in terms of odd ratios for each covariate. A risk value greater than one denotes the variable increases the probability of scoring high with respect to the related attitude. Conversely, a risk value lower than one implies that the variable is negatively associated to the attitude index. The list of covariates includes many background factors related to family background (number of siblings, number of children, marital status), economic indicators (household income and employment status), religiosity and education.

The dependent variable represented in Table 5 is a dichotomized indicator for positive and negative attitudes i. e. *benefits and costs* of a future childbearing. The reasons for a dichotomous specification of the treatment may be criticized because of the recent development of the generalized propensity score approach in both theoretical (Hirano and Imbens, 2004) and applied framework (Bia and Mattei, 2008): unfortunately the continuous treatment is required to be normally distributed according to the cited applied literature. Kernel density estimates and Kolmogorov-Smirnov tests reject the hypothesis of normality for each of the five factor score distributions, although continuous. Also, the common normalizing transformations fail in this framework because feasible for strictly positive treatments; the retained factors score also negative and it make safer to implement a traditional dichotomous propensity score specification. However, the dichotomous specification appears as a drawback in presence of a continuous factor score; we address the robustness of findings implementing a sensitivity analysis: we realize our purpose varying the cut-point of the dichotomous index. We start considering a treatment that takes value one if the factor score is greater than the median and zero otherwise. Then, we compare the results with those obtained with two different cut-points. For example we will run the algorithm for a treatment that is one if factor score is greater than the third quartile and zero otherwise. Finally we test the results adopting an intermediate cut-point between the median and the third quartile. Details are described in appendix 2.C.

Tab 5. Odds Ratio for determinants of attitudes: results of applying logit model.

	Positive attitudes (Benefits)		*Negative attitudes (Costs)*	
	MALES	*FEMALES*	*MALES*	*FEMALES*
Number of children at 1st wave	0.536***	0.469***	1.356***	1.352***
Number of siblings	1.110**	0.970	0.987	0.987
Age				
18-23	1	1	1	1
24-29	1.138	0.982	0.757***	0.904
30-34	0.981	0.908	0.730**	1.059
Household Income				
1st Quintile	1	1	1	1
2nd Quintile	1.012	0.881	0.995	1.020
3rd Quintile	0.977	1.047	0.900	1.082
4th Quintile	0.982	0.972	0.959	0.970
5th Quintile	1.262	0.876	0.822	0.906
Employment				
Does not study and work	1	1	1	1
Studies	0.691**	0.691**	1.455**	1.569***
Works in private firm	1.086	0.807**	0.984	1.278**
Works in state firm	1.368**	0.876	1.054	1.141
Marital Status				
Not in union	1	1	1	1
Married	1.720***	1.653***	0.598***	0.658***
Cohabited	1.895***	1.542***	0.687***	0.880
Education				
Primary or Less	1	1	1	1
Basic	2.056***	1.468*	1.511*	1.133
Secondary	2.153***	1.344	1.583*	1.180
Higher	1.609	1.342	1.761*	1.251
Mother's Education				
Primary or Less	1	1	1	1
Basic	1.444*	0.855	0.968	0.793
Secondary	1.446	0.790	1.173	1.199
Higher	1.399	0.719	1.316	1.183
Father's Education				
Primary or Less	1	1	1	1
Basic	1.262	1.382	0.953	1.311
Secondary	1.231	1.246	0.923	0.894
Higher	1.021	1.100	1.178	1.553*
Religiosity				
Non Religious	1	1	1	1
Religious	1.487***	1.097	1.152*	0.976
Number of observations	2789	3082	2789	3082

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

The first point to note from estimates is that the number of children at first wave decreases the *benefits* linked to a possible childbirth. An opposite result coherently refers to the *negative attitudes*. In other words, positive attitudes are higher in absence

of children, whereas negative attitudes are higher in presence of previous pregnancies. This result confirms the single-child family pattern that reinforced in Bulgaria during the economic crisis; the negative association between children at first wave and attitudes towards childbearing explains the decline of second and third order fertility rates: children, especially in early ages, represent a cost for fathers and mothers both in terms of monetary expenditure and in loss of opportunities in labour fields and in relationship with friends, especially in younger cohorts. Since the age of respondents is below 34, results for children in the first wave do not surprise.

Age reveals a decreasing relationship with *negative attitudes* for males, whereas *benefits* seem to be more insensible with respect to the age of respondents.

Employment status plays a key role in determining both positive and negative attitudes: in particular, students show a lower risk to score high in the *"benefits" factor* and symmetrically a higher level for the *"costs" factor*. A clear explanation of this result may be found in the delayed transition to adulthood that is progressively concerning Bulgaria, similarly to Western countries. The numbers of students that reach the highest level of education are progressively increasing and they are not ready for childbearing, due to the impossibility to reconcile education and parenthood, both in terms of time and economic resources.

Working in State firms shows the highest score for *benefits* relatively to males: as pointed out by Philipov *et al.* (2006) this confirms that job security seems to have an effect to attitudes towards expectations of having children. Coherently, working in a private firm gives more chances of observing negative attitudes for women. The result is confirmed also with respect to a decrease in childbearing's *benefits*. This finding is close to the results from Billari *et al.* (2009), relatively to the association between negative attitudes and background factors. Probably, unemployment status is more acceptable for younger females than working in a private firm, a circumstance that would show an interest for family life. In fact, males display an opposite pattern: the results from estimates of unemployed are the worst after that from students.

In light of estimates from Table 5, the strongest results deal with the marital status: married and cohabited people show the highest connection to the *"benefits" factor*. This result does not surprise and is similar to those from Billari *et al.* (2009) and also from Philipov *et al.* (2006) in the somewhat different context of determining intentions of

having children. However, if theory of reasoned action holds, intentions and attitudes are strongly related and a connection between marital status and attitudes may predict a link between marital status and intentions for transitivity.

The only ideational factor explored in our survey is religiosity. The reason for this choice consists in a correct specification of propensity score. Following Caliendo and Koepinig (2005), we have to exclude from propensity score specification the variables that may be affected by the treatment. Because of the stability of values and attitudes over time (Lesthaeghe and Moors, 2002), we may contemplate the hypothesis that attitudes themselves affect other ideational covariates. Hence, the unique ideational variable introduced in the model is religiosity. The stability of religious beliefs allows us to avoid the risk that attitudes towards parenthood influence religiosity; conversely, we could affirm that religiosity may affect attitudes related to fertility.

Results provide evidence of a significant association between being religious and positive attitude to childbearing for males. Surprisingly, the relationship is direct also for negative attitude. Another central finding is the non correlation between attitudes, religiousness and female gender.

After an analysis of estimates of propensity score, we focus on results from matching pairs. Three methods are analysed and compared, i.e. nearest neighbour matching, radius matching and kernel matching results.

Tab 6. Matching estimates for positive attitudes.

Matching Method		*Effect of benefits on childbearing*			
		MALES		*FEMALES*	
		Unmatched	Matched	Unmatched	Matched
Nearest Neighbour (Replacement)	Treated	.205	.205	.234	.231
	Controls	.134	.131	.164	.190
	ATT	.071***	.074***	.070***	.041**
	(t stat)	(5.02)	(3.98)	(4.89)	(2.04)
Radius Matching (Radius=0.05)	Treated	.205	.205	.234	.231
	Controls	.134	.143	.164	.193
	ATT	.071***	.061***	.070***	.038***
	(t stat)	(5.02)	(4.14)	(4.89)	(2.47)
Kernel Matching (Gaussian Kernel)	Treated	.205	.205	.234	.231
	Controls	.134	.134	.164	.187
	ATT	.071***	.071***	.070***	.043***
	(t stat)	(5.02)	(4.84)	(4.89)	(2.94)

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

There is a long debate around the correct matching method to implement in analyses; the response is not univocal and each method presents advantages and disadvantages; asymptotically results from different methods would be the same, but we are in presence of finite samples, thus strong differences may emerge; in particular, there is a trade off in terms of bias and efficiency. Nearest neighbour matching is clearly the most straightforward and it is the best one for decreasing bias. In this setting, we cannot implement nearest neighbour without replacement because of the low number of controls[23]. Moreover, results from nearest neighbour matching with and without the imposition of a caliper equal to 0.05 give the same results: a high value for the positive attitudes factor increases by 7.4% the probability of getting pregnant between the two waves for males' partners. Females show a lower result (4.1%).

Average treatment effect on treated is similar in radius (Dehejia and Wahba, 1999) and kernel matching. The peculiarity of these methods is to match more than one control for each matching. In such cases, the procedure minimizes the variance of estimates due to the use of a large sample. In particular, kernel matching uses all the available information, giving more or less weight to control observations that are more or less distant to each treated unit in terms of propensity score.

Results from radius and kernel matching are close and indicate an increase in the average number of children by about 6-7% for males that register a high level of *benefits*. The result for females is weaker: estimated average treatment effect is lower (about 3-4%) but still significant.

Conversely, negative attitudes reduce the probability of getting pregnant. As we have just seen above, the results are stronger for males: individuals that score low for the *"costs" factor* decrease the likelihood of having a child by about 5%. In this case the estimates are strongly uniform for all matching methods. Results for females are weaker (between 2% and 3%) and only significant at 10% level.

These findings are not surprising: positive attitudes increase the probability of having a child, whereas negative attitudes show an opposite effect, according to the theories that underline the causal effect of attitudes on behaviour.

[23] We have built the treated and controls cutting the factor at the median. Therefore, the number of treated is almost equal to controls.

Tab 7. Matching estimates for negative attitudes.

Matching Method		*Effect of costs on childbearing*			
		MALES		*FEMALES*	
		Unmatched	Matched	Unmatched	Matched
Nearest Neighbour (Replacement)	Treated	.132	.132	.179	.179
	Controls	.201	.187	.223	.213
	ATT	-.069***	-.054***	-.044***	-.034*
	(t stat)	(-4.79)	(-2.94)	(-3.02)	(-1.71)
Radius Matching (Radius=0.05)	Treated	.132	.132	.179	.179
	Controls	.201	.172	.223	.204
	ATT	-.069	-.040***	-.044***	-.025*
	(t stat)	(-4.79)	(-2.83)	(-3.02)	(-1.64)
Kernel Matching (Gaussian Kernel)	Treated	.132	.132	.179	.179
	Controls	.201	.178	.223	.206
	ATT	-.069	-.046***	-.044***	-.027*
	(t stat)	(-4.79)	(-3.23)	(-3.02)	(-1.80)

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

However, we highlight that we examined attitudes; more in detail, we have analyzed attitudes that are strongly related of personal expectation of having a child. Evidence from these results is also in favour of theory of planned behaviour (Ajizen, 1991) completing the results of paper from Billari, Philipov and Testa (2009) that connected this kind of attitudes to intentions; the link between attitudes and behaviour indirectly confirms the link between intentions and behaviour.

2.4.2 Empirical results, value orientations

An additional and interesting topic is to investigate the effect of value orientations on the decision to plan a childbearing between the two waves. Value orientations indexes are obtained through a factor analysis on 5 generalized attitudes shown in Table 4. Following Moors (2002), generalized attitudes are connected to the concept of value orientations. In fact, values can be inferred from a set of attitudinal scales like those displayed above. In particular, an organization of general attitudes (without direct interest in personal experience of respondents), which focus on different objects, transcends the particularity of each attitude and may be interpreted as value orientation as well. Hence, this paragraph could be interpreted also as a proxy of relationship between behaviour and value orientations.

Table 8 displays relative risks for determinants of value orientations for both females and males with respect to several factors.

Tab 8. Odds Ratio for determinants of value orientations: results of applying logit model.

	Parental role traditionalism		*Self actualization*		*Alternative living arrangements*	
	MALES	*FEMALES*	*MALES*	*FEMALES*	*MALES*	*FEMALES*
Number of children at 1st wave	0.927	0.936	0.876	0.891*	1.061	1.087
Number of siblings	1.023	0.915**	1.036	0.948	0.987	0.983
Age						
18-24	1	1	1	1	1	1
24-30	0.981	1.018	1.391***	1.305**	1.123	1.127
30-34	0.955	1.083	1.532***	1.545***	1.211	1.147
Household Income						
1st Quintile	1	1	1	1	1	1
2nd Quintile	1.116	1.040	1.173	0.656***	0.879	1.058
3rd Quintile	0.871	0.969	0.983	0.939	0.855	0.856
4th Quintile	0.927	0.938	1.140	0.832	0.988	0.699*
5th Quintile	1.035	0.981	0.810	0.891	0.849	0.862
Employment						
Does not study and work	1	1	1	1	1	1
Studies	0.890	0.981	0.866	0.970	0.640**	0.941
Works in private firm	1.064	1.212**	0.973	1.241**	0.827*	1.085
Works in state firm	1.259	1.189	1.149	1.274	0.739*	0.889
Marital Status						
Not in union	1	1	1	1	1	1
Married	1.016	0.931	1.091	0.962	0.490***	0.645***
Cohabited	1.099	1.005	1.150	0.975	1.283*	1.355*
Education						
Primary or Less	1	1	1	1	1	1
Basic	1.339	0.603**	0.921	1.411	0.835	0.755
Secondary	1.343	0.621**	1.074	1.449	0.808	0.669
Higher	1.165	0.506***	1.150	1.753*	0.805	0.547**

Tab 8. (Continued)

	Parental role traditionalism		*Self actualization*		*Alternative living arrangements*	
	MALES	*FEMALES*	*MALES*	*FEMALES*	*MALES*	*FEMALES*
Mother's Education						
Primary or Less	1	1	1	1	1	1
Basic	1.366	1.068	1.074	0.731	0.796	1.363
Secondary	1.035	0.953	0.837	0.790	0.784	1.356
Higher	0.873	0.823	0.857	0.738	0.689	1.367
Father's Education						
Primary or Less	1	1	1	1	1	1
Basic	1.368	1.156	0.866	0.580**	0.971	0.716
Secondary	1.632**	1.050	1.120	0.668	1.061	0.731
Higher	1.878**	1.037	1.291	0.621*	1.103	1.152
Religiosity						
Non Religious	1	1	1	1	1	1
Religious	1.422***	1.172**	1.027	0.869	0.764***	0.692***
Number of observations	2350	2370	2350	2370	2350	2370

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

The explanatory power of regression is not good like that implemented in Table 5. As expected, children at first wave appear to be in contrast with *self actualization* (the odd ratio for males is not significant but the p-value is close to 0.1 and the coefficients for both the genders are similar). Moreover, s*elf actualization* increases with the age of respondents. Surprisingly the number of siblings decreases the likelihood of observing *parental role traditionalism*. A remarkable note is that these results are limited to females. In males' sub-sample it is given more relevance to father's education: respondents with more educated father show high score for *parental role traditionalism.* Moreover, individuals' education play an opposite role in determining *parental role traditionalism* for females.

However, the most relevant result involves religiosity. As expected, religious people are more likely to show *parental role traditionalism*, whereas *alternative living arrangements* is attached to more secularized individuals (Lesthaeghe and Surkyn, 2006); in this framework marriage is obviously inversely associated to *alternative living arrangements*, whereas the coefficient of non marital cohabitation shows a positive and significant effect.

Tab 9. Matching estimates for parental role traditionalism.

		Effect of parental role traditionalism on childbearing			
Matching Method		*MALES*		*FEMALES*	
		Unmatched	Matched	Unmatched	Matched
	Treated	.184	.184	.199	.199
Nearest Neighbour	Controls	.159	.153	.195	.198
(Replacement)	ATT	.025*	.031*	.004	.001
	(t stat)	(1.74)	(1.75)	(0.32)	(0.07)
	Treated	.184	.184	.199	.199
Radius Matching	Controls	.159	.156	.195	.197
(Radius=0.05)	ATT	.025*	.028**	.004	.002
	(t stat)	(1.74)	(1.98)	(0.32)	(0.15)
	Treated	.184	.184	.199	.199
Kernel Matching	Controls	.159	.151	.195	.196
(Gaussian Kernel)	ATT	.025*	.034**	.004	.003
	(t stat)	(1.74)	(2.30)	(0.32)	(0.23)

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

Table 9 displays results of *ATT* for *parental role traditionalism.* All the matching methods implemented show evidence that a positive value for the factor significantly increases the likelihood of getting pregnant by about 3. Unmatched results showed a

lower association between treatment and outcome instead. This means that propensity score matching overcame a decisive selection bias.

Results for males do not correspond to those obtained for females. In light of these results from attitudes we do not surprise. In each estimation positive and traditional attitudes are stronger for males and weaker for females.

Table 10 displays no evidence for a causal impact of *self actualization* on childbearing.

Tab 10. Matching estimates for self actualization.

		Effect of self actualization on childbearing			
Matching Method		*MALES*		*FEMALES*	
		Unmatched	Matched	Unmatched	Matched
	Treated	.170	.170	.202	.202
Nearest Neighbour	Controls	.172	.168	.192	.195
(Replacement)	ATT	-.002	.002	.010	.007
	(t stat)	(-0.09)	(0.13)	(0.71)	(0.35)
	Treated	.170	.170	.202	.202
Radius Matching	Controls	.172	.179	.192	.194
(Radius=0.05)	ATT	-.002	-.009	.010	.008
	(t stat)	(-0.09)	(-0.62)	(0.71)	(0.54)
	Treated	.170	.170	.202	.202
Kernel Matching	Controls	.172	.176	.192	.193
(Gaussian Kernel)	ATT	-.002	-.006	.010	.009
	(t stat)	(-0.09)	(-0.39)	(0.71)	(0.63)

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

However, although weak and not significant, a comparison between females and males is interesting: males show a traditional behaviour: *self actualization* seems to undermine fertility, whereas females seems to react in an opposite and alternative direction. This finding is consistent with the idea that males seem to adopt a more traditional behaviour, whereas females seem to be less sensitive to traditional values. Another interesting finding from the analyses underlines as attitudes and value orientations affect stronger men than women. This also emerges from the Table 11 that aims to establish a causal relationship between *alternative living arrangements* and fertility behaviour; although weak and significant only in radius matching approach (however this finding is not confirmed after the sensitivity analysis led in appendix 2.C), males seem more sensitive to *alternative living arrangement* than women that seems to reduce the likelihood of a childbirth between the waves by about 2%

Tab 11. Matching estimates for alternative living arrangements.

Matching Method		*Effect of alternative living arrangements on childbearing*			
		MALES		*FEMALES*	
		Unmatched	Matched	Unmatched	Matched
Nearest Neighbour (Replacement)	Treated	.160	.158	.199	.199
	Controls	.179	.180	.195	.187
	ATT	-.018	-.022	.004	.012
	(t stat)	(-1.29)	(-1.14)	(0.28)	(0.62)
Radius Matching (Radius=0.05)	Treated	.160	.158	.199	.199
	Controls	.179	.187	.195	.196
	ATT	-.018	-.028*	.004	.003
	(t stat)	(-1.29)	(-1.91)	(0.28)	(0.22)
Kernel Matching (Gaussian Kernel)	Treated	.160	.158	.199	.199
	Controls	.179	.178	.195	.194
	ATT	-.018	-.019	.004	.005
	(t stat)	(-1.29)	(-1.36)	(0.28)	(0.35)

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

The factor explored in the last table summarizes the item *marriage is outdated*, that is included in several studies focusing on value orientations jointly to similar items. However, Table 11 offers no clear evidence of a causal impact of *alternative living arrangements* and future pregnancies.

2.5. Discussion

The previous paragraphs have presented the issue of the impact of ideational factors (attitudes and values) on fertility decisions of a sample of Bulgarian respondents between 2002 and 2005.

Many surveys mentioned by the literature find evidence for an association between attitudes/value orientations and behaviour, but causality has not been often proved in most studies. As pointed out by Lesthaeghe and Moors (2002), the identification of a causal relationship requires a panel structure for data, in order to prove the delayed effect of attitudes on behaviour. However, a panel design is not enough to correctly identify the intensity of causal effect; indeed, observational studies are subjected to selection bias. Attitudes would be more common in self selected sub-samples and this may produce overestimation or underestimation of the causal effect. Propensity score matching allows us to compare units on the basis of similarities in observables covariates. This is helpful in order to avoid selection-bias. Moreover, this paper gives also an innovative specification of treatment that represents a binary proxy of

unobservable individual heterogeneity in individual values. This approach is not common in econometric literature and due to the particular form of the questionnaires carried out on Bulgarians; it has been possible to apply the new treatment specification in this paper.

The reliability of matching estimates depends on several conditions: the first one is that balance property requires to be satisfied. This condition is successfully checked in Appendix B. The second condition is the sensitivity of the analysis towards the imposition of common support, which is not relevant because only few units fall out the common support. The last condition concerns the sensitivity to the used matched method: results from nearest neighbour, radius and kernel matching are in general robust and give similar results.

In general, results provide evidence of a positive causal effect of the *"benefits" factor* on pregnancy decisions for males; in other word, respondents that associate ideas of joy and satisfaction to parenthood and that are willing to sacrifice themselves for children are more likely to become pregnant. An analogous results emerges for women. Moreover, females seem to be more subjected to *"benefits" factor* than to negative attitudes. The *"costs" factor* has only an uncertain and weak impact on females' behaviour.

Focusing on value orientations, a surprising finding is that *parental role traditionalism* is weakly and positively connected to an increase of childbirths in males' subsample.

As expected, attitudes/value orientations predict the related behaviour. Traditional attitudes seem to be related to childbearing, whereas alternative attitudes have a negative impact on behaviour.

These results support theories based on ideational factors, although they do not deny theories that emphasize economic factors in demographic choices as well: differences in *matched* and *unmatched* treated effects prove that economic and background factor often lead to an overestimation of the parameter, indicating a remarkable effect of background covariates in producing bias estimation. In light of a prosecution of this survey (Sironi, 2009) economic and social factors are also relevant in life course decisions.

In conclusion, ideational factors and economic conditions interact in forming individuals' expectations and affect attitudes. Attitudes may have a significant effect on

life course events. A final remark states that attitudes and values orientations seem to play a more decisive role in determining males' behaviour than females' one even if the effect of attitudes is stronger for both the genders. Alternative value orientations play an indirect and delay role in orienting life course decision, whereas attitudes, that are behavioural-specific, are deeply connected to subsequent individuals' life course paths.

Appendix 2.A: factor analysis

In this section we provide details of the disjoint factor analysis for males and females. As we can see below results are very close and allow to implement a unique factor analysis for both the genders in the paper.

Tables A.1 – A.4 show results for attitudes that demonstrate two retained factors for both males and females. In both cases the *"benefits" factor* is associated to the largest eigenvalues and is highly correlated with six items. Conversely the *"costs" factor* is associated to high scores for the excluded four items.

Tab A.1. Factor Extraction – *MALES* – Attitudes.

Factor	Eigenvalue	Difference	Proportion	Cumulative
Factor1	*3.07684*	*1.23367*	*0.3077*	*0.3077*
Factor2	*1.84317*	*0.91698*	*0.1843*	*0.4920*
Factor_	0.92619	0.09347	0.0926	0.5846
Factor_	0.83271	0.06763	0.0833	0.6679
Factor_	0.76508	0.09030	0.0765	0.7444
Factor_	0.67479	0.07739	0.0675	0.8119
Factor_	0.59739	0.09420	0.0597	0.8716
Factor_	0.50319	0.04234	0.0503	0.9219
Factor_	0.46085	0.14106	0.0461	0.9680
Factor_	0.31979	0	0.0320	1.0000

Tab A.2. Rotated Factor Loadings – *MALES* – Attitudes.

Items	*Factor 1 Benefits*	*Factor 2 Costs*	*Uniqueness*
1) To have children increases your economic difficulties.	-.0963	**.6000**	.6307
2) To have children decreases your chances in your working career and/or education.	-.2039	**.4819**	.7262
3) To have children increases your security that at old ages the is someone to care about you.	**.5894**	-.0494	.6501
4) To have children increases joy and satisfaction in your life.	**.6941**	.0418	.5164
5) To have children increases worries and preoccupations in the course of daily life.	.0875	**.7850**	.3762
6) To have children decreases the time you have to pursue personal interests or be with friends.	.0438	**.7793**	.3908
7) To have children increases certainty in your life.	**.6860**	-.1265	.5134
8) To have children increases the closeness between you and your partner.	**.8071**	.0288	.3478
9) To have children increases the closeness between you and your parents and relatives.	**.7654**	.0270	.4134
10) To have children means that a part of you continues into the future.	**.6914**	.0831	.5150

Tab A.3. Factor Extraction – *FEMALES* – Attitudes.

Factor	Eigenvalue	Difference	Proportion	Cumulative
Factor1	*3.21454*	*1.26968*	*0.3215*	*0.3215*
Factor2	*1.94485*	*1.03439*	*0.1945*	*0.5159*
Factor_	0.91046	0.10803	0.0910	0.6070
Factor_	0.80243	0.04404	0.0802	0.6872
Factor_	0.75839	0.08204	0.0758	0.7631
Factor_	0.67635	0.16362	0.0676	0.8307
Factor_	0.51273	0.03611	0.0513	0.8820
Factor_	0.47662	0.05180	0.0477	0.9296
Factor_	0.42482	0.14602	0.0425	0.9721
Factor_	0.27880		0.0279	1.0000

Tab A.4. Rotated Factor Loadings – *FEMALES* – Attitudes.

Items	*Factor 1 Benefits*	*Factor 2 Costs*	*Uniqueness*
1) To have children increases your economic difficulties.	-.1516	**.6392**	.5685
2) To have children decreases your chances in your working career and/or education.	-.1724	**.5550**	.6623
3) To have children increases your security that at old ages the is someone to care about you.	**.5932**	-.1254	.6323
4) To have children increases joy and satisfaction in your life.	**.6438**	.0967	.5761
5) To have children increases worries and preoccupations in the course of daily life.	.0064	**.7918**	.3729
6) To have children decreases the time you have to pursue personal interests or be with friends.	.0579	**.7712**	.4020
7) To have children increases certainty in your life.	**.7582**	-.1449	.4042
8) To have children increases the closeness between you and your partner.	**.8202**	-.0436	.3254
9) To have children increases the closeness between you and your parents and relatives.	**.7759**	-.0272	.3973
10) To have children means that a part of you continues into the future.	**.7004**	.0999	.4995

Value orientations show either an identical profile for the two genders: the retained factors are two for each gender and the difference in explained variance is less than above.

Tab A.5. Factor Extraction – *MALES* – Value orientations.

Factor	Eigenvalue	Difference	Proportion	Cumulative
Factor3	*1.62360*	*0.58401*	*0.3247*	*0.3247*
Factor4	*1.03959*	*0.04609*	*0.2079*	*0.5326*
Factor_	0.99349	0.13540	0.1987	0.7313
Factor_	0.85809	0.37287	0.1716	0.9030
Factor_	0.48523	.	0.0970	1.0000

Tab A.6. Factor Extraction – *FEMALES* – Value orientations.

Factor	Eigenvalue	Difference	Proportion	Cumulative
Factor3	*1.57353*	*0.49705*	*0.3147*	*0.3147*
Factor4	*1.07648*	*0.07711*	*0.2153*	*0.5300*
Factor_	0.99936	0.14228	0.1999	0.7299
Factor_	0.85709	0.36356	0.1714	0.9013
Factor_	0.49353	.	0.0987	1.0000

However, when a joint factor analysis mixing men and women is implemented, a third factor, concerning *alternative living arrangements* must be retained.

Tab A.7. Factor Extraction – *MALES/FEMALES* – Value orientations.

Factor	Eigenvalue	Difference	Proportion	Cumulative
Factor3	*1.59455*	*0.54067*	*0.3189*	*0.3189*
Factor4	*1.05388*	*0.05083*	*0.2108*	*0.5297*
Factor5	*1.00306*	*0.14458*	*0.2006*	*0.7303*
Factor_	0.85847	0.36843	0.1717	0.9020
Factor_	0.49004	.	0.0980	1.0000

Tab A.8. Rotated Factor Loadings – *MALES/FEMALES* – Value orientations.

Items	*Factor 3* *Parental-role traditionalism*	*Factor 4* *Self actualization*	*Factor 5* *Alternative living arrangements*	*Uniqueness*
1) Regardless of what the qualities and faults of one's parents are, one must always love and respect them.	**.8819**	.0265	.0411	.2199
2) Parent's duty is to do their best for their children even at the expenses of their own well-being.	**.5280**	**-.5767**	.2303	.3355
3) One does not have the duty to respect and love parents who have not earned it by their behaviour and attitudes.	**-.6349**	-.0121	.4320	.4101
4) Parents have a life of their own and should not be asked to sacrifice their own well-being for the sake of their children.	.0722	**.8934**	.1460	.1753
5) Official marriage is outdated.	.0063	.0929	**.8852**	.2077

Therefore, we adopt a three factor solution. This finding is confirmed with different extraction methods, like principal factors that underlines a three-factor solution for both joint and disjoint sample.

A remarkable note is that the statement "Parent's duty is to do their best for their children even at the expenses of their own well-being." is strongly correlated with both *Factor 3* and *Factor 4* despite of the varimax rotation. However, the opposite sign for factor loadings is coherent with the factors interpretation.

Appendix 2.B: balance property in propensity score estimates

Reliability of propensity score estimates depends on several factors. One of them is following condition, that states:

$$T_i \perp \mathbf{X}_i \mid p(\mathbf{X}_i) \tag{B.1}$$

In other words, treatment must be independent of distribution of covariates conditionally on the propensity score. Hence, if after conditioning on the propensity score there is still dependence on the matrix of covariates, it suggests a mis-specification in the model or a failure of the *Conditional Independence Assumption* (Caliendo and Kopeinig, 2005).

Many suitable indicators are provided to verify condition B.1. The first one is the comparison between standard bias before and after matching procedure. Rosenbaum and Rubin (1985) proposed to compute standard bias with the following formula:

$$bias = \frac{100\left(\bar{x}_T - \bar{x}_C\right)}{\sqrt{\frac{\left(s_T^2 - s_C^2\right)}{2}}} \tag{B.2}$$

The limit of this approach is that we do not have a clear threshold for the success of matching procedure, even if Gangl and Di Prete (2004) suggest a successful level of 5%, to declare that matching procedure satisfies balance property.

The tables below provide evidence that bias is successfully reduced below 5% in most cases. Additionally, Rosenbaum and Rubin (1985) suggest the implementation of T-test between treated and control units after matching, in order to demonstrate that no significant difference can be found. Our remark is that no covariate is equal in means in treatment and control units for each matching procedure implemented in our survey at 10% level.

In the following tables we selected five tables that belong to all matching procedures that showed significant results. Details of estimates can be found below:

Tab B.1. Balance Check – "Benefits" Factor – *Males* – (Radius Matching).

		Mean			%reduct		
Variable	Sample	Treated	Control	%bias	|bias|	t	p>|t|
N. Children at 1st wave	Unmatched	0.51793	0.74513	-27.4		-7.29	0
	Matched	0.51931	0.53149	-1.5	94.6	-0.46	0.647
Household inc. II quintile	Unmatched	0.22178	0.21356	2		0.52	0.601
	Matched	0.22104	0.22081	0.1	97.2	0.02	0.988
Household inc. III quintile	Unmatched	0.18792	0.18472	0.8		0.22	0.829
	Matched	0.18775	0.18644	0.3	59	0.09	0.927
Household inc. IV quintile	Unmatched	0.16467	0.16056	1.1		0.29	0.769
	Matched	0.16511	0.16108	1.1	1.9	0.3	0.765
Household inc. V quintile	Unmatched	0.13546	0.10366	9.8		2.57	0.01
	Matched	0.13515	0.1368	-0.5	94.8	-0.13	0.895
Studies	Unmatched	0.05246	0.07638	-9.8		-2.59	0.01
	Matched	0.0526	0.04844	1.7	82.6	0.52	0.603
Works pvt	Unmatched	0.54449	0.50818	7.3		1.91	0.056
	Matched	0.54461	0.53968	1	86.4	0.27	0.786
Works state	Unmatched	0.1494	0.12081	8.4		2.19	0.028
	Matched	0.14847	0.14933	-0.3	97	-0.07	0.947
Married	Unmatched	0.31939	0.33749	-3.9		-1.01	0.31
	Matched	0.31957	0.31611	0.7	80.8	0.2	0.838
Cohabited	Unmatched	0.18194	0.1894	-1.9		-0.51	0.613
	Matched	0.18043	0.17528	1.3	31.1	0.37	0.713
Basic Edu	Unmatched	0.17264	0.19641	-6.1		-1.62	0.106
	Matched	0.1731	0.16837	1.2	80.1	0.34	0.731
Secondary Edu	Unmatched	0.71182	0.63445	16.5		4.37	0
	Matched	0.71105	0.70965	0.3	98.2	0.08	0.932
Higher Edu	Unmatched	0.09363	0.106	-4.1		-1.09	0.276
	Matched	0.09387	0.0974	-1.2	71.5	-0.33	0.742
Number Siblings	Unmatched	1.2722	1.385	-10		-2.65	0.008
	Matched	1.269	1.2728	-0.3	96.7	-0.1	0.918
Basic Edu mother	Unmatched	0.2344	0.21122	5.6		1.46	0.143
	Matched	0.23435	0.22837	1.4	74.2	0.39	0.698
Secondary Edu mother	Unmatched	0.54382	0.4848	11.8		3.11	0.002
	Matched	0.54328	0.55037	-1.4	88	-0.39	0.696
Higher Edu mother	Unmatched	0.14807	0.15355	-1.5		-0.4	0.687
	Matched	0.14847	0.14505	1	37.5	0.26	0.791
Basic Edu father	Unmatched	0.23705	0.2198	4.1		1.08	0.28
	Matched	0.23702	0.22835	2.1	49.8	0.56	0.574
Secondary Edu father	Unmatched	0.56839	0.50039	13.7		3.6	0
	Matched	0.56791	0.57348	-1.1	91.8	-0.31	0.758
Higher Edu father	Unmatched	0.13147	0.14809	-4.8		-1.26	0.206
	Matched	0.13182	0.13077	0.3	93.7	0.09	0.932
Religious	Unmatched	0.48539	0.39595	18.1		4.76	0
	Matched	0.48402	0.48304	0.2	98.9	0.05	0.957
Age24-29	Unmatched	0.43958	0.38036	12.1		3.17	0.002
	Matched	0.43808	0.43681	0.3	97.8	0.07	0.944
Age30-34	Unmatched	0.26096	0.31411	-11.8		-3.1	0.002
	Matched	0.26165	0.26141	0.1	99.5	0.02	0.988

Tab B.2. Balance Check – "Costs" Factor – *Males* – (Radius Matching).

		Mean			%reduct		
Variables	Sample	Treated	Control	%bias	|bias|	t	p>|t|
N. Children at 1st wave	Unmatched	0.60674	0.63358	-3.2		-0.84	0.399
	Matched	0.60674	0.62539	-2.2	30.5	-0.52	0.602
Household inc. II quintile	Unmatched	0.22385	0.21385	2.4		0.63	0.528
	Matched	0.22385	0.22079	0.7	69.4	0.18	0.86
Household inc. III quintile	Unmatched	0.1841	0.18811	-1		-0.27	0.789
	Matched	0.1841	0.18266	0.4	64.3	0.09	0.929
Household inc. IV quintile	Unmatched	0.1694	0.15809	3.1		0.8	0.425
	Matched	0.1694	0.16408	1.4	53	0.34	0.732
Household inc. V quintile	Unmatched	0.121	0.12071	0.1		0.02	0.981
	Matched	0.121	0.12335	-0.7	-704.3	-0.17	0.863
Studies	Unmatched	0.08902	0.04534	17.5		4.68	0
	Matched	0.08902	0.07479	5.7	67.4	1.25	0.212
Works pvt	Unmatched	0.50475	0.54412	-7.9		-2.05	0.04
	Matched	0.50475	0.51518	-2.1	73.5	-0.5	0.616
Works state	Unmatched	0.13483	0.13725	-0.7		-0.18	0.854
	Matched	0.13483	0.13589	-0.3	56.4	-0.07	0.941
Married	Unmatched	0.29127	0.35355	-13.4		-3.46	0.001
	Matched	0.29127	0.29559	-0.9	93.1	-0.23	0.82
Cohabited	Unmatched	0.17286	0.19424	-5.5		-1.43	0.152
	Matched	0.17286	0.1773	-1.1	79.2	-0.28	0.779
Basic Edu	Unmatched	0.18237	0.18444	-0.5		-0.14	0.89
	Matched	0.18237	0.18567	-0.9	-59.5	-0.2	0.838
Secondary Edu	Unmatched	0.68107	0.67279	1.8		0.46	0.645
	Matched	0.68107	0.68212	-0.2	87.3	-0.05	0.957
Higher Edu	Unmatched	0.10458	0.09559	3		0.78	0.434
	Matched	0.10458	0.10073	1.3	57.1	0.31	0.76
Number Siblings	Unmatched	1.2965	1.3438	-4.2		-1.1	0.272
	Matched	1.2965	1.3112	-1.3	68.8	-0.31	0.753
Basic Edu mother	Unmatched	0.20052	0.2402	-9.6		-2.48	0.013
	Matched	0.20052	0.20354	-0.7	92.4	-0.18	0.856
Secondary Edu mother	Unmatched	0.51945	0.51471	0.9		0.25	0.805
	Matched	0.51945	0.52525	-1.2	-22.4	-0.28	0.78
Higher Edu mother	Unmatched	0.17978	0.1299	13.8		3.64	0
	Matched	0.17978	0.16894	3	78.3	0.69	0.493
Basic Edu father	Unmatched	0.20916	0.24326	-8.2		-2.11	0.035
	Matched	0.20916	0.21229	-0.7	90.8	-0.18	0.854
Secondary Edu father	Unmatched	0.53328	0.53983	-1.3		-0.34	0.733
	Matched	0.53328	0.53976	-1.3	1.1	-0.31	0.755
Higher Edu father	Unmatched	0.1694	0.11765	14.8		3.9	0
	Matched	0.1694	0.15691	3.6	75.9	0.81	0.416
Religious	Unmatched	0.4624	0.43137	6.2		1.63	0.104
	Matched	0.4624	0.46138	0.2	96.7	0.05	0.961
Age24-29	Unmatched	0.38548	0.43137	-9.3		-2.43	0.015
	Matched	0.38548	0.39248	-1.4	84.7	-0.35	0.73
Age30-34	Unmatched	0.26361	0.30086	-8.3		-2.15	0.032
	Matched	0.26361	0.26941	-1.3	84.4	-0.32	0.753

Tab B.3. Balance Check – "Benefits" Factor – *Females* – (Radius Matching).

		Mean			%reduct		
Variables	Sample	Treated	Control	%bias	|bias|	t	p>|t|
N. Children at 1st wave	Unmatched	0.74829	1.1436	-45.6		-12.58	0
	Matched	0.75447	0.76939	-1.7	96.2	-0.51	0.608
Household inc. II quintile	Unmatched	0.20464	0.21968	-3.7		-1.02	0.308
	Matched	0.20633	0.20664	-0.1	97.9	-0.02	0.983
Household inc. III quintile	Unmatched	0.2101	0.19059	4.9		1.35	0.176
	Matched	0.21045	0.20955	0.2	95.4	0.06	0.952
Household inc. IV quintile	Unmatched	0.16303	0.15408	2.4		0.68	0.497
	Matched	0.16437	0.16764	-0.9	63.5	-0.24	0.813
Household inc. V quintile	Unmatched	0.10164	0.10334	-0.6		-0.16	0.876
	Matched	0.10248	0.10249	0	98.9	0	0.999
Studies	Unmatched	0.07776	0.07302	1.8		0.5	0.618
	Matched	0.0784	0.07767	0.3	84.5	0.07	0.941
Works pvt	Unmatched	0.40109	0.40656	-1.1		-0.31	0.757
	Matched	0.40371	0.40746	-0.8	31.5	-0.21	0.837
Works state	Unmatched	0.11801	0.12314	-1.6		-0.44	0.662
	Matched	0.11898	0.12311	-1.3	19.7	-0.34	0.733
Married	Unmatched	0.42087	0.46101	-8.1		-2.24	0.025
	Matched	0.41953	0.41744	0.4	94.8	0.11	0.909
Cohabited	Unmatched	0.22988	0.25186	-5.1		-1.42	0.155
	Matched	0.22834	0.23216	-0.9	82.6	-0.24	0.807
Basic Edu	Unmatched	0.16098	0.1646	-1		-0.27	0.786
	Matched	0.15612	0.15269	0.9	5.3	0.26	0.798
Secondary Edu	Unmatched	0.57231	0.54765	5		1.38	0.169
	Matched	0.57497	0.57084	0.8	83.3	0.22	0.822
Higher Edu	Unmatched	0.22851	0.21782	2.6		0.71	0.477
	Matched	0.2304	0.23843	-1.9	24.9	-0.51	0.61
Number Siblings	Unmatched	1.3035	1.4499	-12.9		-3.55	0
	Matched	1.3006	1.3028	-0.2	98.5	-0.06	0.954
Basic Edu mother	Unmatched	0.23602	0.23082	1.2		0.34	0.733
	Matched	0.2304	0.22517	1.2	-0.6	0.34	0.737
Secondary Edu mother	Unmatched	0.53342	0.49629	7.4		2.06	0.039
	Matched	0.53783	0.54307	-1	85.9	-0.28	0.777
Higher Edu mother	Unmatched	0.14529	0.14666	-0.4		-0.11	0.915
	Matched	0.14649	0.14447	0.6	-48	0.15	0.877
Basic Edu father	Unmatched	0.2442	0.23577	2		0.55	0.584
	Matched	0.23865	0.23431	1	48.5	0.28	0.783
Secondary Edu father	Unmatched	0.55525	0.51361	8.4		2.32	0.021
	Matched	0.55915	0.55887	0.1	99.3	0.02	0.988
Higher Edu father	Unmatched	0.13029	0.13676	-1.9		-0.53	0.598
	Matched	0.13136	0.13208	-0.2	88.9	-0.06	0.954
Religious	Unmatched	0.63506	0.61015	5.1		1.42	0.154
	Matched	0.63411	0.62924	1	80.4	0.27	0.785
Age24-29	Unmatched	0.38677	0.36696	4.1		1.13	0.257
	Matched	0.38858	0.38492	0.8	81.5	0.2	0.839
Age30-34	Unmatched	0.25853	0.35025	-20		-5.54	0
	Matched	0.25997	0.26585	-1.3	93.6	-0.36	0.719

Tab B.4. Balance Check – "Costs" Factor – *Females* – (Radius Matching).

		Mean			%reduct		
Variables	Sample	Treated	Control	%bias	|bias|	T	p>|t|
N. Children at 1st wave	Unmatched	0.98996	0.90768	9.3		2.53	0.012
	Matched	0.98547	0.97819	0.8	91.1	0.24	0.81
Household inc. II quintile	Unmatched	0.21194	0.21334	-0.3		-0.09	0.925
	Matched	0.21173	0.20751	1	-199.9	0.31	0.756
Household inc. III quintile	Unmatched	0.20636	0.19085	3.9		1.06	0.288
	Matched	0.20615	0.20316	0.7	80.8	0.22	0.825
Household inc. IV quintile	Unmatched	0.16062	0.15516	1.5		0.41	0.682
	Matched	0.16089	0.16407	-0.9	41.8	-0.26	0.797
Household inc. V quintile	Unmatched	0.10318	0.10163	0.5		0.14	0.889
	Matched	0.10335	0.10326	0	93.9	0.01	0.993
Studies	Unmatched	0.08589	0.06051	9.8		2.64	0.008
	Matched	0.08603	0.07865	2.8	70.9	0.8	0.422
Works pvt	Unmatched	0.41718	0.38557	6.4		1.76	0.078
	Matched	0.41788	0.42079	-0.6	90.8	-0.18	0.86
Works state	Unmatched	0.1227	0.11792	1.5		0.4	0.688
	Matched	0.12291	0.12453	-0.5	66.1	-0.15	0.883
Married	Unmatched	0.42443	0.46625	-8.4		-2.31	0.021
	Matched	0.42458	0.42552	-0.2	97.7	-0.06	0.955
Cohabited	Unmatched	0.24819	0.23196	3.8		1.04	0.299
	Matched	0.24804	0.2465	0.4	90.5	0.11	0.915
Basic Edu	Unmatched	0.15839	0.16912	-2.9		-0.8	0.426
	Matched	0.15754	0.15136	1.7	42.4	0.51	0.609
Secondary Edu	Unmatched	0.55605	0.564	-1.6		-0.44	0.661
	Matched	0.55698	0.56448	-1.5	5.7	-0.45	0.651
Higher Edu	Unmatched	0.23313	0.20869	5.9		1.61	0.108
	Matched	0.23352	0.23075	0.7	88.7	0.2	0.844
Number Siblings	Unmatched	1.3687	1.3964	-2.4		-0.66	0.506
	Matched	1.3665	1.3629	0.3	87	0.09	0.924
Basic Edu mother	Unmatched	0.21919	0.25291	-7.9		-2.18	0.029
	Matched	0.21899	0.21638	0.6	92.2	0.19	0.85
Secondary Edu mother	Unmatched	0.5159	0.51125	0.9		0.25	0.799
	Matched	0.51676	0.52703	-2.1	-121	-0.61	0.539
Higher Edu mother	Unmatched	0.16007	0.12645	9.6		2.61	0.009
	Matched	0.16034	0.15259	2.2	76.9	0.64	0.524
Basic Edu father	Unmatched	0.24149	0.23739	1		0.26	0.793
	Matched	0.2419	0.24435	-0.6	40.2	-0.17	0.864
Secondary Edu father	Unmatched	0.50976	0.56633	-11.4		-3.11	0.002
	Matched	0.51006	0.526	-3.2	71.8	-0.95	0.34
Higher Edu father	Unmatched	0.15895	0.09853	18.1		4.88	0
	Matched	0.15922	0.14136	5.4	70.5	1.49	0.135
Religious	Unmatched	0.62019	0.62452	-0.9		-0.24	0.807
	Matched	0.62067	0.62519	-0.9	-4.5	-0.28	0.78
Age24-29	Unmatched	0.36196	0.39643	-7.1		-1.95	0.051
	Matched	0.36201	0.3718	-2	71.6	-0.61	0.544
Age30-34	Unmatched	0.32515	0.28084	9.7		2.63	0.008
	Matched	0.32458	0.32285	0.4	96.1	0.11	0.912

Tab B.5. Balance Check – Parental role traditionalism – *Males* – (Radius matching)

Variable	Sample	Mean Treated	Mean Control	%bias	%reduct |bias|	T	p>|t|
N. Children at 1st wave	Unmatched	0.59312	0.64863	-6.7		-1.79	0.074
	Matched	0.5944	0.60024	-0.7	89.5	-0.19	0.847
Household inc. II quintile	Unmatched	0.23281	0.2	8		2.13	0.033
	Matched	0.23187	0.22144	2.5	68.2	0.66	0.511
Household inc. III quintile	Unmatched	0.1798	0.19452	-3.8		-1.01	0.314
	Matched	0.18019	0.18508	-1.3	66.7	-0.33	0.738
Household inc. IV quintile	Unmatched	0.15974	0.1637	-1.1		-0.29	0.774
	Matched	0.16009	0.16306	-0.8	24.8	-0.21	0.831
Household inc. V quintile	Unmatched	0.12393	0.11438	2.9		0.79	0.431
	Matched	0.12419	0.12626	-0.6	78.3	-0.17	0.869
Studies	Unmatched	0.06017	0.06781	-3.1		-0.83	0.405
	Matched	0.0603	0.06149	-0.5	84.5	-0.13	0.896
Works pvt	Unmatched	0.52794	0.51849	1.9		0.5	0.614
	Matched	0.52836	0.5344	-1.2	36	-0.32	0.749
Works state	Unmatched	0.14685	0.12603	6.1		1.62	0.105
	Matched	0.14573	0.14205	1.1	82.3	0.28	0.782
Married	Unmatched	0.32163	0.32945	-1.7		-0.45	0.656
	Matched	0.32233	0.33145	-1.9	-16.7	-0.51	0.608
Cohabited	Unmatched	0.17908	0.18562	-1.7		-0.45	0.651
	Matched	0.17947	0.17439	1.3	22.3	0.35	0.726
Basic Edu	Unmatched	0.18481	0.18836	-0.9		-0.24	0.808
	Matched	0.18521	0.18291	0.6	35	0.16	0.876
Secondary Edu	Unmatched	0.69269	0.65479	8.1		2.16	0.031
	Matched	0.69203	0.69708	-1.1	86.7	-0.29	0.772
Higher Edu	Unmatched	0.09456	0.10342	-3		-0.79	0.428
	Matched	0.09476	0.09408	0.2	92.4	0.06	0.951
Number Siblings	Unmatched	1.2901	1.3575	-6		-1.6	0.11
	Matched	1.2893	1.2812	0.7	87.9	0.21	0.835
Basic Edu mother	Unmatched	0.24499	0.20137	10.5		2.8	0.005
	Matched	0.24336	0.2334	2.4	77.2	0.62	0.537
Secondary Edu mother	Unmatched	0.52507	0.50959	3.1		0.83	0.408
	Matched	0.5262	0.53322	-1.4	54.7	-0.37	0.711
Higher Edu mother	Unmatched	0.14398	0.15548	-3.2		-0.86	0.39
	Matched	0.14429	0.14818	-1.1	66.2	-0.29	0.772
Basic Edu father	Unmatched	0.23926	0.21849	4.9		1.32	0.187
	Matched	0.23977	0.2398	0	99.8	0	0.998
Secondary Edu father	Unmatched	0.55229	0.52397	5.7		1.52	0.129
	Matched	0.55133	0.55386	-0.5	91.1	-0.13	0.893
Higher Edu father	Unmatched	0.13754	0.1363	0.4		0.1	0.924
	Matched	0.13783	0.13739	0.1	64.2	0.03	0.973
Religious	Unmatched	0.48997	0.40411	17.3		4.63	0
	Matched	0.48887	0.47097	3.6	79.2	0.95	0.345
Age24-29	Unmatched	0.41762	0.41096	1.4		0.36	0.718
	Matched	0.4178	0.41542	0.5	64.3	0.13	0.899
Age30-34	Unmatched	0.2765	0.28699	-2.3		-0.62	0.534
	Matched	0.2771	0.27958	-0.6	76.4	-0.15	0.884

Tab B.6. Balance Check – Alternative Living Arrangements – *Males* – (Radius Matching).

		Mean			%reduct		
Variables	Sample	Treated	Control	%bias	|bias|	t	p>|t|
N. Children at 1st wave	Unmatched	0.62511	0.61908	0.7		0.19	0.849
	Matched	0.61921	0.61723	0.2	67.1	0.06	0.955
Household inc. II quintile	Unmatched	0.20924	0.2206	-2.8		-0.72	0.47
	Matched	0.20961	0.20963	0	99.8	0	0.999
Household inc. III quintile	Unmatched	0.16827	0.20012	-8.2		-2.14	0.032
	Matched	0.16856	0.17418	-1.4	82.4	-0.36	0.722
Household inc. IV quintile	Unmatched	0.15519	0.16618	-3		-0.78	0.434
	Matched	0.15546	0.15707	-0.4	85.3	-0.11	0.915
Household inc. V quintile	Unmatched	0.10985	0.12522	-4.8		-1.24	0.214
	Matched	0.11004	0.11016	0	99.3	-0.01	0.993
Studies	Unmatched	0.05405	0.0708	-6.9		-1.79	0.073
	Matched	0.05415	0.05494	-0.3	95.3	-0.08	0.934
Works pvt	Unmatched	0.51177	0.53072	-3.8		-0.99	0.32
	Matched	0.51266	0.51781	-1	72.9	-0.25	0.806
Works state	Unmatched	0.1116	0.15272	-12.2		-3.15	0.002
	Matched	0.11179	0.11473	-0.9	92.8	-0.22	0.824
Married	Unmatched	0.24586	0.37917	-29.1		-7.52	0
	Matched	0.24629	0.25605	-2.1	92.7	-0.54	0.59
Cohabited	Unmatched	0.24412	0.14102	26.4		7.05	0
	Matched	0.24279	0.23527	1.9	92.7	0.42	0.673
Basic Edu	Unmatched	0.20837	0.17203	9.3		2.45	0.015
	Matched	0.20873	0.19808	2.7	70.7	0.63	0.527
Secondary Edu	Unmatched	0.64342	0.69339	-10.6		-2.79	0.005
	Matched	0.64454	0.65129	-1.4	86.5	-0.34	0.736
Higher Edu	Unmatched	0.09067	0.10474	-4.7		-1.23	0.218
	Matched	0.09083	0.09218	-0.5	90.4	-0.11	0.911
Number Siblings	Unmatched	1.422	1.2592	14.1		3.8	0
	Matched	1.4017	1.3962	0.5	96.6	0.11	0.912
Basic Edu mother	Unmatched	0.22319	0.22235	0.2		0.05	0.958
	Matched	0.22358	0.2162	1.8	-779.9	0.43	0.67
Secondary Edu mother	Unmatched	0.50392	0.52604	-4.4		-1.16	0.246
	Matched	0.5048	0.50869	-0.8	82.4	-0.19	0.853
Higher Edu mother	Unmatched	0.13339	0.16091	-7.8		-2.02	0.043
	Matched	0.13362	0.1378	-1.2	84.8	-0.29	0.771
Basic Edu father	Unmatched	0.23452	0.22469	2.3		0.61	0.54
	Matched	0.23493	0.22776	1.7	27	0.41	0.684
Secondary Edu father	Unmatched	0.52049	0.54944	-5.8		-1.52	0.128
	Matched	0.5214	0.5271	-1.1	80.3	-0.27	0.785
Higher Edu father	Unmatched	0.1238	0.1457	-6.4		-1.67	0.095
	Matched	0.12402	0.12568	-0.5	92.4	-0.12	0.904
Religious	Unmatched	0.39756	0.47864	-16.4		-4.29	0
	Matched	0.39825	0.40203	-0.8	95.3	-0.18	0.854
Age24-29	Unmatched	0.42633	0.40609	4.1		1.08	0.282
	Matched	0.4262	0.4275	-0.3	93.6	-0.06	0.95
Age30-34	Unmatched	0.26678	0.29198	-5.6		-1.47	0.142
	Matched	0.26638	0.2635	0.6	88.6	0.16	0.876

Appendix 2.C: sensitivity analysis to different cut-points for treatment.

A dichotomized specification for a treatment index, that has been defined as continuous, may be criticized, because a dichotomous index causes a loss of information contained in original data. In order to give support to the previous analyses, estimates with different cut points in generating the treatment variable are presented in the following tables.

The adopted cut points are the following ones:

- We have initially defined the treatment equal to one if each factor overcomes the median; this procedure splits in two equal part the sample of treated and controls: this method has been applied in Chapter 2.
- Then, we propose the same estimates with radius matching for the dichotomized treatment that takes value one if the factor is greater than the 60^{th} percentile and zero otherwise.
- Finally, we check the robustness of analyses considering a higher level of the cut-point that is represented by the third quartile.

Thresholds lower than median are excluded because of the reduction of the choice of controls to realize matching procedures among units. Thresholds greater than third quartile are also avoided; in this case treated sample would considerably be reduced, whereas controls would cover almost the whole sample causing a smooth in the distance between means of treated ad controls.

Tab C.1. Matching estimates for positive attitudes.

		Effect of benefits on childbearing			
Radius Matching		*MALES*		*FEMALES*	
Caliper=.05		Unmatched	Matched	Unmatched	Matched
$T_i = 1 \mid$	Treated	.205	.205	.234	.231
	Controls	.134	.143	.164	.193
$Factor1_i > P_{50}$	ATT	.071***	.061***	.070***	.038***
	(t stat)	(5.02)	(4.14)	(4.89)	(2.47)
$T_i = 1 \mid$	Treated	.213	.213	.235	.235
	Controls	.143	.149	.174	.207
$Factor1_i > P_{60}$	ATT	.070***	.064***	.061***	.028*
	(t stat)	(4.84)	(4.18)	(4.13)	(1.75)
$T_i = 1 \mid$	Treated	.227	.227	.253	.253
	Controls	.152	.169	.180	.222
$Factor1_i > P_{75}$	ATT	.075***	.057***	.072***	.030*
	(t stat)	(4.70)	(3.28)	(4.33)	(1.67)

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

Focusing on the effect of *benefits* on childbearing, we can see as the *ATT* estimates appear robust for any adopted threshold.

Tab C.2. Matching estimates for negative attitudes.

		Effect of costs on childbearing			
Radius Matching		*MALES*		*FEMALES*	
Caliper=.05		Unmatched	Matched	Unmatched	Matched
$T_i = 1 \mid$	Treated	.132	.132	.179	.179
	Controls	.201	.172	.223	.204
$Factor2_i > P_{50}$	ATT	-.069***	-.040***	-.044***	-.025*
	(t stat)	(-4.79)	(-2.83)	(-3.02)	(-1.64)
$T_i = 1 \mid$	Treated	.131	.131	.177	.177
	Controls	.192	.167	.217	.198
$Factor2_i > P_{60}$	ATT	-.061***	-.036***	-.040***	-.021
	(t stat)	(-4.00)	(-2.48)	(-2.82)	(-1.42)
$T_i = 1 \mid$	Treated	.117	.117	.167	.167
	Controls	.185	.161	.212	.198
$Factor2_i > P_{75}$	ATT	-.067***	-.044***	-.045***	-.031**
	(t stat)	(-3.65)	(-2.65)	(-2.93)	(-2.05)

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

Focusing on the Effect of *costs* on childbearing, we can see as the *ATT* estimates appear robust for males for all the different cut-points at 1% level. The results hold also for women, proving an uncertain relationship: the adoption of a cut-point at 60th percentile smooth the effect of negative attitudes. On the contrary, *ATT* for females appears

stronger and significant when we adopt the third quartile for splitting the sample in treated and controls. This trend reveals a U-shaped relationship between female's negative attitudes and behaviour.

Tab C.3. Matching estimates for parental role traditionalism.

		Effect of parental role traditionalism on childbearing			
Radius Matching Caliper=.05		*MALES*		*FEMALES*	
		Unmatched	Matched	Unmatched	Matched
$T_i = 1 \mid Factor3_i > P_{50}$	Treated	.184	.184	.199	.199
	Controls	.159	.156	.195	.197
	ATT	.025*	.028**	.004	.002
	(t stat)	(1.74)	(1.98)	(0.32)	(0.15)
$T_i = 1 \mid Factor3_i > P_{60}$	Treated	.182	.183	.202	.202
	Controls	.164	.158	.194	.197
	ATT	.018	.024*	.008	.005
	(t stat)	(1.26)	(1.66)	(0.55)	(0.30)
$T_i = 1 \mid Factor3_i > P_{75}$	Treated	.178	.178	.197	.197
	Controls	.169	.161	.197	.197
	ATT	.009	.017	.000	.000
	(t stat)	(0.56)	(1.02)	(-0.00)	(-0.01)

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

The effect of *parental role traditionalism* confirms significant also in presence of a cut-point at 60th percentile, but the effect loses its intensity when the treated group is only the third quartile of the distribution. These estimates that are rather sensitive with respect to different thresholds confirm that a non-parametric approach represents the best solution for investigating *ATT* in this context.

Results confirm robust and not significant for the two last proxies of value orientations, as we shown in the previous secions.

Tab C.4. Matching estimates for self actualization.

		Effect of self actualization on childbearing			
Radius Matching		*MALES*		*FEMALES*	
Caliper=.05		Unmatched	Matched	Unmatched	Matched
$T_i = 1 \mid Factor4_i > P_{50}$	Treated	.170	.170	.202	.202
	Controls	.172	.179	.192	.194
	ATT	-.002	-.008	.010	.008
	(t stat)	(-0.09)	(-0.62)	(0.71)	(0.54)
$T_i = 1 \mid Factor4_i > P_{60}$	Treated	.175	.175	.208	.209
	Controls	.170	.173	.189	.194
	ATT	.005	.003	.019	.015
	(t stat)	(0.35)	(0.17)	(1.33)	(1.03)
$T_i = 1 \mid Factor4_i > P_{75}$	Treated	.167	.167	.205	.205
	Controls	.172	.174	.195	.197
	ATT	-.005	-.007	.010	.080
	(t stat)	(-0.31)	(-0.41)	(0.66)	(0.48)

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

Tab C.5. Matching estimates for alternative living arrangements.

		Effect of alternative living arrangements on childbearing			
Radius Matching		*MALES*		*FEMALES*	
Caliper=.05		Unmatched	Matched	Unmatched	Matched
$T_i = 1 \mid Factor5_i > P_{50}$	Treated	.160	.158	.199	.199
	Controls	.179	.187	.195	.196
	ATT	-.018	-.028*	.004	.003
	(t stat)	(-1.29)	(-1.91)	(0.28)	(0.22)
$T_i = 1 \mid Factor5_i > P_{60}$	Treated	.161	.161	.198	.198
	Controls	.177	.186	.197	.199
	ATT	-.016	-0.25	.001	-.001
	(t stat)	(-1.06)	(-1.61)	(0.11)	(-0.12)
$T_i = 1 \mid Factor5_i > P_{75}$	Treated	.163	.163	.195	.194
	Controls	.174	.179	.198	.196
	ATT	-.011	-.016	-.003	-.002
	(t stat)	(-0.64)	(-0.95)	(-0.21)	(-0.16)

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

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3. Childbearing and Attitude Adaptation in Bulgaria[24]

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SECTIONS: 3.1. Introduction. – 3.2. Attitudes and values. – 3.3. Data Gathering. – 3.4. Attitudes Indicators – 3.5. Statistical methodology – 3.6. Empirical results. – 3.7. Sensitivity Analysis. – 3.8. Conclusions – Appendix 3.A: Balance property in propensity score estimates – Appendix 3.B: Rosenbaum bounds method. *Bibliography*.

ABSTRACT

Life course choices like family formation and childbearing are consequences of socio-economic constrains and ideational factors. At the same time they also cause a process of attitudes and values adaptation that started with the predicted behaviour. This paper implements propensity score matching algorithms, a statistical technique that allows to remove selection bias, to prove that positive attitudes towards childbearing drastically decrease after a recent pregnancy, independently of the starting level of the individual attitude. Conversely negative attitudes towards childbearing increase after a childbirth. Value orientations seem to be more stable in time and are not significantly affected individuals' reproductive paths.

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3.1. Introduction

Since 1989, former communist states of Eastern and Central Europe have been experiencing dramatic social and economic transformations. The sudden change in political structure and the contemporary economic transition to a market economy caused a deep crisis in Eastern Europe. The economic development did not follow a common path in all former communist countries and Bulgaria belongs to a group of countries where the societal change ran more slowly and heavily; conversely Hungary and Czech Republic experimented a faster transition that led these countries to a considerably higher level of GDP with respect to that of Bulgaria in 2000.

As a consequence of the long crisis, substantial changes also occurred in the demographic behaviour of Bulgaria; the demographic indexes, that were rather stable before 1990, showed consistent modifications: non-marital births suddenly reached the level of 43% of total. Moreover, an increase in non marital births was linked to a change in observed total fertility rate for second order births that declined from 0.68 in 1990 to 0.34 in 1997 (Koytcheva, 2006). Furthermore, the mean age at first birth for women started to increase from 22 in 1990 to 24 in 2002. Finally, mean age at first birth has overcome mean age at marriage.

In order to explain the decline in fertility and the change in family behaviours, two complementary approaches have been adopted in literature: the first approach is based on economic rationality: individuals have given preferences on children that are considered as *consumption goods* in a utility function that is maximized under material constraints (Becker 1991; Becker and Stigler, 1977). According to this approach, the deeper the economic crisis and the decline in individuals' economic sources are, the lower will be the *demand* for children.

The second approach, the i*deational approach* was developed by Ron Lestaeghe and Van de Kaa in the 1980s. These authors do not deny the effects of economic factors on life course decisions but argue that this approach is not sufficient to get full explanation of changes in individuals' behaviour. Therefore, they interpret a generalized decline in fertility and a rise of non-marital births as common features of a complex and multifaced process called *Second Demographic Transition* (from now onwards SDT). This phenomenon is supposed, in recent literature although without unanimous

agreement[25], to spread out all over Europe, including former soviet countries (Liefbroer and Fokkema, 2008). Another contribute to ideational framework related to Eastern countries derives from Thornton and Philipov (2009)

According to ideational theories, there is a strong correspondence between childbearing decisions and changes in individual values in a post-materialistic sense (Inglehart, 1970): an increase in gender-equality, jointly to a common rise of values based on self-realization and personal autonomy are suspected to be connected to a decline in total fertility rates and a desire for childbearing postponement in several countries.

On the contrary, parenthood is clearly associated with more conventional views of family life (Lestaeghe and Meekers, 1986). However, a mere association does not imply causality. Hence, the main question for our research is the following: do traditional value orientations imply a reduction in fertility rates or vice versa?

Longitudinal surveys such as *The Impact of Social Capital and Coping Strategies on Reproductive and Marital Behaviour in Bulgaria* help us to answer this question, introducing temporal sequences in observations and behaviours, allowing us to establish a causal relationship between the two phenomena.

As reported in socio-demographic literature, value orientations' role played with respect to demographic behaviour is two-folded: on the one hand they contribute at the micro-level to influence individual choices, *producing a selection effect through which individuals sort themselves over the various paths of the life course* (Lestaeghe and Moors, 2002).

On the other hand, value orientations themselves are subjected to a process of adaptation given previous demographic behaviours (Lestaeghe and Moors, 2002; Surkyn and Lesthaeghe, 2004). Therefore, we are dealing with a double causal direction. Whereas values are suspected to modify individuals' behaviour, similarly important events in individual life course also affect attitudes and value orientations. This would also show duality in a process of value adaptation: as some demographers

[25] Koytcheva (2006) found early traces of Second Demographic Transition analyzing the couples' behaviour with respect to childbearing: postponement of births, decrease in out of wedlock pregnancies and fertility indicators point to an affirmation of post-materialistic values. However, some other indicators are against this evidence. Empirical evidence seems to show that highly educated women are more likely to enter direct marriage without previous cohabitation.

have pointed out, there is a macro-effect in value orientations broadcasted by society with education, social relationship and a strong micro-effect caused by personal experience of a subject. In this framework the first child birth is influenced by economic constraints and personal attitudes but it is itself supposed to modify individual attitudes in a more traditional direction (Lestaeghe and Moors, 2002). Indeed, whereas the issue of value selection is widely debated in literature, value adaptation has obtained scarce relevance in sociological literature during the last decades (Thomson, 2002). In this paper we intend to focus on the reverse causality process trying to provide further evidence of a causal relationship between life course events and changes in respondents' attitudes and values.

More in detail, we want to focus on one specific demographic behaviour, i.e. fertility, in order to explain the dynamics of childbearing with respect to related values and attitudes.

This study uses micro-level survey data on attitudes and fertility behaviour in Bulgaria collected in two separate waves in 2002 and 2005. On a first stage we conducted the analysis identifying different attitudes related to childbearing, through a factor analysis that reduced the responses obtained in several items related to fertility intentions and value characteristics of individuals.

On a second stage, in order to address a causal effect of childbearing on individual attitudes related to parenthood, we propose an original application of propensity score matching algorithms, a statistical tool used in observational studies in order to avoid selection bias. Indeed, there could be confounder factors that may affect both the decision of starting a pregnancy and the attitude to parenthood, with the effect of producing biased estimates in causal relationship.

Propensity score matching allows us to compare only units with quasi-identical confounding observable characteristics, in order to detect and capture only the pure effect of childbearing on attitude differences between the first and the second wave.

In addition, propensity score can estimate causal effect, when the effect is not homogenous for each participant to the survey thanks to the absence of any parametrical specification for the link between the outcome and the treatment.

The remainder of this paper is structured as follows. Section 2 outlines the theoretical background that deals to the topic of attitudes and value orientations; Section 3 and 4

present data and variables used in the analysis with a particular emphasis on attitude indicators. Section 5 illustrates statistical methodology. Section 6 and 7 present the results of the empirical analysis and subsequent sensitivity analyses, implemented to check the robustness of its findings.

The last section is a general discussion of the study and its results. Finally, the Appendix provides further details about statistical estimates and robustness checks.

3.2. Attitudes and values

As anticipated in the previous section, the aim of this survey is to identify the effect of childbearing on a change in individuals' attitudes and values towards parenthood. In this framework, there is the necessity to start defining the concepts of values, value orientations and attitudes that were used in the following sections. Despite the long debate in literature about these concepts, there is a great heterogeneity in theoretical and empirical works. In particular, value orientations and attitudes are often used interchangeably.

According to the theory elaborated by Rokeach (1973) *values and value orientations* are based on convictions or choices relative to *preferable end-states of existence* and are defined as the relative importance people attach to general spheres of social life, such as family, life, friends, religion. The difference between values and value orientations is that values refer to society, whereas value orientations interest individuals.

The term *attitude* is used one step down on an abstraction scale, when *domain-specific* options are being considered (Lestaeghe and Moors, 2002). Ajzen (1988) provides a more accurate and useful definition that is formalized as follows: attitude is *a disposition to respond favourably or unfavourably to an object, person, institution, or event*. An alternative definition from Ajzen (1991) is more oriented to a specific behaviour and can be elected as a paradigm for our survey: attitude is *the degree to which a person has a favourable or unfavourable evaluation or appraisal of the behaviour in question*. Both the definitions are fully operative, because allow us to measure this disposition through questionnaires built with point scales, demanding to respondents their opinion about a specific topic. Once the terms used in the survey have been defined following the summary of Haas and Steiber (2009), we distinguish between different dimensions to understand how concepts are related to each other in

theory. The first dimension assesses whether this concept is applied to societal or individual level. In this setting, values are situated at macro-level and can be investigated after an aggregation of individual data. On the contrary, value orientations and attitudes may be studied at an individual level.

The second dimension considers the level of abstraction: values and value orientations, although they have an impact also on specific topics of life course decisions, are still relatively abstract and hard to capture. Attitudes are seen as being more concrete and specifically related to behaviour. As compared to value orientations are easier to measure, since values entail complex latent dimensions.

Finally, the strongest difference concerns the opposition to changes: values and value orientations are relatively stable over time, whereas attitudes are more volatile and subject to change along life course events.

These considerations suggest two kinds of questions:

(I) How can we basically distinguish value orientations from attitudes in socio-demographic literature?

Following the previous reflections, attitudes would be easier to identify, measuring themselves in attitudinal questionnaires. However, in demographic literature the very same items are defined as value orientations indicators or attitudinal questions in different works. For example, Lestaeghe and Moors (2002) use the term value indicator to investigate the agreement to the item "Marriage is an outdated institution". Questions with similar formulation are used as attitude indicators in Fokkema and Liefbroer (2008).

Another example refers with the agreement to the statement "Children should love and respect parents unconditionally" that is used by Lestaeghe and Moors as a proxy for value orientations and is included also in this research, but it could also be considered as an attitude indicator according to Ajzen's approach. The solution of the dilemma is not easy and both the answers seem to be admissible due to the generality of the item.

In this framework, it can be adopted a compromise, distinguishing two types of attitudes according to Haas and Steiber (2009): we have *personal attitudes* that may differ from *general attitudes*. Personal attitudes are connected to the own specific life-course situations, whereas general attitudes refer to general expression about what is actually desirable or not in society. Therefore, personal attitudes express individuals' opinion

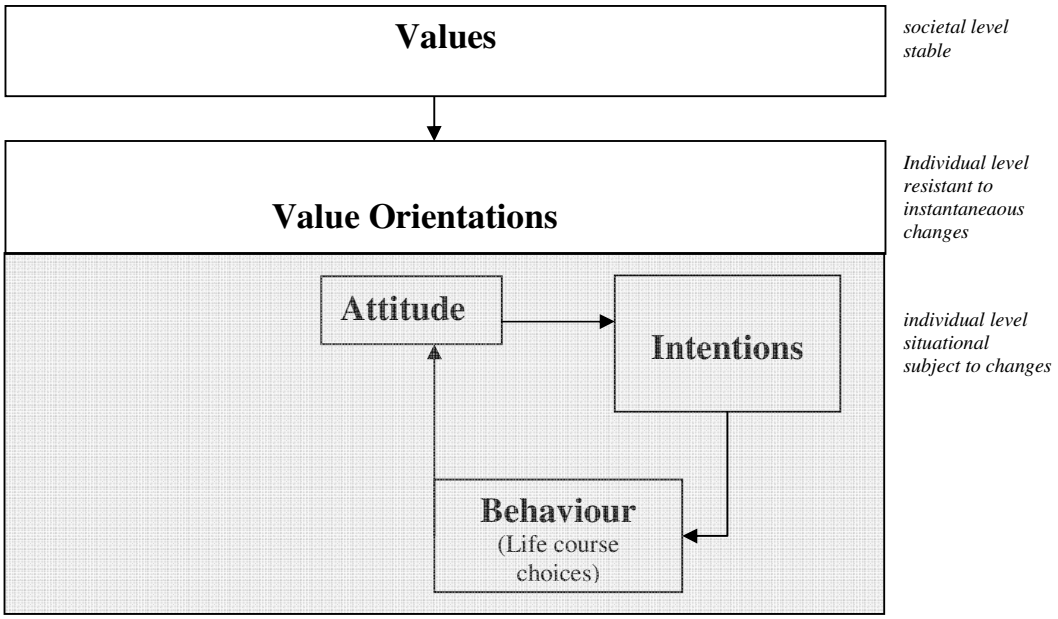
about concrete hypotheses connected to plausible life-course events, whereas general attitudes are more abstract and the meaning is closely related to the concept of value orientation. In conclusion, we can consider a combination of them also as proxies for value indicators. For example, "Marriage is an outdated institution" can be fully considered as expressing a generalized attitude that reflects a value orientation, because it is a general opinion of what is considered admissible in a society without direct connection to the own respondent's experience. Conversely, "To have a child increases *your* joy and satisfaction" deals with the own experience of the respondent and can be doubless defined as representing a "personal attitude" or simply an "attitude", because it asks an opinion on a particular *event* in *own* respondent's experience.

The second question concerns the bond between values, value orientation and attitudes:

(II) How do values, value orientations and attitudes interact?

The theory of Planned Behaviour developed by Fishbein and Ajzen (1975) links in a simplified exposition the concepts described above: attitudes towards a particular behaviour, along with subjective norms, predict intentions that can be viewed as an antecedent of behaviour.

Fig. 1: The relationship between Values, Value Orientations, Attitudes and Behaviour.



In this framework, the intention to give birth to a child, thus influencing the subsequent behaviour, depends on individuals' positive attitudes to entering into parenthood. Evidence from Bulgaria is provided by Billari, Philipov and Testa (2009), where positive attitudes increase the intentions to entering into parenthood. Conversely, negative attitudes act against the intention to give birth to the first child.

Values, norms and value orientations are more distant: they contribute to shape the attitudes in a background process that is considered stable in time and hardly subjected to be modified by life course events.

Attitudes are less stable in time instead: in this setting the next step is the recursive effect of behaviour, when intentions are realized, on the previous attitudes. This aspect is called *value adaptation* even if, to avoid cognitive dissonance, it will be replaced with the term *attitude adaptation*, although literature often uses the two terms as synonymous.

At macro-level Lestaeghe and Surkyn (2006) observes a consistent transition to post-materialistic values for countries belonging to Northern, Western and Southern Europe. More recently Fokkema and Liefbroer (2008) extended this evidence also with respect to former Eastern countries analyzing two attitudes dimensions: they identified attitudes towards parenthood and attitudes towards traditional marriage. The levels of these dimensions shift towards non-traditional directions, showing evidence of SDT value diffusion also in East and Centre of Europe. However macro level studies allow to see the evolution of general context of values changes in a long-run perspective, but do not permit to identify the recursive process illustrated in Fig.1 that can be applied to investigate attitudes adaptation after individual life course events; empirical literature scarcely documented attitudes or values adaptation in demographic field at a micro-level: US National Longitudinal Surveys of Young Men and Young Women indicated as the choice of abandoning parental home reinforces attitudes towards a non-traditional family orientation. Another example of values reinforcement after certain behaviour belongs to Detroit Panel that provides evidence that religious participation decreases attitudes in premarital sexuality. In both cases there is a *recursive spiral* that links traditional living arrangements and related values (Thornton, 1985).

In recent literature there is plenty of examples related to parenthood that represent the specific aim of this paper. Moors (1998) used *Bielefeld panel* to remark a lower risk of

pregnancy for German women who placed high value on personal autonomy: the birth of the first child readjustes orientations towards traditional family patterns (see also Moors, 2002). In this context, the birth of the first child seems to have a bigger impact on attitudes adaptation because it represents a more significant change of status and of way to live in family. Thomson (2002) focuses on values adaptation, defining values as *ideas about life-course choices appropriate for people in general (applied to everyone rather than to the individual himself)* and finds a positive effect of first-time parenthood and traditional familism.

The focus of this work is the casual relationship between childbearing and a certain set of attitudes regarding values towards children and the role they play in their parents' happiness establishment. Thus, in order to investigate this purpose we proceed to define the data source and variables used in the analysis, with particular emphasis on attitude indicators.

3.3. Data gathering

We use data from a recent survey in Bulgaria entitled *The Impact of Social Capital and Coping Strategies on Reproductive and Marital Behavior* and sponsored by the Max Planck Institute for Demographic Research in Rostock, Germany. The first wave of the survey was carried out in 2002 with the aim of studying family formation and childbearing. The sample includes 10,003 men and women aged 18-34.

The second wave took place in the winter of 2005/06 to 7,481 subjects of the first wave that have been re-interviewed in order to capture changes in intentions, behaviours, values and social characteristics through a panel design.

In our framework, we focus on the effect of childbearing between the two waves on the change in related attitudes after the second wave.

3.4. Attitudes indicators

The survey carried out in 2002 and 2005 to Bulgarian respondents includes several items involving questions about childbearing and parenthood. As it has been anticipated above, all these items may be included in two different groups, i.e. items related to *attitudes* and those reflecting *value orientations.*

The first group includes ten items that evaluate consequences either positive or negative of a further possible childbearing in the following two years to respondents, *irrespective they really wish to have a child or not*. They are asked to give an answer for every item ranked from 1 to 5, according as they are disagree or agree for each statement. The wording of these items is:

1) To have children (in the next two years) increases your economic difficulties;
2) To have children (in the next two years) decreases your chances in your working career and/or education;
3) To have children (in the next two years) increases your security that at old ages the is someone to care about you;
4) To have children (in the next two years) increases joy and satisfaction in your life;
5) To have children (in the next two years) increases worries and preoccupations in the course of daily life;
6) To have children (in the next two years) decreases the time you have to pursue personal interests or be with friends;
7) To have children (in the next two years) increases certainty in your life;
8) To have children (in the next two years) increases the closeness between you and your partner;
9) To have children (in the next two years) increases the closeness between you and your parents and relatives;
10) To have children (in the next two years) means that a part of you continues into the future.

This set of items has been already used by Billari, Philipov and Testa (2009) to investigate costs and benefits of a potential pregnancy. Therefore, we have implemented an analogous factor analysis, since we decided to consider attitudes as latent factors emerging from actual answers. The factor extraction, realized through the method of principal components[26] is performed for a joint sample that includes both females and

[26] This method is preferred to principal factors, because it provides the best results with respect to the number of factor obtained (two instead of three) and to the lowest value of uniqueness. Principal

males[27]. The answers we have taken into consideration belong to the first wave of the survey:

Tab 1. Results of a factor analysis on "attitudes"

Items	*Factor 1 Benefits*	*Factor 2 Costs*	*Uniqueness*
1) To have children increases your economic difficulties.	-.1274	**.6177**	.6023
2) To have children decreases your chances in your working career and/or education.	-.2018	**.5343**	.6738
3) To have children increases your security that at old ages there is someone to care about you.	**.5967**	-.1013	.6337
4) To have children increases joy and satisfaction in your life.	**.6591**	.0927	.5571
5) To have children increases worries and preoccupations in the course of daily life.	.0368	**.7923**	.3709
6) To have children decreases the time you have to pursue personal interests or be with friends.	.0461	**.7772**	.3938
7) To have children increases certainty in your life.	**.7261**	-.1266	.4568
8) To have children increases the closeness between you and your partner.	**.8151**	-.0337	.3345
9) To have children increases the closeness between you and your parents and relatives.	**.7734**	-.0228	.4013
10) To have children means that a part of you continues into the future.	**.6946**	.1017	.5072

The results suggest the retention of two principal components[28] whose loadings are displayed in the table above after a varimax rotation[29]. As clearified by the table above,

components method is also used in literature to detect attitudes. See for example Liefbroer and Fokkema (2008).

[27] Following Sironi (2009), a factor analysis obtained separating males and females, has led to very close results. In this survey it is preferred a more parsimonious specification of the model.

[28] The retention of two principal components is motivated by the observed eigenvalues: when they assume a value greater than one are only two. Factor 1 registers an eigenvalue equal to 3.13, whereas *Factor 2* is associated to a value equal to 1.93.

[29] As suggested by Kaiser (1958), Varimax Rotation implies that *for each factor, high loadings (correlations) will result for a few variables; the rest will be near zero*. This makes easier the interpretation of the sociological meaning of each factor. Finally Varimax Rotation gives satisfying values for uniqueness, that is greater than 0.6 only for Items 2 and 3.

two latent dimensions are set as proxies for individuals' attitudes related to fertility. As in Billari, Philipov and Testa (2009) items 3, 4, 7, 8, 9 10 have high factor loadings on the first factor, whereas the opposite pattern can be observed for the other four items: people scoring high for this factor are positively oriented to childbearing and to give more emphasis to *benefits* in perceiving the hypothesis of a potential pregnancy. Therefore, *Factor 1* can be interpreted as *"benefits" factor*. On the contrary, people with a high score for *Factor 2* are strongly agree with items describing the *costs* of starting a pregnancy. They remark the loss of chances in working career, in the relationship with friends and focus especially on the increase of worries and apprehensions. Consequently, people scoring high for this factor are supposed to express a *"costs" factor*. Due to the specific formulation of the question we do not assess that these orientation may be applied to all the life course of respondents. We can only affirm that it expresses preferences for an interval of about two years, starting from the date of first interview.

Because of the statistical construction of indicators, orthogonal by definition, it can be admitted the case of individuals that score high values for both the indicators. We say that in this case two opposite tendencies may persist in each individual, that are considered to live together in every respondent (Sironi, 2009).

Related items can be discovered also for value orientations, after an analogous statistical procedure. The list includes the following statements:

1) Regardless of what the qualities and faults of one's parents are, one must always love and respect them;
2) Parent's duty is to do their best for their children even at the expenses of their own well-being;
3) One does not have the duty to respect and love parents who have not earned it by their behaviour and attitudes;
4) Parents have a life of their own and should not be asked to sacrifice their own well-being for the sake of their children.
5) Official marriage is outdated.

The main difference concerning the set of items refers to the wording of questions and can be summarized in two points:

a) These items explain generalized attitudes, because are more general and do not involve the respondents' life course path; therefore the latent factors extracted may be interpreted as *value orientations*.
b) These items, in their own formulation, are indirectly related to fertility, but dedicate more attention to the "role" of parent towards children and family. It is decided to include themselves, because they are the only general attitudes proxies somewhat related to children in the survey.

Tab 2. Results of a factor analysis for value orientations

Items	*Factor 3* *Parental-role traditionalism*	*Factor 4* *Self actualization*	*Factor 5* *Alternative living arrangements*	*Uniqueness*
1) Regardless of what the qualities and faults of one's parents are, one must always love and respect them.	**.8819**	.0265	.0411	.2199
2) Parent's duty is to do their best for their children even at the expenses of their own well-being.	**.5280**	**-.5767**	.2303	.3355
3) One does not have the duty to respect and love parents who have not earned it by their behaviour and attitudes.	**-.6349**	-.0121	.4320	.4101
4) Parents have a life of their own and should not be asked to sacrifice their own well-being for the sake of their children.	.0722	**.8934**	.1460	.1753
5) Official marriage is outdated.	.0063	.0929	**.8852**	.2077

As We mentioned before, a factor analysis is implemented in order to obtain data reduction and to evaluate latent dimensions of respondents' items: more in detail, *Factor 3* scores high for items associated to ideas of respect for parents, independent on their own qualities. This attitude is linked to rural-traditional views of family and has been already investigated in Laestaeghe and Moors (2002), that underline that is associated to reciprocal duties between the generations: if young adults have been downplaying their unconditional support to parents, at the same time parents themselves

are kept to provide unconditional support to children. Therefore, we have labelled this factor as *parental role traditionalism*. In our survey the parents' duties towards children are addressed in items 2 and 4 that are correlated to *Factor 4*. Our survey identified different independent dimensions for those profiles; hence, the last factor is named as meaning *self actualization*, consistently to post materialistic values.

The last item is related to preferences for *alternative living arrangements* instead and is expressed by *Factor 5*

The results illustrated above give a static perspective of the correlation between original items and factors. The next step is to evaluate how attitudes indicator has changed in the second interview. Factor *i* is defined as follows and represents a linear combination of *J* items, each of them weighted with factor coefficient a_{ijt}:

$$y_{it} = \sum_{j=1}^{J} a_{ijt} X_{ijt} \qquad (1).$$

The indicators we used for the second wave maintain a_{ijt} constant and replace the vector of observations in t with that observed in $t + \Delta t$:

$$y_{i(t+\Delta t)} = \sum_{j=1}^{J} a_{ijt} X_{ij(t+\Delta t)} \qquad (2)$$

Table 3 displays overall factor means compared between the two waves:

Tab 3. Comparison between factors in the first and second wave.

Factors		*Sample Means*		*Difference*
		2002	*2005*	
Attitudes	Positive attitudes towards childbearing	0	-.053	-.053***
	Negative attitudes towards childbearing	0	.003	.003
Value orientations	Parental role traditionalism	0	-.127	-.127***
	Self actualization	0	.040	.040***
	Alternative living arrangements	0	.082	.082***

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

As we can see significant changes occurred in almost all indexes between the interviews: *positive attitudes towards childbearing* decrease their score, supporting the idea that there has been a transition to post materialistic values; this statement is confirmed also observing changes in value orientations: whereas *parental role traditionalism* seems to decrease after three years for a generic individual from our

survey, beliefs that parents have a life of their own seem to widespread among respondents. Transition towards post-materialistic values is confirmed also by the increase of *alternative living arrangements*, whereas suprinsingly *negative attitudes towards childbearing* appear as stable in time. *Negative attitudes* have not changed instead between the waves. As we can see in the following section, gender differences in attitude changes could affect this result. Therefore, it is helpful to lead separate analyses for the two genders (also in light of past studies like Thornton *et al.,* 1983).

Results in Table 3 are not enough to investigate the causes of changes in individuals' attitudes; in other words they give us only a first evidence of changes in attitudes and value orientations without any explanations of the reasons for this change. In particular, Table 3 does not provide evidence for any causal effects between changes in values and individual life course choices and events. In particular, the question "How have respondents reacted to parenthood experience in terms of attitudes scores?" cannot be answered. This seems to be the key question for establishing a relationship between value changes and life course paths and we address this in the following sections.

3.5. Statistical methodology

The aim of the empirical analysis is to identify the causal impact of childbearing on individuals' attitudes and value orientations. To measure the effect of childbearing we are interested in the difference of individual outcomes in presence or less of childbearing between the two waves. In our setting we assume that each individual has two potential outcomes: Y_{1i} in the case the respondent or his partner gave birth to a child and Y_{0i} in the case he or she did not. The causal impact of childbearing for each respondent included in the survey is $Y_{1i} - Y_{0i}$. Because this is individual specific and it is not clear the distribution of the population, Rosenbaum and Rubin (1983) suggested to focus on the quantity $E[Y_{1i} - Y_{0i}]$, that is defined in literature as *Average Treatment Effect* (*ATE*), i.e. in our case the expected effect of childbearing on a randomly drawn person from the population. Now let T_i be a dichotomous index (that we will denominate as "Treatment", that takes value 1 if an individual gave birth or adopted a child between the two waves and 0 otherwise), recent Literature[30] proposed to restrict

[30] See, for example Heckman (1997).

the analysis only to those are actually eligible for the treatment or are likely to eligible in the future. Hence, a second quantity of interest is

$$ATT = E[Y_{1i} - Y_{0i} \mid T_i = 1] = E[Y_{1i} \mid T_i = 1] - E[Y_{0i} \mid T_i = 1] \quad (3)$$

that is the mean effect of having a child on attitudes and value orientations for those experimented a pregnancy between the two waves.

Many problems deal with the identification of *ATT*. The first is that only one among the potential outcomes Y_{1i}, Y_{0i} is observed for each individual, making a direct comparison impossible; consequently, in order to estimate *ATT* we need to identify the quantity $E[Y_{0i} \mid T_i = 1]$. This is impossible, because we require identifying the potential outcome of Y_i in the case of absence of pregnancy for an individual that has had a child instead.

A possible solution to overcome the problem is to use an estimator of $E[Y_{0i} \mid T_i = 0]$.

To replace an estimate of $E[Y_{0i} \mid T_i = 1]$ with that of $E[Y_{0i} \mid T_i = 0]$, we deal to the possible presence of selection bias: men and women that experienced pregnancies between the two waves of the interview may be qualitatively different from the others. For example, considering the Bulgarian context attached to a single-child family pattern, people belonging to older cohorts should be less likely to give birth to a child. Similarly, more educated individuals may show a higher propensity to postpone the entering into parenthood. As a result, an estimation of *ATT* based on the difference between the sample means of treated and untreated groups may lead to an overestimation of the causal effect of childbearing.

A possible solution is conditioning on pre-pregnancy covariates *X* (insofar the analysis compares only individuals with identical observable characteristics) and then computing an overall mean:

$$\begin{aligned} ATT &= E[Y_{1i} - Y_{0i} \mid T_i = 1] = E_{X|T_i=1}\{E[Y_{1i} - Y_{0i} \mid X_i, T_i = 1]\} = \\ &E_{X|T_i=1}\{E[Y_{1i} \mid X_i, T_i = 1] - E[Y_{0i} \mid X_i, T_i = 1]\} = \\ &= E_{X|T_i=1}\{E[Y_{1i} \mid X_i, T_i = 1] - E[Y_{0i} \mid X_i, T_i = 0]\} \end{aligned} \quad (4)$$

Identification of *ATT* in (3) is feasible if we impose *mean* independence (Smith and Todd, 2005), i.e. $E[Y_{0i} \mid X_i, T_i = 1] = E[Y_{0i} \mid X_i, T_i = 0]$[31] (5)

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

Rosenbaum and Rubin (1983) proposed matching based on a univariate quantity called *propensity score*, which is the conditional probability of receiving the treatment given *X*, $P[T_i = 1 \mid X_i]$. Rosenbaum and Rubin (1983) stated 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:

$$ATT = E_{p(X_i)}\{E[Y_{1i} \mid p(X_i), T_i = 1] - E[Y_{0i} \mid p(X_i), T_i = 0]\}$$[32] (6)

Several matching algorithms[33] can be used to estimate (4); in this framework we implemented *nearest neighbour matching*, consisting in matching each treated unit *i* (that gave birth to a child between the two interviews) with the closest control unit (childless between the waves) in terms of propensity score. In such case we will have that

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[31] Condition (3) is a weaker version of the more general requirement, imposing that $Y_{1i}, Y_{0i} \perp T_i \mid X_i$. This stronger condition is called *Conditional Independence Assumption (CIA)* and it will be recalled when we address the problem of hidden bias below.

[32] In general two other conditions are required to use successfully equation (7). Firstly $0 < P(T = 1 \mid X) < 1$, that implies equality in the support of *X* in the two groups of treated and controls and, secondly, $T \perp X \mid p(X)$. The first condition could be guaranteed imposing the common support of covariates before estimating *ATT*. The last condition is called *balance property* and requires that observations with the same propensity score have the same distribution of covariates independently of treatment status. This condition can be tested comparing the differences in means of each covariate between treated and control units.

[33] In this setting, it is used the Stata modules written by Becker and Ichino (2002) and Leuven and Sianesi (2003).

$$\hat{ATT} = \frac{1}{N_1} \sum_{i \in \{T_i = 1\}} \left[Y_{1i} - \sum_{j \in \{T_i = 0\}} w_{ij} Y_{0j} \right] \tag{7}$$

Where N_1 indicates the number of units that experienced childbearing in the considered time interval; w_{ij} represents a sample weight for control units used in matching procedure. Generally, *nearest neighbour matching* compares each treated unit with the control unit that shows the closest value of propensity score in the estimates, so in the weight is usually equal to one; however there are cases where more than one control unit satisfies the matching rule; in this case $w_{ij} = \frac{1}{k}$, where *k* is the number of control units matched to the treated. In this framework, we apply *nearest neighbour matching within a caliper* consisting in a comparison of every treated unit to the nearest control in terms of propensity score, only if the absolute difference in propensity score among these ones falls in a predetermined caliper that is equal to .025. Finally, matching procedure is implemented without replacement. This method, in presence of several controls, decreases the variance of estimates (Caliendo and Kopeinig, 2005) with respect to nearest neighbour matching with replacement[34].

The results obtained with *nearest neighbour matching within a caliper* are compared with those obtained with *gaussian kernel matching*.

Kernel matching compares all treated and a weighted average of all controls, with weights inversely proportional to the distance between the propensity score of treated and untreated (Becker and Ichino, 2002). The Kernel matching estimator is given by:

$$\hat{ATT} = \frac{1}{N_1} \sum_{i \in \{T_i = 0\}} \left[Y_i - \frac{\sum_{j \in \{T_i = 0\}} Y_j^C G\left(\frac{p_j - p_i}{h_n} \right)}{\sum_{j \in \{T_i = 0\}} Y_j^C G\left(\frac{p_k - p_i}{h_n} \right)} \right] \tag{8}$$

Where $G(\cdot)$ is a gaussian distribution and h_n is a bandwitch parameter.

In literature, propensity score matching presents several advantages: for example it is a non-parametric approach and does not require any specification in a functional form for the relationship between the outcome and the treatment, in our case attitudes indexes

[34] Since the estimates obtained with nearest neighbour matching without replacements depend on the order in which observations get matched, the algorithm has randomized the matching pairs..

and childbearing. Differently from the standard regression approach, the effect of the treatment could vary across the individuals, without affecting the efficiency of the estimates.

Propensity score matching presents also a strong disadvantage: its estimates gives robust results when we match on observables but fail in presence of unobservable confounding factors. Reliability of estimates are based on the validity of *CIA*, that is selection on observable characteristics. When in presence of unobservables affecting both assignment into treatment and the outcome variable simultaneously, a 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 can intervene in three complementary ways:

1. The richer is the set of pre-treatment variables included in the matching, the lower is the probability to omit relevant unobserved variables. Thus, some latent traits could be captured by observable variables that are someway related to unobservables. Hence, the first suggestion we have implemented, is to use a rich vector of covariates in estimating propensity score. In this context, we have also added variables related to possible unobservable dimensions like the attitudes indicators measure after the first wave and other variables capturing the psychological well-being of respondents. These variables, jointly to covariates capturing education, income and familiar background, help us to construct the best stratification of the sample obtained with propensity score, limiting the influence of omitted or unobservable variables.

2. The approach described above is used in cross-sectional surveys. Conversely, this study is longitudinal and measures each variable available before and after the treatment. This allows to compare the mean change of attitudes and values indicators from the first wave t and to the time after the second wave $t + \Delta t$. The estimator obtained this way is defined as *difference in difference estimator* and is used to estimate the differences in mean of the outcomes before and after Δt,

$$DD = E(Y_{1i}^{t+\Delta t} - Y_{1i}^{t}) - E(Y_{0i}^{t+\Delta t} - Y_{0i}^{t}) = E(\Delta_{1i}) - E(\Delta_{0i}) \qquad (9)$$

An important advantage of *DD* estimator is that allows to control for selection due to unobservables. In particular, the difference between potential outcomes at time t and

$t + \Delta t$ preserves estimates from time invariant sources of bias[35]. Of course even this assumption might be violated, if some time varying confounders exist. Thus, it's possible to combine *DD* with *propensity score matching* estimator, summing the advantages of two approaches. The *DD-PSM* combined estimator for *ATT* can be implemented to estimate the following quantity:

$$ATT_{DD} = E_{p(X_i)}\{E[\Delta_{1i} \mid p(X_i), T_i = 1] - E[\Delta_{0i} \mid p(X_i), T_i = 0]\} \quad (10)$$

3. In the last case, if there are time varying unobservables that are not captured by an increase of the set of covariates, sensitivity analysis may test the robustness of *ATT* estimates, depending on the violation of *CIA*. The approach used in the following sections has been proposed by Rosenbaum (2002) and will be treated in section 7. Analytical details will be given in Appendix B.

3.6.1 Empirical results: specification of propensity score

Table 4 presents the results from a logit model, addressing the choice to give birth or not to a child during the time elapsed between the two interviews. It is a unified specification of the propensity score used for the matching stages. The parameters estimated in Table 4 are expressed in terms of relative risks for the various categories of the covariates. A risk value bigger than one implies that the propensity to have a child is higher than for an individual classified in reference category, where the reference category for each variable is denoted by 1, if the variable is dichotomous. If the variable is continuous and odds ratio bigger than one, it indicates that the probability to have a child increases as the value of the variable becomes higher.

The first and the second columns show results for odd ratios and standard errors for males, whereas the last two columns on the right provide analogous estimates for females' subsample.

[35] A simple proof of this statement can be found in Smith and Todd (2005).

Tab 4. Odd Ratios for determinants of childbearing: results of logit model.

	MALES		*FEMALS*	
Variables	*odd ratios*	*s.e.*	*odd ratios*	*s.e.*
Number of children at 1st wave	0.366***	(0.045)	0.415***	(0.049)
Number of siblings	1.231***	(0.074)	0.972	(0.055)
Age				
18-24	1		1	
25-29	1.076	(0.164)	0.867	(0.108)
30-34	0.762	(0.144)	0.360***	(0.061)
Household Income				
Household Income 1st quintile	1		1	
Household Income 2nd quintile	0.700**	(0.116)	0.770*	(0.114)
Household Income 3rd quintile	0.616***	(0.110)	0.773*	(0.114)
Household Income 4th quintile	0.783	(0.146)	0.804	(0.134)
Household Income 5th quintile	0.829	(0.175)	0.813	(0.154)
Labour market position				
Does not study and work	1		1	
Studies	0.281***	(0.127)	0.651**	(0.137)
Works in a private firm	1.241	(0.178)	1.041	(0.121)
Works in a state firm	1.038	(0.208)	1.092	(0.194)
Marital Status				
Not in union	1		1	
Married	7.688***	(1.462)	2.818***	(0.484)
Cohabited	9.014***	(1.652)	2.961***	(0.489)
Education				
Primary or less	1		1	
Basic education	0.518**	(0.168)	0.407***	(0.107)
Secondary education	0.428**	(0.145)	0.388***	(0.108)
Higher education	0.759	(0.296)	0.495**	(0.153)
Father's education				
Primary or less	1		1	
Basic education father	0.815	(0.224)	0.648	(0.171)
Secondary education father	0.943	(0.270)	0.81	(0.223)
Higher education father	0.662	(0.235)	0.63	(0.196)
Mather's education				
Primary or less	1		1	
Basic education mother	0.804	(0.220)	0.637*	(0.163)
Secondary education mother	0.866	(0.253)	0.642	(0.176)
Higher education mother	1.154	(0.403)	0.805	(0.245)
Religiosity				
Not religious	1		1	
Islam	0.981	(0.218)	1.513*	(0.359)
Christian-Orthodoxy	0.939	(0.165)	1.143	(0.250)

Tab 4. (Continued)

	MALES		*FEMALS*	
Variables	*odd ratios*	*s.e.*	*odd ratios*	*s.e.*
Ideational factors				
Positive attitudes	1.281***	(0.089)	1.089*	(0.055)
Negative attitudes	0.861**	(0.051)	0.942	(0.048)
Parental role traditionalism	1.025	(0.058)	1.004	(0.048)
Self actualization	0.933	(0.054)	1.04	(0.050)
Alternative living arrangements	0.887**	(0.053)	1.019	(0.049)
Psychological Wellbeing	1.02	(0.084)	1.098*	(0.062)
Disorientation	1.039	(0.102)	1.019	(0.086)
Exchange of help (social capital)	0.924	(0.091)	1.075	(0.106)
Perceived behavioural control	0.9	(0.065)	0.865**	(0.051)
Observations	2783		3065	

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

As shown from parameter estimations, the number of children at the time of first interview is negatively correlated to the propensity of having another child between the two waves for both males and females. This finding is consistent to Bulgarian family changes that have led to a transition from a pattern based on two children per couple before 1989 to subsequent *lowest low* levels of fertility characterized by a drop in total fertility rates at levels around 1.2, interestingly one of the lowest in the world. On this premises, having a child during the first wave discourages parents to plan a subsequent pregnancy; the odd ratios for *age* show evidence of a quadratic relationship between the age of potential parents and the likelihood to give birth to a child for males. Indeed, mean age at birth reached the level of 25.5 in 2002 (Koytcheva, 2006). Females show a lower likelihood of having a child in older cohorts instead.

Household income shows a U-shaped relationship for males and childbearing: lowest levels of household income seem to be associated to a higher likelihood of pregnancy for a partner, as for income greater than fourth quintile. Consequently, we can infer that it is the middle-class, which presents the highest propensity for delaying childbearing. Conversely, females provide evidence for only a marginally significant correlation between household income and pregnancy. However, economic and social wellbeing are not only consequences of household income, but also of the position in labour market: both females and males show a lower relative risk for pregnancy, if they study and do not work. This finding is coherent to an analogous regression results from

Philipov, Speder and Billari (2006), who underline as "Studies, does not work" is positively associated with the intention of postponing motherhood in Bulgaria.

Notwithstanding the findings contained in Philipov, Speder and Billari (2006) pertaining to individuals' intentions, unemployed and non studying individuals do not show a lower propensity to have a child. In this case, empirical evidence presents a discordance between intentions and behaviour, as highlighted also in Spéder (2009).

However, the strongest findings deal with individuals' marital status: married and cohabited individuals, both men and women, are more likely to give birth to a child during the time between the interviews. This result confirms the realization of intentions of parenthood, as anticipated in Philipov, Speder and Billari (2006) and in Speder (2009).

There is also evidence of the impact of educational levels on the decision to become father or mother. A primary educational level is associated with the highest likelihood of becoming a parent; coherently with the literature relative to intentions, this likelihood reaches lowest levels for people that completed secondary school, and started to increase for highly educated individuals. Conversely, parents' education seems to have no causal effects on this specific life course event.

While the set of covariates discussed above refers to economic and familiar factors, the last covariates investigate ideational issues.

The first examined ideational factor consists in the religiousness of respondent. The answers are summarized in three categories: non religious, reference category, Islamic and Christian-Ortodox; results support the evidence of a higher likelihood of childbearing only for Muslim women.

The remaining items, detect ideational factors and explore the following dimensions: measures of anomie and social capital. Due to the impossibility to measure directly these dimensions we try to measure the proxies for them on the basis of factor analysis on related items.

Anomies, following Durkheim (1893, 1897) and Merton (1968), are connected to the loss of norm power, which implies an increase in the sense of disorientation and uncertainty and the deterioration of mental wellbeing. The items used to measure disorientation are the statements "I have no influence over my everyday affairs", "Life is so complicated nowadays that most of the time I don't know what to do" and "No one

cares what happens to other people". The factor extracted does not show any impact on the decision to become father or mother, whereas we identified a marginal positive effect of psychological wellbeing[36] on the probability to give birth to a child for Bulgarian females. Finally, neither Exchange of Help seems to have any impact on likelihood of childbearing[37].

In order to improve the quality of matching, we added also all the measures of the attitudes and value orientations indexes at time *t* in propensity score regression. This procedure is common in literature, e.g. Dehejia and Wahba 1999, 2002, and allows us for a comparison between treated and controls on a common starting level of the outcome.

Results support the association between the *positive attitudes* towards childbearing and pregnancy. Conversely, *negative attitudes* seems to be irrelevant for females. Exploratory principal components analysis has discussed this statement, proving a strong correlation between perceived behavioural control and *Factor 2*. Hence, the surprising result obtained for the female sample is probably due to collinearity. Perceived behavioural control[38] is a factor-covariate that is included in Billari, Philipov and Testa (2009) and that plays a key role in the theory of planned behaviour. This covariate scores high when individuals perceive an item as a significant one, being able to control it. Value orientations are not significant instead with the exception of *alternative living arrangements* that decreases males' likelihood of having a child as in Sironi (2009).

[36] The items explored are "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?"

[37] Philipov and Shkolnikov (2001) suggest using exchange of help as measure of Social capital. In this setting the questions from our survey for this purpose are "During the last two years, how many people have given you substantial, important help or support?" and "If you need substantial help and support, how many people can you ask for this?"

[38] It is obtained by a factor analysis involving the importance of Health, Family Status, Economic Income and Working conditions on the direct choice to start a pregnancy within two years since first the interview.

3.6.2 Empirical results: matching estimates

As mentioned above, the propensity score matching is based on a large set of covariates that includes extremely detailed controls for both background and ideational factors. The outcome variable considered in matching estimates is the variation of outcome indexes between the two interviews, whereas the treatment is the birth of a child between the two waves. We decided to consider the effective birth of a child as a treatment, because it is supposed that adaptation of value orientations and attitudes starts when a couple directly experiences childcare, thus pregnant women (or their partner in the case the respondent is a male) at the time of first interview are considered treated if the birth of a child did happen between the waves.

We start analyzing attitudes, comparing results obtained with nearest neighbour matching within a caliper with those obtained with kernel matching. The analysis is led, imposing the common support for treated and control units: the results show that very few units are off common support, meaning that almost all of the treated units are matched with comparable control units.

As shown by Table 4, the birth of a child has a negative and highly significant effect on the *positive attitudes* towards childbearing for both females and males. More in detail, childbearing between the two waves seems to decrease the joy and the satisfaction in case of a further pregnancy within two years following the second interview.

Tab 4. Estimates of propensity score estimation – Attitudes – (Nearest neighbour matching within a caliper).

Attitudes		*MALES*		*FEMALES*	
		Unmatched	Matched	Unmatched	Matched
Benefits	Treated	-.359	-.324	-.333	-.325
	Controls	.021	-.085	.009	.122
	ATT	-.380***	-.238***	-.342***	-.447***
	(t stat)	(-6.24)	(-2.84)	(-6.02)	(-6.06)
Costs	Treated	.176	.167	.242	.242
	Controls	-.077	.086	-.029	-.132
	ATT	.254***	.081	.272***	.374***
	(t stat)	(3.95)	(0.92)	(4.70)	(4.72)

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

Unsurprisingly, the negative effect on *benefits* is stronger for females. A set of possible explanations may theoretically support this finding: the first one consists in females' higher propensity to postnatal depression (affecting more than 10% of women in the

first six months after childbirth). However, recent studies demonstrate (see for example Boyce and Hickey, 2005) that background factors are proved to be prominent determinants for mothers' psychological wellbeing. In such case propensity score matching allow us to control for many of this factors like the number of children at the first wave, the psychological wellbeing before childbirth and many others relevant covariates. This does not suggest emphasizing the role of depression after childbirth in explaining gender differences in estimated *ATT*. Another alternative explanation for this finding is that mothers, in the first months, are the very ones who undertake childcare and it would be very arduous to link this experience to ideas of happiness and satisfaction in the hypothesis of further pregnancies in a short run perspective.

The results confirm also for the *negative attitudes* that have significantly increased after childbirth. Once again, the effect is stronger for females, whereas it seems to be not significant for males, supporting the idea that women emphasise the *costs* of further childbirths and leave out the *benefits* of themselves in the first months after the entering in motherhood.

However, for men the estimated average treatment effect after matching is smaller than before matching. This underlines that there was an overestimation of causal effect of childbearing due to the presence of confounders. Hence, propensity score has reduced the bias generated by confounders. An opposite results is related to women, that increase *ATT* after matching.

The estimates displayed in Table 5 are obtained comparing the previous results with those obtained through kernel matching method instead. The choice of the best matching method depends on several factors and it is difficult to identify the best choice. More often there is a trade-off in advantages and disadvantages for each method.

The most straightforward matching estimator is *nearest neighbour matching:* the individual from the comparison group is chosen as a single partner for treated individual that is closest in terms of propensity score. In this case, we have implemented nearest neighbour estimator without replacement. This method, that is to say nearest neighbour, improves the quality of matching and decreases the bias in point estimation with respect to radius and kernel matching. However, in such a way many observations among controls are discarded (Caliendo and Koepenig, 2005), thus increasing the variance of

estimation as the matched sample size decreases, when implementing nearest neighbour matching and especially when the controls are much more than treated. In other words, there exists a trade off between bias and variance. Nearest neighbour matching optimizes reduction of bias, despite of the level of variance that consistently rises.

Conversely, Kernel Matching is a non parametric matching estimator using weighted averages of all individuals to construct counterfactual outcomes. This method incorporates all information available about the control group, improving the efficiency of estimates. The main disadvantage is that we add also units that are very distant to treated individuals in terms of propensity score, increasing the bias.

For these reasons, we decided to compare estimates obtained through the two different methods illustrated above and in Section 5.

Tab 5. Estimates of propensity score estimation – Attitudes – (Kernel matching).

Attitudes		*MALES*		*FEMALES*	
		Unmatched	Matched	Unmatched	Matched
Benefits	Treated	-.359	-.358	-.333	-.331
	Control	.021	-.118	.009	.008
	ATT	-.380***	-.240***	-.342***	-.339***
	(t stat)	(-6.24)	(-3.51)	(-6.02)	(-5.43)
Costs	Treated	.176	.170	.242	.239
	Control	-.077	-.011	-.030	-.013
	ATT	.253***	.181***	.272***	.253***
	(t stat)	(3.95)	(2.50)	(4.70)	(3.95)

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

These results provide evidence for a process of attitudes adaptation. Individuals' experience in life course choices modifies previous attitudes: *attitudes towards childbearing* negatively readjusts after the birth of a child, confirming what emerges in Table 4.

The results are also similar for the second factor that represents a proxy for the "costs" that significantly increase after childbirth. In this case, there is also a significant effect for males, even if the *ATT* estimates confirm smaller than those obtained for females' subsample.

We may conclude that among Bulgarian females and males aged from 18 to 34 at the time of the first interview, there is a significant process of attitude adaptation in an anti-traditional direction: childbirth seems to decrease benefits and to increase costs in parents' life in the perspective of considering the impact of a further childbearing.

In the following tables we explore the results obtained for *value orientations*. Table 6 presents results from *nearest neighbour matching* and they do not provide evidence for any significant causal effects of childbearing on all the factors.

Tab 6. Estimates of propensity score estimation – Value orientations – (Nearest neighbour matching within a caliper).

Attitudes		*MALES*		*FEMALES*	
		Unmatched	Matched	Unmatched	Matched
Traditional role parenthood	Treated	-.150	-.131	-.175	-.164
	Controls	-.128	-.054	-.136	-.105
	ATT	-.022	-.077	-.039	-.059
	(t stat)	(-0.35)	(-0.88)	(-0.66)	(-0.78)
Self actualization	Treated	.031	.024	-.046	-.046
	Controls	.075	.090	.026	-.044
	ATT	-.044	-.066	-.072	-.001
	(t stat)	(-0.71)	(-0.81)	(-1.27)	(-0.02)
Alternative living arrangements	Treated	.219	.189	.094	.081
	Controls	.123	.180	.055	.099
	ATT	.096	.009	.039	-.018
	(t stat)	(1.60)	(0.12)	(0.71)	(-0.25)

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

The result is confirmed in Table 7, when we have replaced nearest neighbour matching with kernel matching.

Tab 7. Estimates of propensity score estimation – Value orientations – (Kernel matching).

Attitudes		*MALES*		*FEMALES*	
		Unmatched	Matched	Unmatched	Matched
Traditional role parenthood	Treated	-.150	-.150	-.175	-.171
	Controls	-.128	-.144	-.136	-.117
	ATT	-.022	-.006	-.039	-.054
	(t stat)	(-0.35)	-(0.08)	(-0.66)	(-0.84)
Self actualization	Treated	.031	.030	-.046	-.047
	Controls	-.075	.100	.026	.010
	ATT	-.044	-.070	-.072	-.057
	(t stat)	(-0.71)	(-1.01)	(-1.27)	(-0.92)
Alternative living arrangements	Treated	.219	.209	.094	.094
	Controls	.123	.169	.055	.080
	ATT	.096	.040	.039	.014
	(t stat)	(1.60)	(0.60)	(0.71)	(0.22)

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

The wording of the items may partially explain the differences in empirical results. Whereas items collected in Table 1 are directly connected to childbirth, some of the items addressed in the last table focus on the relationship between parents and the growth of children: in particular we refer to the items related to *parental role traditionalism*. In this case, the uncorrelation between childbearing and value adaptation is not surprising. A more delayed adjustment for value orientations should be expected, when children will grow up.

As we have just discussed, *self realization* gives more attention to general aspects on parenthood role that may be directly connected to childbirth: statements like "Parent's duty is to do their best for their children even at the expenses of their own well-being" or "Parents have a life of their own and should not be asked to sacrifice their own well-being for the sake of their children" may be subjected to change also in short run, but in this case the role played by counfounders may be central. Indeed, the results do not provide evidence of a causal relationship; whereas the process of attitude adaptation seems to work value orientations are insensitive to change in life course paths in the short run.

The findings from this section lead to the following conclusion: attitudes that link directly the experience of childbearing to specific consequences that this experience have on material and immaterial aspects of individual's life register a process of selection (Sironi 2009) and adaptation. In particular, the adaptation involves a process of anti-traditional reaction against childbirth. Conversely it is true that the greater is the level of factors related to childbearing, the greater is the propensity to give birth to a child. The same people, who experience childbearing when they are asked to express a positive opinion on a further pregnancy, show a negative attitude adjustment.

This process of "attitude negation" is perfectly coherent with lowest low levels of fertility in Bulgarian couples that usually prefer to give birth to only one child, causing a dramatic drop of second order fertility rates.

In general, processes of attitude adaptation reinforce the attitude orientation: for example childbirth should be expected to improve attitudes indexes related to itself; however, examples of "attitude negation", although not common in literature, are somewhat present in more recent surveys. An example of "attitude negation" comes from Bielefeld panel (Moors, 1998), denoting that women moving out of cohabitation

and into marriage readjust their views in favour of economic autonomy and personal freedom choices. This paper shows a similar dynamic of selection and adaptation in attitudes formation with respect to personal attitudes.

Different results belong to *value orientations*, because of the general formulation of the items; in this context, *value orientations* seem to be more stable than *attitudes*. This result is connected to theories that state attitudes more susceptible to change than values and value orientations as underlined in section 2. This implies that an effect of childbearing could produce a value adjustment in a long run perspective that our panel structure with two interviews in three years cannot capture.

3.7. Sensitivity analysis

As mentioned in Section 5, propensity score matching provides an estimate of the effect of childbearing on changes in attitude indicators. However, the estimates of average treatment effects are reliable if the outcome variable is largely free of bias arising from an association between the choice to have children and unobservable factors (Di Prete and Gangl, 2004). Since the sociological approach to the issue of value orientations and attitudes may be consistently interested by the presence of unobservable covariates, we need an analysis of the robustness of matching results.

A first strategy implemented to defend our findings against hidden bias has consisted in using *difference in difference estimator*, which is helpful in case of time-constant sources of bias, and in trying to include in the model proxies for unobservables, such as anomie measures, social capital proxies and attitude indicators.

The second strategy adopted has been to combine propensity score and *difference in difference* estimator, avoiding the impact of time-constant sources of bias.

A third strategy, which is described in this section, is based on an application of the Rosebaum bounds method (Rosenbaum, 2002), following the example of Di Prete and Gangl (2004) only for one to one matching.

Rosenbaum developed this approach in order to assess the impact of hidden bias; in fact if unobserved variables affect both the assignment process and the outcome, propensity score estimation would be biased. Table 8 shows results of p-values from Wilcoxon sign-rank test, while imposing the level of hidden bias to a set of values for parameter Γ (indicated in first column), that reflects the odds ratio of differential treatment

assignment due to unobserved simulated covariate. The second column of Table 8 displays for each level of Γ the hypothetical p-critical level, which represents the bound on the significance level of *ATT* in the case of endogenous self-selection into treatment status. By evaluating the Rosenbaum bounds on *ATT* for increasing levels of Γ, we can test the robustness of the estimate treatment effect at increasing levels of hidden bias, till the presence of a strong confounder will undermine the significance of the estimates. In this section the analysis focuses on the *ATT* estimates obtained with kernel matching and applies only on personal attitudes indicators, because only *ATT* results from this kind of attitudes gave significant results.

Sensitivity analysis uses stata module rbounds, written by Gangl (2004). The elements of the outcome include moving from left to right: log odds of differential assignment due to unobserved factors (Γ); the upper and lower bound significance levels (sig+ and sig-); upper and lower bounds for Hodges-Lehmann point estimate (t-hat+ and t-hat-) and finally upper and lower bound confidence interval (CI+ and CI-) at 95%.

Tab 8. Sensitivity analysis – Positive Attitudes – *Males*.

Γ	sig+	sig-	t-hat+	t-hat-	CI+	CI-
1	<.001	<.001	-.260	-.260	-.419	-.101
1.05	<.001	.003	-.296	-.225	-.454	-.065
1.1	<.001	.009	-.329	-.192	-.488	-.031
1.15	<.001	.026	-.362	-.160	-.519	.002
1.2	<.001	.059	-.391	-.129	-.551	.033
1.25	<.001	.114	-.421	-.099	-.581	.063
1.3	<.001	.196	-.449	-.070	-.610	.090
1.35	<.001	.300	-.477	-.043	-.638	.119
1.4	<.001	.419	-.502	-.017	-.666	.147
1.45	<.001	.541	-.526	.008	-.691	.174
1.5	<.001	.656	-.550	.033	-.716	.200

As displayed by Table 8, the estimates of *ATT* of the *benefits* seem to be not relatively robust to hidden bias: the critical level of Γ at which the significance of *ATT* is questioned is less than 1.25.

However, it is important to remember that this is the worst case scenario. Hence, a critical value of $\Gamma = 1.25$ does not mean that the unobserved heterogeneity exists and that there is no effect of treatment on outcome variable. This result states only that the confidence interval for the treatment effect includes zero, if an unobservable causes the

odd ratios of treatment assignment to differ by 1.25 points between the treatment and comparison group.

Furthermore, for females it would require a hidden bias of Γ larger than 1.5 to makes the conclusion of a negative effect of childbirth to the attitude towards childbearing spurious.

Tab 9. Sensitivity analysis – Positive Attitudes – *Females*.

Gamma	sig+	sig-	t-hat+	t-hat-	CI+	CI-
1	<.001	<.001	-.447	-.447	-.594	-.299
1.05	<.001	<.001	-.483	-.412	-.632	-.262
1.1	<.001	<.001	-.520	-.375	-.668	-.227
1.15	<.001	<.001	-.554	-.340	-.702	-.192
1.2	<.001	<.001	-.586	-.308	-.734	-.159
1.25	<.001	<.001	-.617	-.276	-.766	-.128
1.3	<.001	<.001	-.648	-.246	-.798	-.097
1.35	<.001	.002	-.676	-.218	-.826	-.069
1.4	<.001	.006	-.703	-.190	-.853	-.041
1.45	<.001	.015	-.729	-.164	-.880	-.015
1.5	<.001	.034	-.755	-.139	-.906	.011

Focusing on *"costs" factor*, sensitivity analysis produces worse results than those analyzed above: the effect under a hidden gives no significant results..

Tab 10. Sensitivity analysis – Negative Attitudes – *Males*.

Gamma	sig+	sig-	t-hat+	t-hat-	CI+	CI-
1	.183	.183	.083	.083	-.097	.261
1.05	.320	.090	.043	.122	-.136	.300
1.1	.479	.039	.005	.160	-.175	.340
1.15	.634	.016	-.031	.196	-.213	.375
1.2	.765	.006	-.065	.231	-.246	.407
1.25	.862	.002	-.099	.263	-.279	.441
1.3	.925	.001	-.130	.294	-.312	.474
1.35	.962	<.001	-.162	.326	-.342	.506
1.4	.982	<.001	-.191	.354	-.373	.536
1.45	.992	<.001	-.219	.382	-.402	.566
1.5	.997	<.001	-.246	.407	-.428	.593

Moreover, we can also be argued that *ATT* for *negative attitudes* for males is not significant in the estimates of the previous section obtained through nearest neighbour matching; therefore, the negative response of sensitivity analysis does not imply a change in parameter interpretation.

Tab 11. Sensitivity analysis – Negative Attitudes – *Females*.

Gamma	sig+	sig-	t-hat+	t-hat-	CI+	CI-
1	<.001	<.001	.370	.370	.222	.521
1.05	<.001	<.001	.333	.408	.185	.558
1.1	<.001	<.001	.298	.445	.149	.594
1.15	<.001	<.001	.264	.480	.114	.628
1.2	.001	<.001	.231	.513	.081	.662
1.25	.004	<.001	.200	.544	.049	.694
1.3	.014	<.001	.169	.574	.018	.725
1.35	.034	<.001	.140	.601	-.011	.756
1.4	.073	<.001	.113	.629	-.039	.785
1.45	.134	<.001	.085	.657	-.067	.812
1.5	.221	<.001	.060	.684	-.093	.839

Conversely, females with a highly significant positive effect of childbearing on the *negative attitudes* show a greater stability of results with respect to hidden bias: with a critical value of $\Gamma = 1.45$ the confidence interval of treatment effect at 90% includes the zero.

Literature discussed around an acceptable value for Γ, to assess the robustness of estimates towards hidden bias. Obviously there is not a deterministic rule, because the ideal level of Γ depends on the context. Gangl and Di Prete (2004) consider in their work values close to 1.5 as a significant threshold to make a decision on ATT estimations full reliability.

In this setting, estimation of *positive* and *negative attitudes* satisfie the condition for females, whereas results show weaker evidence for the significance of treatment effect in the case of males.

3.8. Conclusions

In social sciences several paradigms have been analyzed side by side and have either been considered adjustment of attitudes in a traditional sense after family formation or considered a shift towards anti-traditional views.

In social sciences several paradigms concerning family formation have been analyzed thoroughly. On occasions, adjustments of theory have proved to be necessary as the values, value formation and attitudes evolved during the SDT.

There is a common trait shared by all paradigms, which sets a first pillar in approaching values, value orientations and attitudes analysis. Indeed, whereas attitudes are more

susceptible to changes due to events in life course path, values and value orientations opposite stronger to changes in human behaviour in a short run perspective.

In this paper the analysis used data from recent surveys in Bulgaria to assess the effect of childbearing on changes in ideational factors. In order to identify a possible process of attitude adaptations, we explored several attitudinal items related directly or indirectly to fertility, ordered in two distinct groups. The first group included attitudinal items that asked to evaluate costs and benefits of a further pregnancy after the second interview, the second group included a set of general questions about the nature of the relationship between parents and children in family life.

The analysis has been conducted with propensity score matching algorithms, which allow to identify the causal effect of childbearing on attitude shifts, controlling for possible observable confounders and for the heterogeneity effect of childbirth for each individual. Indeed, both these two aspects may affect the estimates of simple regression results.

As shown by the empirical analysis, childbirth does not have any significant effect on changes in value orientations. Probably, the few time spent with the new child can lead to delayed effects on modifications in respondents' parenthood orientations that cannot be captured after few months since childbirth.

Moreover, the survey investigated value orientations in the most general way, without concrete reference to respondents' own experience.

The second set of attitudes, which are directly connected to the hypothesis of a further pregnancy, shows a relevant and highly significant process of attitude selection and adaptation: parents that emphasise costs of pregnancy are less likely to give birth to a child coherently with the theory of planned behaviour (Sironi, 2009); after childbirth they are subjected to a reinforcement of this attitude, when a further pregnancy hypothesis is prospected to them. This proves the recursive process of selection and adaptation to be accurate, where attitudes predict behaviours and behaviours readjust attitudes. In this prospect, a negative attitude towards childbearing decreases the propensity to give birth to a child; then childbirth reinforces the level of negative attitude itself.

The considered surveys also investigated the effect of childbirth on perceived benefits towards childbearing in a process of attitude selection and adaptation. If parents

agreeing to the positive aspects of parenthood are more likely to become fathers or mothers, this paper discovered an opposite adaptive effect. Childbirth significantly decreases the attitude towards giving birth to a further child. This is an example of negative attitude adaptation (Moors, 1998). Attitudes affect behaviours, but behaviour readjusted attitude in an opposite direction.

In conclusion, childbirth seems to discourage parents to plan a further pregnancy in Bulgaria, because of the perceived rise in costs of child rearing and a decrease in benefits related to it.

Appendix 3.A: balance property in propensity score estimations

The following tables present the results of balance score checks for the results obtained in Section 6 with respect to *attitudes* and kernel estimates. Results about *value orientations* are omitted, because results are not significant, even if they also denote an optimal balance of covariates. The balance property is satisfied in almost all propensity score procedures. In this setting, the analysis is led using the approach from Sianesi (2004), who compares the sample means before and after matching for each covariate included in the model through a simple t test. As showed in all cases considered many variables are significantly different in treated and control groups before the matching. Propensity score reduces the bias and allows us to join a rather high degree of covariate balance between control and treatment samples; indeed, the null hypothesis of equality of means is not rejected in all cases at a very high level of significance (10% level). Moreover, we have computed another indicator that measures the bias through a comparison between treated and controls:

$$bias = \left| \frac{100\left(\bar{x}_T - \bar{x}_C\right)}{\sqrt{\frac{\left(s_T^2 - s_C^2\right)}{2}}} \right| \qquad \text{(A.1)}$$

This index can be calculated before and after the matching procedure, in order to compare the bias reduction in percentage terms. Di Prete and Gangl (2004) fixed a threshold of about 5% to indicate optimal bias after matching procedures for covariates included in the model.

In the outcome, bias overcomes 6% only in few cases, proving a good balance results, despite of the higher number of matching applications implemented in our analysis.

Tab A.1. Balance Check – Positive attitudes – *Males* – (Nearest neighbour matching within caliper)

		Mean			%reduct		
Variable	Sample	Treated	Control	%bias	|bias|	t	p>|t|
N. Children I Wave	Unmatched	0.60259	0.63579	-4.1		-0.78	0.433
	Matched	0.64471	0.69176	-5.9	-41.8	-0.92	0.36
N Siblings	Unmatched	1.5853	1.2634	24.9		5.72	0
	Matched	1.52	1.5624	-3.3	86.8	-0.45	0.652
Age	Unmatched	26.661	26.325	7.8		1.44	0.149
	Matched	26.819	27.021	-4.7	39.7	-0.75	0.452
Age^2	Unmatched	726.19	714.77	5		0.93	0.353
	Matched	734.74	745.27	-4.6	7.9	-0.73	0.466
Household Income II q	Unmatched	0.17927	0.22368	-11.1		-2.11	0.035
	Matched	0.19059	0.16471	6.5	41.7	0.99	0.324
Household Income III q	Unmatched	0.15767	0.19205	-9.1		-1.73	0.084
	Matched	0.16	0.17412	-3.7	58.9	-0.55	0.582
Household Income IV q	Unmatched	0.14903	0.16539	-4.5		-0.87	0.386
	Matched	0.15059	0.13647	3.9	13.7	0.59	0.558
Household Income V q	Unmatched	0.11663	0.1193	-0.8		-0.16	0.872
	Matched	0.11529	0.12	-1.5	-76.6	-0.21	0.832
Studies	Unmatched	0.0108	0.07546	-32.2		-5.18	0
	Matched	0.01176	0.00235	4.7	85.4	1.64	0.101
Works pvt	Unmatched	0.58531	0.51514	14.1		2.75	0.006
	Matched	0.58588	0.57412	2.4	83.2	0.35	0.729
Works state	Unmatched	0.13607	0.13737	-0.4		-0.07	0.941
	Matched	0.13882	0.14353	-1.4	-261.7	-0.2	0.844
Married	Unmatched	0.41685	0.31315	21.7		4.33	0
	Matched	0.43059	0.42588	1	95.5	0.14	0.89
Cohabited	Unmatched	0.32613	0.15725	40.2		8.6	0
	Matched	0.28941	0.32	-7.3	81.9	-0.97	0.333
Basic Edu	Unmatched	0.20302	0.17985	5.9		1.17	0.242
	Matched	0.19765	0.20706	-2.4	59.4	-0.34	0.733
Secondary Edu	Unmatched	0.56371	0.69724	-27.9		-5.61	0
	Matched	0.58353	0.57882	1	96.5	0.14	0.89
Higher Edu	Unmatched	0.13823	0.09173	14.6		3.04	0.002
	Matched	0.13412	0.13647	-0.7	94.9	-0.1	0.92
Basic Edu Father	Unmatched	0.23974	0.23317	1.5		0.3	0.761
	Matched	0.23765	0.24706	-2.2	-43.2	-0.32	0.749
Secondary Edu Father	Unmatched	0.49676	0.54406	-9.5		-1.86	0.064
	Matched	0.50588	0.50588	0	100	0	1
University Edu Father	Unmatched	0.10583	0.14053	-10.6		-1.99	0.047
	Matched	0.10588	0.10353	0.7	93.2	0.11	0.911
Basic Edu Mother	Unmatched	0.22678	0.22594	0.2		0.04	0.969
	Matched	0.22588	0.21412	2.8	-1293.6	0.41	0.679
Secondary Edu Mother	Unmatched	0.46868	0.52869	-12		-2.35	0.019
	Matched	0.48471	0.49647	-2.4	80.4	-0.34	0.732
Higher Edu Mother	Unmatched	0.12959	0.14776	-5.3		-1.01	0.312
	Matched	0.12471	0.11765	2	61.2	0.31	0.753
Islam	Unmatched	0.17495	0.1333	11.5		2.35	0.019
	Matched	0.17412	0.16706	2	83	0.27	0.785

Tab A.1. (Continued)

		Mean			%reduct		
Variable	Sample	Treated	Control	%bias	|bias|	t	p>|t|
Christian Orthodoxy	Unmatched	0.69546	0.75418	-13.2		-2.64	0.008
	Matched	0.70353	0.70353	0	100	0	1
Benefits	Unmatched	0.31072	0.06011	27.3		5.27	0
	Matched	0.26817	0.22174	5.1	81.5	0.74	0.457
Costs	Unmatched	-0.36752	-0.11314	-26.6		-5.24	0
	Matched	-0.35457	-0.41633	6.5	75.7	0.94	0.35
Parental role traditionalism	Unmatched	0.00817	-0.02387	3.3		0.64	0.521
	Matched	0.00425	-0.0393	4.5	-35.9	0.65	0.517
Self actualization	Unmatched	-0.11718	-0.08742	-3.1		-0.61	0.545
	Matched	-0.08341	-0.08649	0.3	89.6	0.05	0.963
Alternative living arrangements	Unmatched	-0.07042	0.01294	-8.5		-1.67	0.095
	Matched	-0.07123	-0.01241	-6	29.4	-0.87	0.382
Psychological wellbeing	Unmatched	0.1885	0.16122	3.7		0.72	0.472
	Matched	0.17806	0.15621	3	19.9	0.44	0.662
Disorientation	Unmatched	0.02764	5.80E-05	4	6	0.89	0.372
	Matched	0.02361	0.03561	-2	56.5	-0.3	0.768
Exchange of help	Unmatched	-0.01383	-0.01893	0.9		0.18	0.859
	Matched	-0.02144	-0.04035	3.2	-270.8	0.46	0.648
Perceived behavioural control	Unmatched	-0.13915	0.07472	-25.3		-5.07	0
	Matched	-0.09212	-0.09182	0	99.9	-0.01	0.996
Number of Treated			*425*				
Number of Controls			*2213*				

Tab A.2. Balance Check – Positive attitudes – *Females* – (Nearest neighbour matching within caliper)

		Mean			%reduct		
Variable	Sample	Treated	Control	%bias	|bias|	t	p>|t|
N. Children I Wave	Unmatched	0.6505	1.0269	-44.7		-9.46	0
	Matched	0.68051	0.69314	-1.5	96.6	-0.27	0.787
N Siblings	Unmatched	1.408	1.353	4.9		1.08	0.281
	Matched	1.3881	1.4531	-5.7	-18.2	-0.9	0.37
Age	Unmatched	24.679	26.799	-48.5		-10.11	0
	Matched	24.857	24.953	-2.2	95.5	-0.4	0.693
Age^2	Unmatched	624.93	740.53	-50.8		-10.47	0
	Matched	633.97	639.01	-2.2	95.6	-0.41	0.683
Household Income II q	Unmatched	0.18896	0.21703	-7		-1.51	0.132
	Matched	0.19134	0.19134	0	100	0	1
Household Income III q	Unmatched	0.1806	0.21	-7.4		-1.6	0.11
	Matched	0.18592	0.17148	3.6	50.9	0.63	0.531
Household Income IV q	Unmatched	0.15719	0.1604	-0.9		-0.19	0.848
	Matched	0.16426	0.17148	-2	-125.2	-0.32	0.748
Household Income V q	Unmatched	0.10368	0.10045	1.1		0.23	0.815
	Matched	0.10289	0.10469	-0.6	44	-0.1	0.922
Studies	Unmatched	0.06355	0.07979	-6.3		-1.34	0.181
	Matched	0.06679	0.05957	2.8	55.5	0.49	0.622
Works pvt	Unmatched	0.40635	0.40471	0.3		0.07	0.942
	Matched	0.40975	0.43682	-5.5	-1549.1	-0.91	0.362
Works state	Unmatched	0.10535	0.1265	-6.6		-1.41	0.158
	Matched	0.1065	0.09386	3.9	40.3	0.7	0.484
Married	Unmatched	0.38462	0.45349	-14		-3.04	0.002
	Matched	0.39531	0.38989	1.1	92.1	0.18	0.854
Cohabited	Unmatched	0.31438	0.22654	19.9		4.49	0
	Matched	0.28159	0.30505	-5.3	73.3	-0.86	0.391
Basic Edu	Unmatched	0.15385	0.16412	-2.8		-0.61	0.542
	Matched	0.15704	0.14982	2	29.7	0.33	0.739
Secondary Edu	Unmatched	0.50502	0.57503	-14.1		-3.09	0.002
	Matched	0.51805	0.50722	2.2	84.5	0.36	0.719
Higher Edu	Unmatched	0.23913	0.2191	4.8		1.05	0.292
	Matched	0.24007	0.24729	-1.7	64	-0.28	0.78
Basic Edu Father	Unmatched	0.19398	0.25506	-14.7		-3.12	0.002
	Matched	0.20036	0.23105	-7.4	49.8	-1.24	0.215
Secondary Edu Father	Unmatched	0.55351	0.52956	4.8		1.05	0.293
	Matched	0.55596	0.52527	6.2	-28.1	1.02	0.306
University Edu Father	Unmatched	0.1204	0.13683	-4.9		-1.06	0.29
	Matched	0.12635	0.12635	0	100	0	1
Basic Edu Mother	Unmatched	0.18729	0.24886	-14.9		-3.18	0.002
	Matched	0.19495	0.18953	1.3	91.2	0.23	0.819
Secondary Edu Mother	Unmatched	0.50334	0.5184	-3		-0.66	0.51
	Matched	0.50903	0.50542	0.7	76	0.12	0.904
Higher Edu Mother	Unmatched	0.15719	0.14262	4.1		0.9	0.366
	Matched	0.16245	0.15884	1	75.2	0.16	0.87
Islam	Unmatched	0.17057	0.13105	11.1		2.5	0.012
	Matched	0.16065	0.1769	-4.5	58.9	-0.72	0.471

Tab A.2. (Continued)

		Mean			%reduct		
Variable	Sample	Treated	Control	%bias	|bias|	t	p>|t|
Christian Orthodoxy	Unmatched	0.76087	0.80612	-11		-2.47	0.014
	Matched	0.77437	0.77076	0.9	92	0.14	0.886
Benefits	Unmatched	0.12376	-0.12033	23.8		5.17	0
	Matched	0.09244	-0.00053	9	61.9	1.5	0.135
Costs	Unmatched	0.01946	0.19044	-16.6		-3.7	0
	Matched	0.03136	0.08704	-5.4	67.4	-0.88	0.379
Parental role traditionalism	Unmatched	0.04901	0.02905	2		0.44	0.662
	Matched	0.04595	0.05036	-0.4	77.9	-0.07	0.942
Self actualization	Unmatched	0.09621	0.05794	3.7		0.81	0.416
	Matched	0.08868	0.07515	1.3	64.6	0.22	0.827
Alternative living arrangements	Unmatched	-0.00111	-0.00948	0.8		0.18	0.857
	Matched	0.00627	-0.04454	5	-507.1	0.83	0.406
Psychological wellbeing	Unmatched	-0.06357	-0.14175	9		1.93	0.054
	Matched	-0.07952	-0.06446	-1.7	80.7	-0.29	0.773
Disorientation	Unmatched	0.05258	0.04817	0.7		0.16	0.875
	Matched	0.04644	0.02354	3.7	-419.2	0.6	0.548
Exchange of help	Unmatched	0.00976	0.00068	1.7		0.39	0.696
	Matched	0.0111	0.0261	-2.9	-65	-0.46	0.646
Perceived behavioural control	Unmatched	-0.18837	-0.00588	-21		-4.66	0
	Matched	-0.1492	-0.15527	0.7	96.7	0.12	0.908
Number of Treated				*554*			
Number of Controls				*2419*			

Tab A.3. Balance Check – Negative attitudes – *Males* – (Nearest neighbour matching within caliper)

		Mean			%reduct		
Variable	Sample	Treated	Control	%bias	|bias|	t	p>|t|
N. Children I Wave	Unmatched	0.60259	0.63579	-4.1		-0.78	0.433
	Matched	0.64471	0.69176	-5.9	-41.8	-0.92	0.36
N Siblings	Unmatched	1.5853	1.2634	24.9		5.72	0
	Matched	1.52	1.5624	-3.3	86.8	-0.45	0.652
Age	Unmatched	26.661	26.325	7.8		1.44	0.149
	Matched	26.819	27.021	-4.7	39.7	-0.75	0.452
Age^2	Unmatched	726.19	714.77	5		0.93	0.353
	Matched	734.74	745.27	-4.6	7.9	-0.73	0.466
Household Income II q	Unmatched	0.17927	0.22368	-11.1		-2.11	0.035
	Matched	0.19059	0.16471	6.5	41.7	0.99	0.324
Household Income III q	Unmatched	0.15767	0.19205	-9.1		-1.73	0.084
	Matched	0.16	0.17412	-3.7	58.9	-0.55	0.582
Household Income IV q	Unmatched	0.14903	0.16539	-4.5		-0.87	0.386
	Matched	0.15059	0.13647	3.9	13.7	0.59	0.558
Household Income V q	Unmatched	0.11663	0.1193	-0.8		-0.16	0.872
	Matched	0.11529	0.12	-1.5	-76.6	-0.21	0.832
Studies	Unmatched	0.0108	0.07546	-32.2		-5.18	0
	Matched	0.01176	0.00235	4.7	85.4	1.64	0.101
Works pvt	Unmatched	0.58531	0.51514	14.1		2.75	0.006
	Matched	0.58588	0.57412	2.4	83.2	0.35	0.729
Works state	Unmatched	0.13607	0.13737	-0.4		-0.07	0.941
	Matched	0.13882	0.14353	-1.4	-261.7	-0.2	0.844
Married	Unmatched	0.41685	0.31315	21.7		4.33	0
	Matched	0.43059	0.42588	1	95.5	0.14	0.89
Cohabited	Unmatched	0.32613	0.15725	40.2		8.6	0
	Matched	0.28941	0.32	-7.3	81.9	-0.97	0.333
Basic Edu	Unmatched	0.20302	0.17985	5.9		1.17	0.242
	Matched	0.19765	0.20706	-2.4	59.4	-0.34	0.733
Secondary Edu	Unmatched	0.56371	0.69724	-27.9		-5.61	0
	Matched	0.58353	0.57882	1	96.5	0.14	0.89
Higher Edu	Unmatched	0.13823	0.09173	14.6		3.04	0.002
	Matched	0.13412	0.13647	-0.7	94.9	-0.1	0.92
Basic Edu Father	Unmatched	0.23974	0.23317	1.5		0.3	0.761
	Matched	0.23765	0.24706	-2.2	-43.2	-0.32	0.749
Secondary Edu Father	Unmatched	0.49676	0.54406	-9.5		-1.86	0.064
	Matched	0.50588	0.50588	0	100	0	1
University Edu Father	Unmatched	0.10583	0.14053	-10.6		-1.99	0.047
	Matched	0.10588	0.10353	0.7	93.2	0.11	0.911
Basic Edu Mother	Unmatched	0.22678	0.22594	0.2		0.04	0.969
	Matched	0.22588	0.21412	2.8	-1293.6	0.41	0.679
Secondary Edu Mother	Unmatched	0.46868	0.52869	-12		-2.35	0.019
	Matched	0.48471	0.49647	-2.4	80.4	-0.34	0.732
Higher Edu Mother	Unmatched	0.12959	0.14776	-5.3		-1.01	0.312
	Matched	0.12471	0.11765	2	61.2	0.31	0.753
Islam	Unmatched	0.17495	0.1333	11.5		2.35	0.019
	Matched	0.17412	0.16706	2	83	0.27	0.785

Tab A.3. (Continued)

		Mean			%reduct		
Variable	Sample	Treated	Control	%bias	|bias|	t	p>|t|
Christian Orthodoxy	Unmatched	0.69546	0.75418	-13.2		-2.64	0.008
	Matched	0.70353	0.70353	0	100	0	1
Benefits	Unmatched	0.31072	0.06011	27.3		5.27	0
	Matched	0.26817	0.22174	5.1	81.5	0.74	0.457
Costs	Unmatched	-0.36752	-0.11314	-26.6		-5.24	0
	Matched	-0.35457	-0.41633	6.5	75.7	0.94	0.35
Parental role traditionalism	Unmatched	0.00817	-0.02387	3.3		0.64	0.521
	Matched	0.00425	-0.0393	4.5	-35.9	0.65	0.517
Self actualization	Unmatched	-0.11718	-0.08742	-3.1		-0.61	0.545
	Matched	-0.08341	-0.08649	0.3	89.6	0.05	0.963
Alternative living arrangements	Unmatched	-0.07042	0.01294	-8.5		-1.67	0.095
	Matched	-0.07123	-0.01241	-6	29.4	-0.87	0.382
Psychological wellbeing	Unmatched	0.1885	0.16122	3.7		0.72	0.472
	Matched	0.17806	0.15621	3	19.9	0.44	0.662
Disorientation	Unmatched	0.02764	5.80E-05	4	6	0.89	0.372
	Matched	0.02361	0.03561	-2	56.5	-0.3	0.768
Exchange of help	Unmatched	-0.01383	-0.01893	0.9		0.18	0.859
	Matched	-0.02144	-0.04035	3.2	-270.8	0.46	0.648
Perceived behavioural control	Unmatched	-0.13915	0.07472	-25.3		-5.07	0
	Matched	-0.09212	-0.09182	0	99.9	-0.01	0.996
Number of Treated			*425*				
Number of Controls			*2213*				

Tab A.4. Balance Check – Negative attitudes – *Females* – (Nearest neighbour matching within caliper)

		Mean			%reduct		
Variable	Sample	Treated	Control	%bias	|bias|	t	p>|t|
N. Children I Wave	Unmatched	0.6505	1.0269	-44.7		-9.46	0
	Matched	0.68051	0.69314	-1.5	96.6	-0.27	0.787
N Siblings	Unmatched	1.408	1.353	4.9		1.08	0.281
	Matched	1.3881	1.4531	-5.7	-18.2	-0.9	0.37
Age	Unmatched	24.679	26.799	-48.5		-10.11	0
	Matched	24.857	24.953	-2.2	95.5	-0.4	0.693
Age^2	Unmatched	624.93	740.53	-50.8		-10.47	0
	Matched	633.97	639.01	-2.2	95.6	-0.41	0.683
Household Income II q	Unmatched	0.18896	0.21703	-7		-1.51	0.132
	Matched	0.19134	0.19134	0	100	0	1
Household Income III q	Unmatched	0.1806	0.21	-7.4		-1.6	0.11
	Matched	0.18592	0.17148	3.6	50.9	0.63	0.531
Household Income IV q	Unmatched	0.15719	0.1604	-0.9		-0.19	0.848
	Matched	0.16426	0.17148	-2	-125.2	-0.32	0.748
Household Income V q	Unmatched	0.10368	0.10045	1.1		0.23	0.815
	Matched	0.10289	0.10469	-0.6	44	-0.1	0.922
Studies	Unmatched	0.06355	0.07979	-6.3		-1.34	0.181
	Matched	0.06679	0.05957	2.8	55.5	0.49	0.622
Works pvt	Unmatched	0.40635	0.40471	0.3		0.07	0.942
	Matched	0.40975	0.43682	-5.5	-1549.1	-0.91	0.362
Works state	Unmatched	0.10535	0.1265	-6.6		-1.41	0.158
	Matched	0.1065	0.09386	3.9	40.3	0.7	0.484
Married	Unmatched	0.38462	0.45349	-14		-3.04	0.002
	Matched	0.39531	0.38989	1.1	92.1	0.18	0.854
Cohabited	Unmatched	0.31438	0.22654	19.9		4.49	0
	Matched	0.28159	0.30505	-5.3	73.3	-0.86	0.391
Basic Edu	Unmatched	0.15385	0.16412	-2.8		-0.61	0.542
	Matched	0.15704	0.14982	2	29.7	0.33	0.739
Secondary Edu	Unmatched	0.50502	0.57503	-14.1		-3.09	0.002
	Matched	0.51805	0.50722	2.2	84.5	0.36	0.719
Higher Edu	Unmatched	0.23913	0.2191	4.8		1.05	0.292
	Matched	0.24007	0.24729	-1.7	64	-0.28	0.78
Basic Edu Father	Unmatched	0.19398	0.25506	-14.7		-3.12	0.002
	Matched	0.20036	0.23105	-7.4	49.8	-1.24	0.215
Secondary Edu Father	Unmatched	0.55351	0.52956	4.8		1.05	0.293
	Matched	0.55596	0.52527	6.2	-28.1	1.02	0.306
University Edu Father	Unmatched	0.1204	0.13683	-4.9		-1.06	0.29
	Matched	0.12635	0.12635	0	100	0	1
Basic Edu Mother	Unmatched	0.18729	0.24886	-14.9		-3.18	0.002
	Matched	0.19495	0.18953	1.3	91.2	0.23	0.819
Secondary Edu Mother	Unmatched	0.50334	0.5184	-3		-0.66	0.51
	Matched	0.50903	0.50542	0.7	76	0.12	0.904
Higher Edu Mother	Unmatched	0.15719	0.14262	4.1		0.9	0.366
	Matched	0.16245	0.15884	1	75.2	0.16	0.87
Islam	Unmatched	0.17057	0.13105	11.1		2.5	0.012
	Matched	0.16065	0.1769	-4.5	58.9	-0.72	0.471

Tab A.4. (Continued)

Variable	Sample	Mean Treated	Mean Control	%bias	%reduct |bias|	t	p>|t|
Christian Orthodoxy	Unmatched	0.76087	0.80612	-11		-2.47	0.014
	Matched	0.77437	0.77076	0.9	92	0.14	0.886
Benefits	Unmatched	0.12376	-0.12033	23.8		5.17	0
	Matched	0.09244	-0.00053	9	61.9	1.5	0.135
Costs	Unmatched	0.01946	0.19044	-16.6		-3.7	0
	Matched	0.03136	0.08704	-5.4	67.4	-0.88	0.379
Parental role traditionalism	Unmatched	0.04901	0.02905	2		0.44	0.662
	Matched	0.04595	0.05036	-0.4	77.9	-0.07	0.942
Self actualization	Unmatched	0.09621	0.05794	3.7		0.81	0.416
	Matched	0.08868	0.07515	1.3	64.6	0.22	0.827
Alternative living arrangements	Unmatched	-0.00111	-0.00948	0.8		0.18	0.857
	Matched	0.00627	-0.04454	5	-507.1	0.83	0.406
Psychological wellbeing	Unmatched	-0.06357	-0.14175	9		1.93	0.054
	Matched	-0.07952	-0.06446	-1.7	80.7	-0.29	0.773
Disorientation	Unmatched	0.05258	0.04817	0.7		0.16	0.875
	Matched	0.04644	0.02354	3.7	-419.2	0.6	0.548
Exchange of help	Unmatched	0.00976	0.00068	1.7		0.39	0.696
	Matched	0.0111	0.0261	-2.9	-65	-0.46	0.646
Perceived behavioural control	Unmatched	-0.18837	-0.00588	-21		-4.66	0
	Matched	-0.1492	-0.15527	0.7	96.7	0.12	0.908
Number of Treated				*554*			
Number of Controls				*2419*			

Appendix 3.B: Rosenbaum bounds method

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 nonparametric statistics like Wilcoxon's signed rank test (preferred in presence of continuous outcomes) and McNemer's test statistic (used in several applications for dichotomous outcomes, see Becker and Caliendo, 2007).

Test statistics in the family of sign score can be written in the following way:

$$T = \sum_{i=1}^{N_1} d_i \sum_{j=1}^{2} c_{ij} t_{ij} \qquad \text{(B.1)}$$

where t_{ij} is a dichotomous variable that indicates which of each of the N_1[39] pairs is the treated unit; c_{ij} is a design-variable defined in the following way:

$c_{i1} = 1, c_{i2} = 0$ if $y_{i1} > y_{i2}$;

$c_{i1} = 0, c_{i2} = 1$ if $y_{i1} \leq y_{i2}$.

Where y_{i1} , y_{i2} are the outcomes of the matched units in the *i*-th pair. Finally, d_i is the rank of $|y_{i1} - y_{i2}|$, i.e. the difference between the outcome of matched and control units in each pair. The product of c_{ij} and t_{ij} causes pairs to be selected where the outcome for the treatment was greater than that for the control. The ranks of these differences are summed and compared to the theoretical distribution of the test statistic under the null hypothesis that the average treatment effect on treated is zero.

In this case, the assignment to treatment is not random, the test statistic is bounded. Suppose there is an unobservable 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:

$$\ln\left[\frac{p_i}{1-p_i}\right] = f(X_i) + \gamma U_i \qquad \text{(B.2)}$$

[39] N_1 represents the number of treated in the common support.

Rosenbaum proved that a transformation of (B.2) implies that the ratio of the odds for treated and untreated units considered in each of the N_1 pairs of our analysis is bounded:

$$\frac{1}{\Gamma} \leq \frac{p_{i1}(1-p_{i2})}{p_{i2}(1-p_{i1})} \leq \Gamma \tag{B.3}$$

where $\Gamma = e^{\gamma}$. Under the assumption of the existence of a confounding factor U_i, the equation (B.1) becomes the sum of N_1 independent random variables, where the *i*-th variations is equal to d_i with probability:

$$p_i = \frac{c_{i1}e^{\gamma U_{i1}} + c_{i2}e^{\gamma U_{i2}}}{e^{\gamma U_{i1}} + e^{\gamma U_{i2}}} \tag{B.4}$$

and is equal to zero with probability $1-p_i$. Define the following values:

$$p_i^+ = \begin{cases} 0 & if\ c_{1i} = c_{i2} \\ \dfrac{\Gamma}{1-\Gamma} & if\ c_{1i} \neq c_{i2} \end{cases} \text{ and } p_i^- = \begin{cases} 0 & if\ c_{1i} = c_{i2} \\ \dfrac{1}{1-\Gamma} & if\ c_{1i} \neq c_{i2} \end{cases} \tag{B.5}$$

For different values of γ, the distribution of *T*, under the null hypothesis, is bounded by two distributions T^+ and T^- that have the following expected values and variances:

$$E(T^+) = \sum_{i=1}^{N_1} d_i p_i^+ \text{ and } E(T^-) = \sum_{i=1}^{N_1} d_i p_i^- \tag{B.6}$$

$$V(T^+) = \sum_{i=1}^{N_1} d_i^2 p_i^+(1-p_i^+) \text{ and } V(T^+) = \sum_{i=1}^{N_1} d_i^2 p_i^-(1-p_i^-) \tag{B.7}$$

One can use these formulas to compute the significance levels of the null hypothesis associated to the upper and lower bounds through the following standardizations:

$$\frac{T-E(T^+)}{\sqrt{V(T^+)}} \text{ and } \frac{T-E(T^-)}{\sqrt{V(T^-)}} \tag{B.8}$$

respectively for lower and upper bounds.

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4. Do Partnership and Childbearing reduce anomies? Evidence from Bulgaria[40]

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SECTIONS: 4.1. Introduction. – 4.2. Anomies and subjective wellbeing in sociological literature. – 4.3. Data Gathering and Research Outcome. – 4.4. Statistical Methodology – 4.5. Propensity Score Specification – 4.6. Empirical results – 4.7. Discussion and Conclusions – Appendix 4.A: Balance property in propensity score estimates – Appendix 4.B: Sensitivity Analysis. *Bibliography*.

ABSTRACT

Anomie measures represent possible proxies for investigating the *subjective wellbeing* of individuals in transitional societies like Bulgaria after 1989. Anomie is a phenomenon, which derives from a weakening in the power of norms, mainly caused by external factors and psychological state of mind of anomic individual, that are characterized by a sense of uncertainty and disorientation. Anomies are negatively associated to females' likelihood of having children and also reduce the relative risk to form a union with a partner. However, anomies are not only the source but also the outcome of individuals' life course events. This paper aims at applying Propensity Score estimates in order to investigate how the birth of a first child increases mothers' psychological wellbeing, as well as to what extent marital or extramarital childbirth may influence anomies pattern. This paper also endeavours to look deeper into the effects on partnership on both male and females, proposing a gender prospective on how attitudes and values play a different role in childbearing when filtrated by gender specific views. Indeed, although partnership benefits also the males' subsample, this paper research outcome demonstrates that anomie dimensions play a substantially decisive role in women's behaviour, while men are more sensitive to attitude and value orientations.

[40] The author thanks the Max Planck Institute for Demographic Research (Rostock, Germany) for the data.

4.1. Introduction

After the fall of the Communist regime in Europe in 1989 and the subsequent economic crisis that spread in the Former Iron Curtain, several changes in demographic behaviour arose as those countries were being engaged in a difficult transition to a market economy.

Bulgaria has been no exception to this scenario. Indeed, in Bulgaria the Total Fertility Rate (TFT*)* joined low fertility levels. Moreover, mean age at marriage overcame the mean age at first birth (Koytcheva, 2006), with the consequent increase of out of wedlock births. Since the early 1980s, a decrease in the relative risk of marriage and a temporary increase of the rate of entry in cohabitation modified the common patterns of union formation (Hoem and Kostova, 2004). According to some scholars, these changes represent the manifestation of some traits of the so-called process of Second Demographic Transition (SDT) as already occurred extensively in Western Europe (Lesthaeghe and Van de Kaa, 1986).

However, the causes for these radical transformations were not structured univocally: two broad opposite theoretical frameworks can be successfully applied to Bulgaria; on the one hand, the economic framework theory (Becker, 1991) states that the increasing cost of children in modern societies affects couples' fertility decision. In Bulgaria, the issue of the costs of children is intensified by the macroeconomic context, through the difficult transition to a market economy. Indeed, the lowest level in TFT was reached in 1997, with a level equal to 1.09 children per woman, when the economic crisis reached its climax. The economic crisis, with its hyperinflation and relevant loss in private and public capital discouraged young cohorts to marry or to start cohabitating; this partially explains the surprising decline in cohabitation risk rate during the middle 1990s (Koytcheva, 2006).

On the other hand, the sociological theories implemented to understand the SDT argue that drop in fertility rates, postponement of childbearing, and spread of cohabitation, which is replacing official marriage, are driven by changes in individuals' value orientations. In particular, such theories suggest that an increase in individual autonomy and individualistic values form individuals' attitude that affect changes in demographic

behaviour. Sironi (2009a) confirmed the significant role of attitudes and value orientations in determining individual choices in Bulgaria with respect to fertility.

Anyway, attitudes and values are not the only ideational factors that may be associated to demographic behaviour. Demographic literature underlines also as other ideational dimensions like anomies and subjective wellbeing can produce a causal effect on individuals' intentions (Philipov, Speder and Billari, 2006) and subsequent life course decisions. In addition, these dimensions are also subjected to a process of adaptation on new life course paths similarly to what happens for attitudes and value orientations.

In particular, many past studies support the idea that decisive life course events like childbearing and entry in partnership can improve the psychological wellbeing of individuals and reduce loneliness and disorientation. However, the identification of a possible adaptive effect of life course events on subjective wellbeing shows statistical problems in estimates due to 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 the post-childbirth subjective wellbeing with the effect of overestimating children's positive effect. Propensity score matching is a statistical method that was developed in observational studies (Rosenbaum and Rubin, 1983; Rosenbaum, 2002) in order to reduce estimates' bias due to observable confounders and to identify the causal effect of binary variable on continuous outcomes.

In the study presented here, it has been used a micro-level survey on family formation in Bulgaria, in order to identify a process of causation and adaptation that links anomie measures, fertility behaviour and union formation. For this reason, the analysis is divided in a two stages step. In the first stage, two simple logit models are implemented in order to identify separately the determinants of childbearing and of new union formations. The logit regression results are also helpful for the second stage of the analysis when implementing a propensity score matching in order to identify the effects of childbearing and of union formations on measures of anomie and subjective wellbeing.

The remainder of the paper is organized as follows. Section 2 outlines the theoretical background that addressed the subjective wellbeing framework. Section 3 gives

information about the data and the outcome variables while Section 4 provides details on the statistical methodology. Section 5, 6 and 7 present, analyze and discuss empirical results. Appendixes give further details on estimates and provide some robustness checks.

4.2. Anomies and subjective wellbeing in sociological literature

As Kohler, Behrman and Skytthe (2005) had pointed out, also in countries characterized by lowest levels of fertility, an emerging issue is answering to the following question: "Why do individuals in developed countries continue to form union and have children?" Most studies developed a theory based on the costs and benefits of having children and entering partnerships. This approach assumes that individuals derive a 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 paths is in literature expressed as *subjective wellbeing* strictly linked to *happiness*. Easterlin (2001) uses the terms *happiness*, *subjective wellbeing* and *utility* interchangeably in order to measure the satisfaction associated to events in the life cycle. The main way through which *subjective wellbeing* is measured is represented by a direct question used since 1972 in the U.S. General Social Survey: "Taken all together, how would you say that you are very happy, pretty happy, or not too happy?". A similar question was used by Kohler, Behrman and Skytthe (2005) to measure *happiness* in presence of childbearing and partnership: the exact wording of the item is very similar to that used by Easterlin (2001) and confirms its reliability thanks to many psychologists such as Veenhoven (1993) and Diener (1984). Results of Kohler, Behrman and Skytthe (2005) survey, led to a sample of Danish twins, stated that the birth of a first child strongly increases *subjective wellbeing*, whereas there is uncertainty about the effect of the birth of a second child, which is supposed to be negatively correlated with *happiness* in *within monozygotic twin pair estimates*. In addition, also cohabitation or marriage increases *subjective wellbeing* in Danish Twins. This last finding is only partially consistent with those found by Blanchflower and Oswald (2004), who argued as *subjective wellbeing* is positively correlated with marriage status in Great Britain, between 1975 and 1998. Indeed, in this survey, cohabitation does not show a positive causal impact on *happiness* instead.

In 2006, Philipov, Speder and Billari focused on Hungarian and Bulgarian samples addressing the causal effect of anomie measures on intensions of having a child, demonstrating the strong role of anomie in conditioning individuals' behaviour especially in Bulgaria.

In this framework, it is important to explain the difference between the concept of *subjective wellbeing* and *anomie*. *Subjective wellbeing* is a more general item, measuring the overall satisfaction of individuals with regard to his life. 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. Genov (1998) addressed the impact of *anomie* on the quality of life in Bulgaria, discovering that uncertainty is often linked to high levels of anxiety and fear. Hence, the connection between an anomic society and a decrease of subjective wellbeing is strong.

Anomie measures involve several dimensions of uncertainty and of subjective wellbeing. Philipov, Speder and Billari (2006) addressed five dimensions of anomie and in order to identify their possible effect on childbearing decision. The investigated dimensions are listed as follows:

- The violation of norms and rules;
- Powerlessness;
- Lack of orientations;
- Alienation from work;
- Loneliness.

The authors determined an effect of anomie measures on fertility intentions in their study. As Speder (2009) found that intentions realized in Bulgaria only partially, the goal of the paper is two folded: on the one hand there is the need to determine whether anomie measures predict appreciably not only intentions, but also the individuals' behaviour. During the second stage of this analysis, we follow Kohler, Behrman and

Skytthe (2005) approach and test whether childbearing and marriage/cohabitation contribute to increase *subjective wellbeing* and to reduce *anomie* of individuals. In order to reach this purpose, it is pivotal define more precisely the outcome of the research and the design of the panel used in the analysis.

4.3. Data gathering and research outcome

This study has been carried out using data from a recent survey in Bulgaria entitled *The Impact of Social Capital and Coping Strategies on Reproductive and Marital Behavior* and sponsored by the Max Planck Institute for Demographic Research in Rostock, Germany. The first wave of the survey was carried out in 2002 with the aim of studying family formation and childbearing. 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 indeed to capture changes in intentions, behaviours, values and social characteristics through a panel design.

The present background allows for focusing on the effect of a childbirth or a new partnership[41] (marriage or a non marital cohabitation) between the two waves on the change in anomies measure.

The survey provides questions to measure five dimensions of anomie and alienation such as the violation of norms as, powerlessness, lack of orientations, alienation from work and loneliness. Due to the fact that alienation from work and violation of norms have no effect on fertility intentions, the paper from Philipov *et al.* (2006) decided to focus only on the other dimensions of anomies. The exploratory analysis confirms that childbearing has no effect on alienation from work and on violation of norms and rules also in a recursive perspective. These results involve as well the effect of partnership that is not significant for the same dimensions.

Therefore, the measures of anomies adopted in the following analyses deal with three dimensions:

[41] In this framework, entry in partnership means that respondents included in the survey positively answer to the question "did you marry or did you start to live with a partner in a non-marital cohabitation for at least three months during the two waves?".

- Loneliness,
- Disorientation,
- Powerlessness.

This survey includes several questions related to these conditions and based on questions batteries frequently used in literature for the study of anomies. Following Philipov *et al.* (2006) approach and in order to reduce the number of variables used as research outcome, we implement principal factors analysis to allow for identifying two anomie measures: psychological wellbeing and disorientation.

Psychological Wellbeing

This factor is extracted from the analysis of the responses to two questions that respondents were invited to answer choosing among five point scale opinions 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?" As pointed out by Philipov *et al.* (2006), the common factor investigates the *loneliness* dimension of anomie.

Disorientation

This variable is obtained after an analogous 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". The common factor extracted can be interpreted as a proxy for *disorientation* that is supposed to summarize the disorientation and *powerlessness* dimensions of anomies.

4.4. Statistical methodology

The aim of the empirical analysis is two folded. In a first place, we want to investigate the causal effect of having the first or second child on individuals' measure of anomie. On a second a stage, the purpose is to detect the effect of the entrance in partnership with cohabitation on anomies for individuals that were not in union after the first wave. To measure the impact of childbearing or partnership, we are interested in the difference of the outcomes in the presence of childbearing/partnership or not between the two waves. Consequently, it is important to define respondents, who experimented

alternatively childbirth or entrance in partnership as "treated". Conversely, the others are defined as "untreated". Thus, the assumption is that each individual has two potential outcomes: Y_{1i} in the case the respondent is treated, Y_{0i} in the case the respondent did not receive any treatment. The treatment effect for each respondent included in the survey is $Y_{1i} - Y_{0i}$. As this is individual specific, Rosenbaum and Rubin (1983) suggested to focus on the quantity $E[Y_{1i} - Y_{0i}]$, that is defined in literature as *Average Treatment Effect* (*ATE*), i.e. in our case the expected effect of childbearing or entrance in partnership on a randomly drawn person from the population. Now let T_i be a dichotomous index that takes value 1 if an individual is treated and 0 otherwise. Recent literature[42] proposed to restrict the analysis only to those who are actually eligible for the treatment or are likely to be eligible in the future. Hence, the quantity of interest in the survey is

$$ATT = E[Y_{1i} - Y_{0i} \mid T_i = 1] = E[Y_{1i} \mid T_i = 1] - E[Y_{0i} \mid T_i = 1] \quad (3)$$

that is the mean effect of treatment on attitudes for those who experimented a pregnancy between the two waves or entered in a partnership.

Many problems deal with the identification of *ATT*. The first is that only one among the potential outcomes Y_{1i}, Y_{0i} is observed for each individual, making a direct comparison impossible; consequently, in order to estimate *ATT* one needs to identify the quantity $E[Y_{0i} \mid T_i = 1]$. This is impossible, because it is required to identify the potential outcome of Y_i in the case of absence of pregnancy for an individual that has had a child or started to cohabit instead.

A possible solution to overcome the problem is to use an estimator of $E[Y_{0i} \mid T_i = 0]$.

To replace an estimate of $E[Y_{0i} \mid T_i = 1]$ with that of $E[Y_{0i} \mid T_i = 0]$, we deal with the possible presence of selection bias: treated individuals may be qualitatively different from the others. For example, considering the Bulgarian context attached to a single-child family pattern, people belonging to older cohorts should be less likely to give birth to a child as well as younger people are more likely to enter into partnership. Similarly,

[42] See Heckman (1997). For examples of applications of propensity score matching in Economic Literature, see Dehejia R., Wahba S. (1999, 2002); For demographic fields see Aassve *et al.* 2007, Aassve and Lappegård, 2008

more educated individuals may show a higher propensity to postpone parenthood. As a result, an estimation of *ATT* based on a difference between the sample means of treated and untreated groups may lead to bias estimates of *ATT*.

A possible solution is conditioning on pre-treatment covariates *X* and then computing an overall mean:

$$ATT = E[Y_{1i} - Y_{0i} \mid T_i = 1] = E_{X|T_i=1}\{E[Y_{1i} - Y_{0i} \mid X_i, T_i = 1]\} =$$
$$E_{X|T_i=1}\{E[Y_{1i} \mid X_i, T_i = 1] - E[Y_{0i} \mid X_i, T_i = 1]\} = \quad (4)$$
$$= E_{X|T_i=1}\{E[Y_{1i} \mid X_i, T_i = 1] - E[Y_{0i} \mid X_i, T_i = 0]\}$$

Identification of *ATT* in (3) is feasible if imposing *mean* independence (Smith and Todd, 2005), i.e. $E[Y_{0i} \mid X_i, T_i = 1] = E[Y_{0i} \mid X_i, T_i = 0]$ (5)

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

Rosenbaum and Rubin (1983) proposed matching based on a quantity called *propensity score*, which is the conditional probability of receiving the treatment given *X*, $P[T_i = 1 \mid X_i]$. Rosenbaum and Rubin (1983) stated 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:

$$ATT = E_{p(X_i)}\{E[Y_{1i} \mid p(X_i), T_i = 1] - E[Y_{0i} \mid p(X_i), T_i = 0]\}^{43} \quad (6)$$

Several matching algorithms[44] can be used to estimate (4); in such case we will have that

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[43] In general two other conditions are required to use successfully equation (7). Firstly, $0 < P(T = 1 \mid X) < 1$, that implies equality in the support of *X* in the two groups of treated and controls and, secondly, $T \perp X \mid p(X)$. The first condition could be guaranteed imposing the common support of covariates before estimating *ATT*. The last condition is called *balance property* and requires that observations with the same propensity score have the same distribution of covariates independently of treatment status. This condition can be tested comparing the differences in means of each covariate between treated and control units.

$$\hat{ATT} = \frac{1}{N_1} \sum_{i \in \{T_i = 1\}} \left[Y_{1i} - \sum_{j \in \{T_i = 0\}} w_{ij} Y_{0j} \right] \quad (7)$$

where N_1 indicates the number of units that experienced childbearing or cohabitation 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* (that gave birth to a child between the two interviews or that entered in partnership) with the closest control unit, such as for example childless between the waves, in terms of propensity score.

More in detail, the additional caliper option matches treated and controls with similar propensity score 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.

In literature, propensity score matching presents several advantages: for example, it is a non-parametric approach and does not require any specification in a functional form for the relationship between the outcome and the treatment, in this case attitudes indexes and childbearing. Differently from the standard regression approach, the effect of the treatment could vary across individuals, without affecting the efficiency of the estimates.

Propensity score matching presents also a strong disadvantage: its estimates give robust results when individuals are matched to observables but fail in presence of unobservable confounding factors. When in presence of unobservables affecting both assignment into treatment and the outcome variable simultaneously, a 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 measures. These variables limit the influence of omitted or unobservable variables.

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

[44] In this setting, I used the Stata modules written by Becker and Ichino (2002) and Leuven and Sianesi (2003).

mean change of anomie measures from the first wave t and the second wave $t+\Delta t$ in the following equation:

$$DD = E(Y_{1i}^{t+\Delta t} - Y_{1i}^{t}) - E(Y_{0i}^{t+\Delta t} - Y_{0i}^{t}) = E(\Delta_{1i}) - E(\Delta_{0i}) \quad (8)$$

After replacing the expected values with the sample means the so-called *difference in difference estimator* can be obtained.

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. The *DD-PSM* combined estimates the subsequent quantity:

$$ATT_{DD} = E_{p(X_i)}\{E[\Delta_{1i} \mid p(X_i), T_i = 1] - E[\Delta_{0i} \mid p(X_i), T_i = 0]\} \quad (9)$$

Obviously, even this assumption might be violated, if some time varying confounders exist. In such case, also the estimator of (9) fails and we have to implement a sensitivity analysis, in order to quantify the effect determined by unobservable sources of bias.

In order to compute the *difference in difference estimator*, one needs to evaluate how anomie measures changed between the first and the second interview. The outcome of each anomie dimension for the first wave has been obtained through a factor analysis that represents a linear combination of J items, each of them weighted with factor coefficient a_{ijt}:

$$Y_{it} = \sum_{j=1}^{J} a_{ijt} X_{ijt} \quad (10)$$

The measure used for the second wave maintains constant the coefficient $a_{ijt} = a_{ij}$ from the first wave and replaces the vector of observation in t with that observed in $t+\Delta t$.

$$Y_{i(t+\Delta t)} = \sum_{j=1}^{J} a_{ij} X_{ij(t+\Delta t)} \quad (11)$$

Hence, in order to obtain the *difference in difference estimator* for the outcome we can use the arithmetic difference of (10) and (11); therefore the observed outcome for each individual included in the sample is

$$\Delta_i = \left[\sum_{j=1}^{J} a_{ij} X_{ij(t+\Delta t)}\right] - \left[\sum_{j=1}^{J} a_{ij} X_{ijt}\right] = \sum_{j=1}^{J} a_{ij}\left(X_{ij(t+\Delta t)} - X_{ijt}\right) \quad (12)$$

5. Propensity score specification

Propensity Score can be estimated through simple econometric models. The most common are probit and logit models. The results of regression odd ratios are also helpful for giving information about the determinants of childbearing and partnership and then to remove most of the bias attributable to observable covariates. In this setting, we implement two separate logit models for determinants of childbearing and for marriage or entrance in cohabitation. The analysis, led separately for males and females, includes the explanatory variables listed in the following three categories: demographic variables, economic and social background, ideational factors.

Demographic variables

The variables used are the following: age and the number of siblings. In addition, we include the number of children in the first wave and marital status for the childbearing regression only. In particular, respondents were asked to choose among the following options: married, cohabited and *not in union* that collects never in union, widowed and divorced/separated individuals with respect to investigation for marital status. Partnership regression requires a partially different specification of the model that excludes the marital status for the first wave and that includes details on the presence or less of past partnerships before the first interview. The reason for the inclusion of this covariate belongs to the paper of Kohler, Behrman and Skytthe (2005), which demonstrates how the presence of "at least one partnership" in respondents' life course could affect psychological wellbeing. In light of this, Rubin and Thomas (1996) suggest excluding only the variables unrelated to both the outcome and treatment from the model; hence past partnership, which are supposed to influence the outcome, appear in the covariates' list.

Economic and social background

The household income is expressed in levas, and the labour market position is summarized in four categories: "Does not work or study", "Studies, does not work", "Works in a state firm" and, finally "Works in a private firm" that is extended also to mixed firms.

The analyses offer details also on the educational level of respondents and their parents. In particular, the following categories are used: "Basic or less" that collects all the

educational levels below secondary; "Secondary" which consists in approximately twelve years in school, usually completed at age 18-19; finally we provide a category for higher education, which indicates a level higher than secondary. Economic and social variables are used for both the logistic regressions that address the determinants of childbearing and partnership.

Ideational factors

In this context, we decide to add also proxies for ideational factors in propensity score model. Indeed, unobservable factors undermine the robustness of propensity score estimates and combined *DD-PSM* estimator is only helpful for reducing time invariant sources of hidden bias. However, the nature of the survey, that includes questions related to ideational factors that are usually unmeasured, allows us for adding proxies of unobservable factors among covariates; this approach basically smoothes the effect of unobservables on the improper assignment on treated or untreated group. Finally, ideational variables give additional details on the determinants of subsequent life course events.

The first presented factor refers to religiosity of respondents: basically, we create a dummy variable that takes value one, if individuals affirmatively answer to the question "Independently of whether you go to church or not, would you say that you are a religious person?" or if the answer is negative but the respondent declares to attend religious services more often than once a week. Conversely, the variable *Religious* takes value zero in all the other cases. Ideational factors provide also measures of social capital. The proxy used to summarize the impact of social capital on life course events is obtained using questions about the exchange of help as suggested by Philipov and Shkolnikov (2003). The variable *Exchange of help* is built in two separate stages. In the first stage, we have built the variable *help received* combining the questions "During the last two years, how many people helped or supported you substantially?" and "If you need substantial help and support, how many people can you ask for this?" (Buehler and Philipov, 2005). During the same stage, I have built a second variable the we have defined *help given* obtained combining "How many people have you helped out in the last two years?" and "How many people do you think would ask you for help and support if they needed it?". The final stage has provided a principal factor analysis in order to extract a common factor from *help received* and *help given*. This last variable is

called *Exchange of help* and represents a useful measure of social capital (see for details Buehler and Philipov, 2005).

Ideational factors include also attitudes that are proved to be often correlated with the behaviour (Lesthaeghe and Moors, 2002 and Lesthaeghe and Surkyn 2004). In childbearing regression we follow Philipov *et al.* (2006), who consider the agreement to the statement "Parents should have a life of their own and should not be asked to sacrifice their own wellbeing for the sake of their children". Agreement to this question implies an anti-traditional point of view in a post-materialistic sense (Inglehart, 1970). Conversely, disagreement to the statement could be related to a more traditional family pattern.

Tab. 1. Odds Ratio for determinants of childbearing: results of logit model.

	MALES		*FEMALES*	
Variables	Odd Ratio	S.E	Odd Ratio	S.E.
Age				
18-24	1		1	
25-29	1.079	(0.152)	0.844	(0.103)
30-34	0.726*	(0.125)	0.370***	(0.060)
Number of children at 1st wave	0.311***	(0.033)	0.413***	(0.038)
Number of Siblings	1.312***	(0.067)	1.057	(0.052)
Marital Status				
Not living with a partner	1		1	
Married	9.552***	(1.646)	2.815***	(0.412)
Cohabited	10.219***	(1.753)	3.343***	(0.503)
Income in the household (in Leva)				
Income<=200	1		1	
200<Income<=400	0.578***	(0.103)	0.703**	(0.118)
400<Income<=600	0.494***	(0.102)	0.660**	(0.123)
Income>600	0.612*	(0.154)	0.685	(0.158)
Labour Market Position				
Does not work or Study	1		1	
Studies, does not work	0.237***	(0.115)	0.574***	(0.122)
Works in a private firm	1.260	(0.185)	0.974	(0.115)
Works in a state firm	1.012	(0.211)	1.041	(0.194)
Education				
Basic or less	1		1	
Secondary	0.671**	(0.110)	0.693**	(0.110)
Higher	1.147	(0.277)	0.935	(0.190)
Father's Education				
Basic or less	1		1	
Secondary	1.235	(0.243)	1.088	(0.182)
Higher	0.915	(0.264)	0.792	(0.182)
Mother's Education				
Basic or less	1		1	
Secondary	0.956	(0.188)	0.905	(0.160)
Higher	1.199	(0.328)	1.142	(0.255)
Non Religious	1		1	
Religious	1.048	(0.115)	1.095	(0.111)
Parents should have a life of their own				
Disagree	1		1	
Agree	0.783**	(0.096)	1.190	(0.141)
Psychological Wellbeing	1.135	(0.087)	1.134**	(0.066)
Disorientation	0.977	(0.094)	1.001	(0.084)
Exchange of Help	1.011	(0.096)	1.062	(0.103)
Number of observations	2821		2938	
Pseudo R^2	.15		.09	

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

In the partnership regression we replace the previous attitude, which is related to fertility, on a similar statement about partnership effect on individual life. Respondents are asked to answer whether they agree to the following sentence: “Living together with a friend in a marriage or non marital cohabitation would decrease your independence”. In this context, respondents that agree to the item give less importance to living together for their own self realization, showing an attitude towards single life. Finally, we add the starting level of anomie’ measures to improve the matching procedure and to test the presence of a recursive effect of selection and adaptation similar to those proposed for values by Lesthaeghe and Moors (2002) and tested by Sironi (2009b) for Bulgarians.

Table 1 displays odd ratios estimates for the determinants of childbearing:

As expected, older cohorts are less likely to have a child between the two waves. This finding is consistent with the literature (see for example Sobotka, 2004), which remarks the low mean age of women at first birth in Bulgaria. It is also not surprising that the coefficient of the number of children in the first wave strongly decreases the likelihood of having a child between the waves; indeed, a relatively low mean age at first birth is associated in Bulgaria to a strong attachment to a single-child family pattern in a lowest-low fertility context. In other words, Bulgarians have a first child relatively soon and often out of wedlock, but only in few cases plan a second order childbirth. The number of siblings is positively correlated with the probability to have a child, but this result holds only for men.

Conversely, marital status seems to play a key role in determining fertility events. Married and cohabiting individuals are more likely to get pregnant between the waves, even if the result is stronger for men. In particular, the coefficient size is larger for cohabiting couples, underling the increase of out of wedlock births. As underlined by Koytcheva (2006), mean age at marriage has overcome mean age at first birth in recent years.

Economic factors also plays a prominent role in determining childbearing: the middle class seems to be less likely to have a child between 2002 and 2005, showing a U-shape relationship between income and fertility plans, even if it is the occupational status to have the strongest impact on fertility decisions: students are less likely to have a child. This effect is a clear consequence of a widespread access to highest level of education that represents a reason for parenthood postponement. This result affects also the

significance of the coefficient of educational level: respondents that completed secondary school are less likely to become parents; these results would be influenced by the fact that all university students, that usually delay marriage and childbearing, fall in this category.

Ideational factors complete the analysis of covariates, showing strong gender heterogeneity in determinants of fertility behaviour. As expected, males who agree with the statement "Parents should have a life of their own" are less likely to become parents and show clear preferences for childless life or for a postponement of parenthood; on the contrary, this attitude does not predict females' behaviour.

An opposite pattern concerns the role of psychological wellbeing that is substantially connected to childbirths in females' subsample, but not among males, even if the magnitude of odd ratios is similar in the two cases.

More in details, attitudes seems to have a stronger impact on males than on females as displayed in Sironi (2009a), whereas anomie measures of psychological wellbeing play a key role in females' subsample.

Disorientation and Social Capital seem to have no effect on fertility, which can be compared in intensity to that of religiosity: in this case, it has to remarked that religious people belong in most part to Christian-Ortodoxy Church that shows no differences in terms of behaviour with respect to non-religious individuals. Sironi (2009b) shows that the Islamic minority is more likely to get pregnant between the two waves conversely.

Tab. 2. Odds Ratio for determinants of marriage/cohabitation: results of logit model.

	MALES		*FEMALES*	
Variables	Odd Ratio	S.E	Odd Ratio	S.E.
Age				
18-24	1		1	
25-29	0.997	(0.169)	0.883	(0.188)
30-34	0.498**	(0.157)	0.429***	(0.124)
Never lived with a partner	1		1	
Lived with a partner	2.161**	(0.820)	1.604*	(0.413)
Number of Siblings	1.000	(0.103)	0.951	(0.103)
Income in the household (in Leva)				
Income<=200	1		1	
200<Income<=400	0.844	(0.227)	0.706	(0.253)
400<Income<=600	0.523**	(0.158)	0.645	(0.242)
Income>600	0.611	(0.212)	0.757	(0.310)
Labour Market Position				
Does not work or Study	1		1	
Studies, does not work	0.371***	(0.137)	0.709	(0.190)
Works in a private firm	1.573**	(0.293)	1.221	(0.252)
Works in a state firm	1.220	(0.361)	0.755	(0.246)
Education				
Basic or less	1		1	
Secondary	0.766	(0.175)	1.613	(0.497)
Higher	1.528	(0.531)	1.917*	(0.693)
Father's Education				
Basic or less	1		1	
Secondary	1.278	(0.309)	0.637*	(0.173)
Higher	0.989	(0.343)	0.556*	(0.186)
Mother's Education				
Basic or less	1		1	
Secondary	0.690	(0.158)	0.948	(0.273)
Higher	0.732	(0.234)	1.054	(0.359)
Non Religious	1		1	
Religious	1.030	(0.155)	1.367*	(0.231)
Living with a partner decreases independence				
Disagree	1		1	
Agree	0.911	(0.137)	0.785	(0.126)
Psychological Wellbeing	1.168	(0.117)	1.199**	(0.110)
Disorientation	0.985	(0.127)	1.087	(0.144)
Exchange of Help	0.970	(0.138)	1.064	(0.163)
Number of observations	1314		865	
Pseudo R^2	.05		.04	

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

Table 2 provides evidence for associations between partnership and its determinants. As it has been found above, older cohorts are less likely to marry or to live in a non marital cohabitation. The event likelihood is highest between 18 and 24 and regularly decreases

year by year. In this framework, the marital status and the number of children at first wave has been replaced with a dummy variable indicating whether the respondents were married or lived in a non-marital cohabitation in the past. As we can see, respondents whose answer has been affirmative are more likely to start a new partnership with cohabitation and the effect is stronger among males.

Labour market position also affects partnership choices and the effects are more relevant for men: being students drastically reduces the probability to marry/cohabit with a partner. On the other hand, working for a private firm has a positive effect on the decision of cohabiting. Females show a similar size for coefficients but their effect appears to be non significant. Ideational factors play again a key role in determining females' behaviour: psychological wellbeing is positively correlated to marriage/cohabitation such as for childbearing. Psychological wellbeing increases also males' likelihood, but the effect is not statistically significant.

Despite of the results, summarized in Table 1, Religiosity is significant in determining marriage, but the effect is significant for only women.

All the other ideational variables do not affect the decision of marrying/cohabiting with the partner. In particular, attitude, although the odd ratio is smaller than one as expected, does not seem to predict behaviour in this case, even if we would need more detailed analyses to confirm the result.

4.6. Empirical results

Because of the birth of the first child is likely to represent a major change of status and leads to considerable reorganization of family and individual life, we decided to lead separate analyses for the effect of the birth of a first or second child.

Table 3 presents the effects of a first child on two anomie dimensions, i.e. psychological wellbeing and disorientation. The results affirm that entering to motherhood increases psychological wellbeing, whereas not any effect seems to involve this anomie measure for men's subsample. Females' result is consistent to that obtained by Kohler *et al.* (2005), who demonstrated how the birth of first child increases subjective wellbeing. In this framework, it is important to remark that measures of psychological wellbeing are different in the survey form Kohler *et al.*: indeed they consider a more general dimension of happiness that answers to question "How satisfied are you with your life,

all things considered?". On the contrary, the measure of *psychological wellbeing* is more specific and focuses especially on loneliness and depression dimensions of *psychological wellbeing*. In addition, this measure is complementary to others dimensions of anomie and happiness like *disorientation* that is also studied in this context. However, although a comparison with other studies is always imperfect, I can conclude that some of the findings are consistent with literature that links fertility to happiness.

Focusing now on disorientation dimension, we obtain that childbearing seems to have no effect on this dimension of anomie in both females' and males' subset.

Table 3 confirms that also the birth of a second child does not decrease disorientations in Bulgarian respondents.

Tab 3. Estimates of propensity score estimation – First Child – (Nearest neighbour matching within a caliper).

Anomies		*MALES*		*FEMALES*	
		Unmatched	Matched	Unmatched	Matched
Psychological Wellbeing	Treated	.060	.060	.132	.134
	Controls	.027	.064	.127	-.120
	ATT	.033	-.004	.005	.254**
	(t stat)	(.49)	(-.04)	(.07)	(2.24)
Disorientation	Treated	-.155	-.155	-.138	-.143
	Controls	-.178	-.192	-.176	-.191
	ATT	.023	.037	.037	.048
	(t stat)	(.44)	(.45)	(.75)	(.58)

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

Surprisingly, mothers' Psychological wellbeing is affected by the birth of a second child again. Kohler *et al.* (2005), analyzing Danish twins cohorts, found a negative correlation between happiness and second or higher order childbirths. As expected, the increase of psychological wellbeing associated to a second child is smaller than that associated to first one. Moreover, the effect is only significant at 10% level. In addition, the *ATT* turns not significant also for women if third and higher order births are also included in the analysis. Results on disorientation confirm not significant for all the samples.

Tab 4. Estimates of propensity score estimation – Second Child – (Nearest neighbour matching within caliper).

Anomies		*MALES*		*FEMALES*	
		Unmatched	Matched	Unmatched	Matched
Psychological Wellbeing	Treated	.087	.075	.064	.068
	Controls	.062	.117	.025	-.127
	ATT	.072	-.042	.039	.195*
	(t stat)	(.35)	(-.40)	(.50)	(1.82)
Disorientation	Treated	-.119	-.117	-.144	-.145
	Controls	-.141	-.109	-.121	-.174
	ATT	.022	-.009	-.023	.029
	(t stat)	(.34)	(-.09)	(-.44)	(.38)

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

Combined *PSM-DD* estimator is reliable only in presence of time-invariant sources of bias. However, the assumption of unconfoundedness would be violated if selection occurs on time-variant unobservables. In order to test the robustness of propensity score estimates in case of failure of unconfoundedness assumption, we implemented a sensitivity analysis, using Rosenbaum's (2002) procedure for bounding the treatment effect estimates in previous tables. Results for sensitivity analysis are described in Appendix B and provide evidence for robustness of estimates at heterogeneous levels of hidden bias; in this case, we test the significance level of treatment effect in case of unmeasured heterogeneity in treatment assignment 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, its positive effect is questioned in presence of an unobservable covariate that causes the odd ratios of differential treatment assignment by about 1.3. Results from Table 4 are less robust, being robust only for a value of the odd ratio equal to 1.05; therefore, evidence of an increase of wellbeing due to a second child is strongly sensitive to hidden bias.

If we focus on the consequences of a new union (marriage or cohabitation) on anomie measures, the results are more informative.

Tab 5. Estimates of propensity score estimation – Marriage/Cohabitation – (Nearest neighbour matching within caliper).

Anomies		*MALES*		*FEMALES*	
		Unmatched	Matched	Unmatched	Matched
Psychological Wellbeing	Treated	.283	.286	.346	.346
	Controls	-.005	-.081	.109	.025
	ATT	.288***	.368***	.237***	.320***
	(t stat)	(4.05)	(3.56)	(2.93)	(2.92)
Disorientation	Treated	-.190	-.207	-.269	-.269
	Controls	-.166	-.146	-.106	-.135
	ATT	-.024	-.061	-.163***	-.134*
	(t stat)	(-0.43)	(-0.74)	(-2.89)	(-1.69)

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

Table 5 shows how psychological wellbeing increases after marriage or cohabitation: estimates of size are higher for men, confirming findings from Kohler *et al.* (2005).

Rosenbaum bound checks suggest that selection due to unobservables would have to attain level between 1.4 and 1.5 to undermine the significance of treatment effect estimates, confirming the results as more robust to hidden bias.

Another remarkable result is that a new partnership reduces disorientation dimension of anomie in women, but sensitivity analysis suggests being careful in considering the significance of the treatment effect.

Matching is based on the *nearest neighbour* method with *replacement* using the psmatch2 module in *STATA* (Leuven and Sianesi, 2003). The reliability of the estimates depends on several factors, such as the balance property being satisfied, the sensitivity to the imposition of common support and the matching method used. With respect to the first condition it is reasonable to argue that balance property is satisfied for all matching procedures implemented in this section (for details, see Appendix A); in particular, differences in means are never statistically significant at 10% level, after propensity score matching. In addition, bias after matching is in almost all the cases below 10% as it can be found in Di Prete and Gangl (2004).

With regard to common support imposition, the only remark to be made is that only few observations fall out of it: this excludes the chance of further sources of bias deriving from sample selection.

Finally, results confirm themselves also robust when the matching methods are changed. In particular, we test robustness of findings using nearest neighbour without

replacement and radius matching (imposing a caliper equal to 0.05). In all cases, analysis provides solutions that are close to those obtained with nearest neighbour matching with replacement. This demonstrates that the analyses are not sensitive to the selection methods of control units.

4.7. Discussion and conclusion

Empirical results offer several arguments for a discussion. Indeed, the empirical analysis is led in two stages; in a first stage we have implemented a logit regression to detect the impact of demographic, economic and ideational factors on life course events, such as childbearing, cohabitation and marriage. The results show interesting results: in particular, psychological wellbeing seems to play a key role in determining a process of individual selection in females' life course paths. Hence, the positive effect of psychological wellbeing is remarkable for both choices of childbearing and cohabitation, while psychological wellbeing seems to be irrelevant in determining males' choices. However, this finding does not imply that men are less sensitive to ideational factors than women; in this context and in other works (Sironi, 2009a), it emerges that men are more sensitive to attitudes selection than to anomie effects; indeed Table 1 shows that respondents agreeing to the item "Parents should have a life of their own" are less likely to give birth to a child between the two waves: this attitude is considered to be a general attitude. The stronger effect of attitudes on men's decision holds also with regard to personal attitudes as shown in the literature by Sironi (2009a). In conclusion of the first part of the analysis, with respect to ideational factors, psychological wellbeing is the strongest behavioural predictor for females, whereas attitudes seem to play a prominent role for males.

In the second place, psychological wellbeing, such as attitudes, are subjected to a process of adaptation as a consequence of life course decisions. Propensity score matching allows us to identify the causal effect of childbearing (or a new union) on anomie measures controlling for covariates and reducing the bias due to observable confounders. In addition, propensity score matching does not require any functional form of dependence between independent variable and outcome. The presence of ideational factors in confounders list and the combined use of a difference in difference estimator also protect estimates from possible sources of hidden bias: results confirm

the presence of a process of anomie reduction in presence of childbearing and new partnerships. In particular, loneliness dimension of anomie is summarized by the factor labelled as *psychological wellbeing* and seems to be more sensitive to a process of adaptation, especially for women that increase wellbeing when they start a new cohabitation or when they get pregnant. Obviously, the increase in wellbeing is higher for a first child than for the second one. Disorientation dimension of anomie shows a more controversial result since it has a positive effect of partnership only on females' psychological wellbeing.

These results are complementary to those obtained by Sironi (2009b) in addressing the process of attitude adaptation: Bulgarians show to react in a complex way to childbearing: on the one hand childbirth increases psychological wellbeing; on the other hand it decreases positive attitudes towards a further childbirth; this result is not surprising in a lowest-low fertility context, where the choice of entering in parenthood is linked to desire of happiness of parents, but the number of children is required to be limited to only one child, in order not to compromise parents' opportunities in self-realization.

Appendix 4.A: balance property in propensity score estimations

The following tables demonstrate how matching restricts the control sample in order to increase the similarity of the control cases selected to be directly compared with treated cases. Table A.1. and following present the means results for all the covariates included in the propensity score specification as they appear in Tables 1 and 2. In all the cases it is evident that samples differences in means between treated and control units become not significant after the matching procedure. This finding allows to check the balance score that requires $T \perp X \mid p(X)$ as shown in the methodological section. The other key condition $0 < P(T = 1 \mid X) < 1$ is obtained through the imposition of common support. In these ways, propensity score reduces the bias and allows us for joining a rather high degree of covariate balance between control and treatment samples; in addition, we use the standardized mean difference between treated and controls (Rosenbum and Rubin, 1985) in order to quantify the bias between treated and control samples

$$bias = \left| \frac{100(\bar{x}_T - \bar{x}_C)}{\sqrt{\frac{(s_T^2 - s_C^2)}{2}}} \right| \qquad \text{(A.1)}$$

where $\bar{x}_T$ and s_T^2 are summary statistics (sample mean and variance) for treated and control units, whereas $\bar{x}_C$ and s_C^2 are the comparable ones for controls. By these measures bias is often reduced below 10% by the matching process. However, even if larger than 10% in few cases, the bias never determines statistically significant differences in covariates' means for treated and controls after matching[45].

The Tables below concern significant *ATT* from the previous section:

[45] To obtain this results we have sometimes introduced interaction terms, as suggested by Caliendo and Koepinig (2005).

Tab A.1. Balance Check – Psychological Wellbeing – First Child – *Females* – (Nearest neighbour matching within a caliper)

		Mean			%reduct		
Variable	Sample	Treated	Control	%bias	|bias|	t	p>|t|
Par. have life their own	Unmatched	0.79931	0.74873	12.1		1.73	0.084
	Matched	0.80208	0.79861	0.8	93.1	0.1	0.917
Psychological wellbeing	Unmatched	-0.02507	-0.1895	18.7		2.66	0.008
	Matched	-0.02801	-0.04662	2.1	88.7	0.27	0.79
Disorientation	Unmatched	-0.01764	-0.07248	9		1.3	0.194
	Matched	-0.01785	-0.05591	6.2	30.6	0.78	0.438
Exchange of help	Unmatched	0.10197	0.06109	7.4		1.11	0.268
	Matched	0.09949	0.03749	11.2	-51.7	1.34	0.181
200<Income<400 leva	Unmatched	0.41176	0.38452	5.6		0.81	0.417
	Matched	0.40972	0.45833	-9.9	-78.4	-1.18	0.24
400<income<600 leva	Unmatched	0.38754	0.3934	-1.2		-0.17	0.862
	Matched	0.38889	0.34028	10	-729.9	1.21	0.226
income>600 leva	Unmatched	0.12457	0.15609	-9.1		-1.29	0.197
	Matched	0.125	0.13889	-4	55.9	-0.49	0.623
Studies (Does not work)	Unmatched	0.10035	0.19162	-26		-3.58	0
	Matched	0.10069	0.125	-6.9	73.4	-0.92	0.357
Works pvt	Unmatched	0.50519	0.45939	9.2		1.33	0.182
	Matched	0.50694	0.48611	4.2	54.5	0.5	0.618
Works state	Unmatched	0.10727	0.11675	-3		-0.43	0.665
	Matched	0.10764	0.12847	-6.6	-119.6	-0.77	0.439
Married	Unmatched	0.23183	0.05457	52.2		8.81	0
	Matched	0.22917	0.21875	3.1	94.1	0.3	0.765
Cohabited	Unmatched	0.23183	0.08376	41.4		6.67	0
	Matched	0.23264	0.26042	-7.8	81.2	-0.77	0.44
Secondary Edu	Unmatched	0.5917	0.61041	-3.8		-0.56	0.578
	Matched	0.59375	0.58333	2.1	44.3	0.25	0.8
Higher Edu	Unmatched	0.27682	0.27411	0.6		0.09	0.93
	Matched	0.27778	0.24306	7.8	-1183.7	0.95	0.343
N. of siblings	Unmatched	1.1903	1.1168	9.2		1.33	0.185
	Matched	1.1875	1.1944	-0.9	90.6	-0.1	0.919
Secondary Edu Father	Unmatched	0.59862	0.58629	2.5		0.36	0.716
	Matched	0.60069	0.57986	4.2	-69.1	0.51	0.612
Higher Edu Father	Unmatched	0.15225	0.22589	-18.9		-2.65	0.008
	Matched	0.15278	0.125	7.1	62.3	0.96	0.336
Secondary Edu Mother	Unmatched	0.56055	0.56726	-1.4		-0.2	0.844
	Matched	0.5625	0.50694	11.2	-728.5	1.34	0.182
Higher Edu Mother	Unmatched	0.20069	0.24873	-11.5		-1.65	0.1
	Matched	0.20139	0.18403	4.2	63.9	0.53	0.598
Religious	Unmatched	0.65052	0.64213	1.8		0.25	0.799
	Matched	0.64931	0.68056	-6.5	-272.6	-0.79	0.428
Age24-29	Unmatched	0.31488	0.25508	13.3		1.96	0.051
	Matched	0.31597	0.31944	-0.8	94.2	-0.09	0.929
Age30-34	Unmatched	0.09343	0.12563	-10.3		-1.46	0.145
	Matched	0.09375	0.10417	-3.3	67.7	-0.42	0.676
Number of Treated			*288*				
Number of Controls			*788*				

Tab A.2. Balance Check – Psychological Wellbeing – Second Child – *Females* – (Nearest neighbour matching within a caliper)

		Mean			%reduct		
Variable	Sample	Treated	Control	%bias	|bias|	t	p>|t|
Par. have life their own	Unmatched	0.75806	0.78372	-6.1		-0.86	0.392
	Matched	0.76423	0.70732	13.5	-121.8	1.43	0.153
Psychological wellbeing	Unmatched	-0.06019	-0.10128	4.9		0.66	0.507
	Matched	-0.06407	-0.02493	-4.6	4.7	-0.5	0.615
Disorientation	Unmatched	0.04919	0.06425	-2.4		-0.34	0.733
	Matched	0.04889	0.1193	-11.4	-367.5	-1.28	0.203
Exchange of help	Unmatched	-0.00959	0.00511	-3		-0.42	0.674
	Matched	-0.00348	-0.00291	-0.1	96.1	-0.01	0.99
200<Income<400 leva	Unmatched	0.40323	0.41628	-2.7		-0.37	0.713
	Matched	0.4065	0.39837	1.7	37.7	0.18	0.854
400<income<600 leva	Unmatched	0.35484	0.41512	-12.4		-1.71	0.088
	Matched	0.35772	0.41057	-10.9	12.3	-1.2	0.229
income>600 leva	Unmatched	0.10081	0.08488	5.5		0.78	0.437
	Matched	0.10163	0.05691	15.4	-180.8	1.84	0.067
Studies (Does not work)	Unmatched	0.03629	0.04186	-2.9		-0.39	0.696
	Matched	0.03659	0.06098	-12.6	-337.9	-1.26	0.21
Works pvt	Unmatched	0.37097	0.3814	-2.1		-0.3	0.766
	Matched	0.36992	0.41463	-9.2	-328.8	-1.01	0.311
Works state	Unmatched	0.1129	0.12558	-3.9		-0.54	0.592
	Matched	0.11382	0.08943	7.5	-92.4	0.89	0.372
Married	Unmatched	0.59274	0.65	-11.8		-1.65	0.099
	Matched	0.5935	0.64634	-10.9	7.7	-1.21	0.228
Cohabited	Unmatched	0.33871	0.26395	16.3		2.31	0.021
	Matched	0.3374	0.30081	8	51.1	0.87	0.385
Secondary Edu	Unmatched	0.46774	0.59186	-25		-3.49	0.001
	Matched	0.47154	0.47967	-1.6	93.4	-0.18	0.857
Higher Edu	Unmatched	0.25403	0.25116	0.7		0.09	0.927
	Matched	0.2561	0.2561	0	100	0	1
N. of siblings	Unmatched	1.3629	1.2535	10.2		1.45	0.148
	Matched	1.3577	1.439	-7.6	25.7	-0.76	0.445
Secondary Edu Father	Unmatched	0.58468	0.59651	-2.4		-0.33	0.738
	Matched	0.58943	0.62602	-7.4	-209.1	-0.83	0.407
Higher Edu Father	Unmatched	0.10484	0.12791	-7.2		-0.97	0.33
	Matched	0.10569	0.09756	2.5	64.8	0.3	0.766
Secondary Edu Mother	Unmatched	0.52419	0.60581	-16.5		-2.3	0.021
	Matched	0.52846	0.53252	-0.8	95	-0.09	0.928
Higher Edu Mother	Unmatched	0.14113	0.11977	6.3		0.9	0.37
	Matched	0.14228	0.12602	4.8	23.9	0.53	0.598
Religious	Unmatched	0.62097	0.6093	2.4		0.33	0.74
	Matched	0.61789	0.65041	-6.7	-178.8	-0.75	0.455
Age24-29	Unmatched	0.41129	0.3593	10.7		1.49	0.136
	Matched	0.41463	0.41057	0.8	92.2	0.09	0.927
Age30-34	Unmatched	0.18548	0.33953	-35.5		-4.68	0
	Matched	0.18699	0.1748	2.8	92.1	0.35	0.726
Number of Treated				*246*			
Number of Controls				*860*			

Tab A.3. Balance Check – Psychological Wellbeing – Marriage/Cohabitation – *Males* – (Nearest neighbour matching within a caliper)

		Mean			%reduct		
Variable	Sample	Treated	Control	%bias	|bias|	t	p>|t|
Psychological wellbeing	Unmatched	0.16263	0.09623	8.6		1.16	0.246
	Matched	0.15638	0.16324	-0.9	89.7	-0.1	0.922
Disorientation	Unmatched	0.00099	-0.02291	4		0.54	0.592
	Matched	0.01683	-0.07517	15.2	-285	1.72	0.086
Partner decreases indep.	Unmatched	0.44444	0.47451	-6		-0.84	0.404
	Matched	0.45217	0.49565	-8.7	-44.6	-0.93	0.352
Lived with past partners	Unmatched	0.05128	0.0241	14.3		2.25	0.025
	Matched	0.03478	0.02609	4.6	68	0.54	0.588
Exchange of help	Unmatched	-0.01603	0.0054	-4.2		-0.54	0.587
	Matched	-0.01339	-0.02386	2	51.1	0.24	0.814
200<Income<400 leva	Unmatched	0.45299	0.38832	13.1		1.83	0.067
	Matched	0.45217	0.46957	-3.5	73.1	-0.37	0.709
400<Income<600 leva	Unmatched	0.28205	0.37535	-19.9		-2.7	0.007
	Matched	0.28261	0.2913	-1.9	90.7	-0.21	0.837
Income>600 leva	Unmatched	0.1453	0.14643	-0.3		-0.04	0.965
	Matched	0.14348	0.12174	6.2	-1819.2	0.69	0.493
Studies (Does not work)	Unmatched	0.04274	0.14272	-35		-4.22	0
	Matched	0.04348	0.03043	4.6	87	0.74	0.46
Works pvt	Unmatched	0.55983	0.44208	23.7		3.29	0.001
	Matched	0.55217	0.53913	2.6	88.9	0.28	0.779
Works state	Unmatched	0.08974	0.09082	-0.4		-0.05	0.958
	Matched	0.0913	0.13913	-16.7	-4323.2	-1.61	0.109
Secondary Edu	Unmatched	0.69231	0.75904	-15		-2.13	0.033
	Matched	0.7	0.74348	-9.8	34.8	-1.04	0.299
Higher Edu	Unmatched	0.10684	0.07229	12.1		1.78	0.075
	Matched	0.1	0.08261	6.1	49.7	0.65	0.518
N. of siblings	Unmatched	1.1538	1.1019	6.9		0.96	0.335
	Matched	1.1391	1.1652	-3.5	49.7	-0.36	0.721
Secondary Edu Father	Unmatched	0.62393	0.59592	5.7		0.79	0.428
	Matched	0.62174	0.63043	-1.8	69	-0.19	0.848
Higher Edu Father	Unmatched	0.14103	0.19926	-15.5		-2.06	0.039
	Matched	0.14348	0.14783	-1.2	92.5	-0.13	0.895
Secondary Edu Mother	Unmatched	0.55128	0.57553	-4.9		-0.68	0.497
	Matched	0.55217	0.58696	-7	-43.4	-0.75	0.452
Higher Edu Mother	Unmatched	0.17094	0.21223	-10.5		-1.42	0.156
	Matched	0.16957	0.14348	6.6	36.8	0.77	0.442
Religious	Unmatched	0.45299	0.42632	5.4		0.75	0.456
	Matched	0.44783	0.38696	12.3	-128.2	1.32	0.186
Age24-29	Unmatched	0.3547	0.28267	15.5		2.19	0.029
	Matched	0.34783	0.32609	4.7	69.8	0.49	0.623
Age30-34	Unmatched	0.0641	0.0899	-9.7		-1.28	0.201
	Matched	0.06522	0.04783	6.5	32.6	0.81	0.42
Number of Treated				*230*			
Number of Controls				*1079*			

Tab A.4. Balance Check – Psychological Wellbeing – Marriage/Cohabitation – *Females* – (Nearest neighbour matching within a caliper)

Variable	Sample	Mean Treated	Control	%bias	%reduct |bias|	t	test p>|t|
Psychological wellbeing	Unmatched	-0.1505	-0.25166	11.3		1.46	0.144
	Matched	-0.1505	-0.13451	-1.8	84.2	-0.2	0.843
Disorientation	Unmatched	-0.0634	-0.07754	2.3		0.3	0.763
	Matched	-0.0634	-0.03025	-5.4	-134.5	-0.59	0.556
Partner decreases indep.	Unmatched	0.41079	0.46314	-10.6		-1.39	0.166
	Matched	0.41079	0.39419	3.3	68.3	0.37	0.711
Lived with past partners	Unmatched	0.14108	0.12981	3.3		0.44	0.662
	Matched	0.14108	0.16598	-7.3	-120.9	-0.76	0.449
Exchange of help	Unmatched	0.07845	0.05481	4.5		0.58	0.563
	Matched	0.07845	0.09584	-3.3	26.4	-0.36	0.718
200<Income<400 leva	Unmatched	0.41079	0.40545	1.1		0.14	0.886
	Matched	0.41079	0.40664	0.8	22.3	0.09	0.926
400<Income<600 leva	Unmatched	0.361	0.39263	-6.5		-0.86	0.392
	Matched	0.361	0.34025	4.3	34.4	0.48	0.634
Income>600 leva	Unmatched	0.15768	0.14423	3.8		0.5	0.618
	Matched	0.15768	0.14523	3.5	7.4	0.38	0.704
Studies (Does not work)	Unmatched	0.14108	0.19712	-15		-1.92	0.055
	Matched	0.14108	0.13693	1.1	92.6	0.13	0.896
Works pvt	Unmatched	0.51867	0.42147	19.5		2.58	0.01
	Matched	0.51867	0.48133	7.5	61.6	0.82	0.413
Works state	Unmatched	0.09129	0.13622	-14.2		-1.8	0.072
	Matched	0.09129	0.11618	-7.9	44.6	-0.9	0.371
Secondary Edu	Unmatched	0.639	0.60096	7.8		1.03	0.304
	Matched	0.639	0.61826	4.3	45.5	0.47	0.638
Higher Edu	Unmatched	0.26141	0.26923	-1.8		-0.23	0.816
	Matched	0.26141	0.27386	-2.8	-59.2	-0.31	0.758
N. of siblings	Unmatched	1.1162	1.109	0.9		0.12	0.905
	Matched	1.1162	1.1162	0	100	0	1
Secondary Edu Father	Unmatched	0.56432	0.58333	-3.8		-0.51	0.612
	Matched	0.56432	0.55187	2.5	34.5	0.27	0.784
Higher Edu Father	Unmatched	0.19502	0.23397	-9.5		-1.23	0.218
	Matched	0.19502	0.18672	2	78.7	0.23	0.817
Secondary Edu Mother	Unmatched	0.53942	0.55609	-3.3		-0.44	0.659
	Matched	0.53942	0.56432	-5	-49.3	-0.55	0.584
Higher Edu Mother	Unmatched	0.24066	0.25	-2.2		-0.28	0.776
	Matched	0.24066	0.20747	7.7	-255.6	0.87	0.383
Religious	Unmatched	0.68465	0.63462	10.6		1.38	0.167
	Matched	0.68465	0.70124	-3.5	66.8	-0.39	0.694
Age24-29	Unmatched	0.26141	0.22436	8.6		1.15	0.25
	Matched	0.26141	0.25311	1.9	77.6	0.21	0.835
Age30-34	Unmatched	0.11203	0.1875	-21.2		-2.68	0.008
	Matched	0.11203	0.15353	-11.7	45	-1.34	0.18
Number of Treated				*241*			
Number of Controls				*624*			

Tab A.5. Balance Check – Disorientation – Marriage/Cohabitation – *Females* – (Nearest neighbour matching within a caliper)

		Mean			%reduct		test
Variable	Sample	Treated	Control	%bias	|bias|	t	p>|t|
Psychological wellbeing	Unmatched	-0.14625	-0.25166	11.8		1.52	0.129
	Matched	-0.14625	-0.13581	-1.2	90.1	-0.13	0.899
Disorientation	Unmatched	-0.06273	-0.07754	2.4		0.31	0.753
	Matched	-0.06273	-0.03265	-4.9	-103.1	-0.52	0.601
Partner decreases indep.	Unmatched	0.4125	0.46314	-10.2		-1.34	0.181
	Matched	0.4125	0.41667	-0.8	91.8	-0.09	0.926
Lived with past partners	Unmatched	0.14167	0.12981	3.5		0.46	0.646
	Matched	0.14167	0.125	4.9	-40.5	0.54	0.592
Exchange of help	Unmatched	0.07708	0.05481	4.2		0.54	0.587
	Matched	0.07708	0.02698	9.4	-125	1.06	0.289
200<Income<400 leva	Unmatched	0.4125	0.40545	1.4		0.19	0.85
	Matched	0.4125	0.37083	8.5	-490.9	0.93	0.351
400<Income<600 leva	Unmatched	0.35833	0.39263	-7.1		-0.93	0.354
	Matched	0.35833	0.3875	-6	15	-0.66	0.51
Income>600 leva	Unmatched	0.15833	0.14423	3.9		0.52	0.602
	Matched	0.15833	0.17917	-5.8	-47.7	-0.61	0.543
Studies (Does not work)	Unmatched	0.14167	0.19712	-14.8		-1.89	0.058
	Matched	0.14167	0.175	-8.9	39.9	-1	0.318
Works pvt	Unmatched	0.52083	0.42147	20		2.64	0.009
	Matched	0.52083	0.45833	12.6	37.1	1.37	0.172
Works state	Unmatched	0.0875	0.13622	-15.5		-1.96	0.051
	Matched	0.0875	0.1125	-7.9	48.7	-0.91	0.362
Secondary Edu	Unmatched	0.64167	0.60096	8.4		1.1	0.272
	Matched	0.64167	0.60417	7.7	7.9	0.85	0.398
Higher Edu	Unmatched	0.25833	0.26923	-2.5		-0.32	0.746
	Matched	0.25833	0.30417	-10.4	-320.6	-1.12	0.265
N. of siblings	Unmatched	1.1167	1.109	0.9		0.13	0.899
	Matched	1.1167	1.1125	0.5	45.8	0.06	0.956
Secondary Edu Father	Unmatched	0.56667	0.58333	-3.4		-0.44	0.657
	Matched	0.56667	0.54167	5.1	-50	0.55	0.583
Higher Edu Father	Unmatched	0.19167	0.23397	-10.3		-1.34	0.181
	Matched	0.19167	0.2	-2	80.3	-0.23	0.819
Secondary Edu Mother	Unmatched	0.54167	0.55609	-2.9		-0.38	0.703
	Matched	0.54167	0.50417	7.5	-160	0.82	0.412
Higher Edu Mother	Unmatched	0.2375	0.25	-2.9		-0.38	0.703
	Matched	0.2375	0.26667	-6.8	-133.3	-0.73	0.463
Religious	Unmatched	0.68333	0.63462	10.3		1.34	0.18
	Matched	0.68333	0.70417	-4.4	57.2	-0.49	0.621
Age24-29	Unmatched	0.2625	0.22436	8.9		1.18	0.237
	Matched	0.2625	0.27917	-3.9	56.3	-0.41	0.682
Age30-34	Unmatched	0.10833	0.1875	-22.4		-2.81	0.005
	Matched	0.10833	0.09583	3.5	84.2	0.45	0.652
Number of Treated				*240*			
Number of Controls				*620*			

Appendix 4.B: Rosenbaum bounds method

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 nonparametric statistics like Wilcoxon's signed rank test (preferred in presence of continuous outcomes) and McNemer's test statistic (used in several applications for dichotomous outcomes, see Becker and Caliendo, 2007).

Test statistics in the family of sign score can be written in the following way:

$$T = \sum_{i=1}^{N_1} d_i \sum_{j=1}^{2} c_{ij} t_{ij} \qquad \text{(B.1)}$$

where t_{ij} is a dichotomous variable that indicates which of each of the N_1[46] pairs is the treated unit; c_{ij} is a design-variable defined in the following way:

$c_{i1} = 1, c_{i2} = 0$ if $y_{i1} > y_{i2}$;

$c_{i1} = 0, c_{i2} = 1$ if $y_{i1} \leq y_{i2}$.

Where y_{i1} , y_{i2} are the outcomes of the matched units in the *i*-th pair. Finally, d_i is the rank of $|y_{i1} - y_{i2}|$, i.e. the difference between the outcome of matched and control units in each pair. The product of c_{ij} and t_{ij} causes pairs to be selected where the outcome for the treatment was greater than that for the control. The ranks of these differences are summed and compared to the theoretical distribution of the test statistic under the null hypothesis that the average treatment effect on treated is zero.

In this case, the assignment to treatment is not random, the test statistic is bounded. Suppose there is an unobservable 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:

$$\ln\left[\frac{p_i}{1-p_i}\right] = f(X_i) + \gamma U_i \qquad \text{(B.2)}$$

[46] N_1 represents the number of treated in the common support.

Rosenbaum proved that a transformation of (B.2) implies that the ratio of the odds for treated and untreated units considered in each of the N_1 pairs of our analysis is bounded:

$$\frac{1}{\Gamma} \leq \frac{p_{i1}(1-p_{i2})}{p_{i2}(1-p_{i1})} \leq \Gamma \tag{B.3}$$

where $\Gamma = e^{\gamma}$. Under the assumption of the existence of a confounding factor U_i, the equation (B.1) becomes the sum of N_1 independent random variables, where the *i*-th variations is equal to d_i with probability:

$$p_i = \frac{c_{i1}e^{\gamma U_{i1}} + c_{i2}e^{\gamma U_{i2}}}{e^{\gamma U_{i1}} + e^{\gamma U_{i2}}} \tag{B.4}$$

and is equal to zero with probability $1-p_i$. Define the following values:

$$p_i^+ = \begin{cases} 0 & if\ c_{1i} = c_{i2} \\ \dfrac{\Gamma}{1-\Gamma} & if\ c_{1i} \neq c_{i2} \end{cases} \text{ and } p_i^- = \begin{cases} 0 & if\ c_{1i} = c_{i2} \\ \dfrac{1}{1-\Gamma} & if\ c_{1i} \neq c_{i2} \end{cases} \tag{B.5}$$

For different values of γ, the distribution of *T*, under the null hypothesis, is bounded by two distributions T^+ and T^- that have the following expected values and variances:

$$E(T^+) = \sum_{i=1}^{N_1} d_i p_i^+ \text{ and } E(T^-) = \sum_{i=1}^{N_1} d_i p_i^- \tag{B.6}$$

$$V(T^+) = \sum_{i=1}^{N_1} d_i^2 p_i^+(1-p_i^+) \text{ and } V(T^+) = \sum_{i=1}^{N_1} d_i^2 p_i^-(1-p_i^-) \tag{B.7}$$

One can use these formulas to compute the significance levels of the null hypothesis associated to the upper and lower bounds through the following standardizations:

$$\frac{T-E(T^+)}{\sqrt{V(T^+)}} \text{ and } \frac{T-E(T^-)}{\sqrt{V(T^-)}} \tag{B.8}$$

respectively for lower and upper bounds.

Results discussed in Empirical Results are listed below:

Tab B.1. Sensitivity analysis for Psychological Wellbeing – First Child – *Females* – (Nearest neighbour matching within a caliper)

Γ	sig+	sig-	t-hat+	t-hat-	CI+	CI-
1	<.001	<.001	.220	.220	.185	.405
1.05	.002	<.001	.208	.370	.035	.417
1.1	.006	<.001	.208	.394	.011	.417
1.15	.015	<.001	.197	.405	.011	.567
1.2	.033	<.001	.197	.405	.000	.591
1.25	.061	<.001	.185	.405	.000	.602
1.3	.103	<.001	.161	.417	.000	.602
1.35	.160	<.001	.023	.417	-.011	.614
1.4	.231	<.001	.011	.429	-.023	.614
1.45	.315	<.001	.011	.579	-.173	.614
1.5	.405	<.001	.000	.591	-.197	.626

Tab B.2. Sensitivity analysis for Psychological Wellbeing – Second Child – *Females* – (Nearest neighbour matching within a caliper)

Γ	sig+	sig-	t-hat+	t-hat-	CI+	CI-
1	.050	.050	.197	.197	.000	.382
1.05	.094	.024	.185	.197	.000	.394
1.1	.158	.011	.023	.208	-.011	.405
1.15	.242	.004	.011	.208	-.023	.405
1.2	.339	.001	.011	.220	-.185	.417
1.25	.444	<.001	.000	.244	-.197	.417
1.3	.549	<.001	.000	.394	-.197	.429
1.35	.646	<.001	.000	.394	-.197	.591
1.4	.732	<.001	-.011	.405	-.208	.602
1.45	.804	<.001	-.011	.405	-.208	.602
1.5	.861	<.001	-.161	.405	-.220	.602

Tab B.3. Sensitivity analysis for Psychological Wellbeing – Partnership – *Males* – (Nearest neighbour matching within a caliper)

Γ	sig+	sig-	t-hat+	t-hat-	CI+	CI-
1	<.001	<.001	.405	.405	.208	.417
1.05	<.001	<.001	.394	.405	.197	.591
1.1	<.001	<.001	.370	.405	.197	.602
1.15	.001	<.001	.208	.405	.197	.602
1.2	.002	<.001	.208	.405	.173	.602
1.25	.005	<.001	.208	.417	.011	.614
1.3	.011	<.001	.208	.417	.000	.614
1.35	.020	<.001	.197	.591	.000	.614
1.4	.034	<.001	.197	.602	.000	.626
1.45	.055	<.001	.197	.602	.000	.788
1.5	.082	<.001	.185	.602	.000	.800

Tab B.4. Sensitivity analysis for Psychological Wellbeing – Partnership – *Females* – (Nearest neighbour matching within a caliper)

Γ	sig+	sig-	t-hat+	t-hat-	CI+	CI-
1	<.001	<.001	.394	.394	.197	.417
1.05	<.001	<.001	.370	.394	.197	.429
1.1	.001	<.001	.220	.405	.185	.591
1.15	.003	<.001	.208	.405	.023	.591
1.2	.007	<.001	.208	.405	.011	.602
1.25	.015	<.001	.197	.417	.011	.602
1.3	.028	<.001	.197	.417	.000	.614
1.35	.049	<.001	.197	.429	.000	.614
1.4	.078	<.001	.185	.591	.000	.614
1.45	.116	<.001	.035	.591	-.011	.626
1.5	.165	<.001	.011	.602	-.011	.638

Tab B.5. Sensitivity analysis for Disorientation – Partnership – *Females* – (Nearest neighbour matching within a caliper)

Γ	sig+	sig-	t-hat+	t-hat-	CI+	CI-
1	.028	.028	-.132	-.132	-.246	-.015
1.05	.013	.058	-.155	-.111	-.273	.006
1.1	.005	.104	-.178	-.088	-.295	.028
1.15	.002	.167	-.199	-.066	-.317	.044
1.2	<.001	.248	-.221	-.050	-.339	.066
1.25	<.001	.341	-.236	-.029	-.354	.088
1.3	<.001	.441	-.258	-.008	-.376	.109
1.35	<.001	.541	-.273	.007	-.397	.125
1.4	<.001	.635	-.288	.022	-.413	.141
1.45	<.001	.718	-.303	.037	-.428	.161
1.5	<.001	.789	-.324	.053	-.449	.176

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