From fertility intentions to realizations.

Implementing Theory of Planned Behavior

with graphical models

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(draft)

Short abstract

Our paper studies fertility intentions and their realization. We derive the theoretical model from the social psychological model of Theory Planned Behavior (TPB), and test its validity in a low fertility context (i.e. Italy). We move beyond existing research and use the theory of graphical models to have a precise understanding and a formal description of the developmental process of the fertility-making process, by representing possible dependencies among all the variables of a multivariate distribution with a chain graph. Overall our analysis strongly supports the validity of TPB for the Italian context and, therefore, provides an input to the systematic study of fertility decision-making processes. However, our analysis also gives some chandelling evidence that partly complicates the application of TPB to fertility research, especially as regards the role of background factors.

1. Introduction

The study of fertility intentions has become central on the discussion of fertility rates in developed countries, under the realistic assumption that, in almost perfect contraceptive regimes, having a child can be considered a result of a reasoned, although imperfect, decision. However, persistent low fertility levels, especially in Southern Europe, seem more and more the result of a "fertility gap" between desired and realized level of fertility (Chesnais, 2000). People declare to want to have more children than they have (Testa, 2006), therefore they are for some reasons unable to implement their desire.

This creates quest for research on the passage between the intention of having a(nother) child and the subsequent realization of such intention. Furthermore, albeit the existence of a plethora of recent studies on determinants and mechanisms of fertility intentions formation, much less it is said on the successive step of the realizations. Most of studies consider the same determinants of intentions influencing also the subsequent behavior, neglecting, or reducing, the importance of intervening factors between the time of fertility intentions formation and the fertility outcome.

In this study, we aim to fill this gap on the literature studying not only the determinants of fertility intentions, but specifically the determinants of fertility realizations, taking into account the couple's formation of intentions, their agreement and their implementation in next future time span. We derive the theoretical model from the social psychological model of Theory Planned Behavior, implemented by the use of graphical models.

We use the 2003 Istat Household Multipurpose Survey on "Family and Social Subjects" (the Italian version of first wave of Gender and Generation Survey) which includes batteries of questions as an adaptation of the of Theory of Planned Behavior for the study of fertility decisions (Vikat et al., 2007). We verify the realization of fertility intentions with the data of the second wave of FSS survey, gathered on 2007.

The Italian context is particular relevant for this research question, being one in which fertility is stable at very low levels and with a high gap between desired and realized fertility.

2. Theoretical background to the study of fertility intentions and realizations

2.1. The Theory of Planned Behavior as a theoretical framework for fertility decision making process

The importance of psychological characteristics, cognitions and social context on fertility decision making and demographic behavior has been highlighted for long time (Fawcett, 1978; 1991). Recently the famous theoretical framework of "Theory of Planned Behaviors" (TPB from now onward; Ajzen, 1991 and 2005; Ajzen & Fishbein, 1980) has been applied also to family and fertility research. According to the TPB social psychological model, that actually is an extension of the earlier "Theory of Reasoned Action" (Fishbein & Ajzen, 1975; 2010), intentions are the immediate antecedents of corresponding behavior. The expectation that intentions predict behavior is supported by several systematic reviews of the empirical literature and strong intention-behavior correlations are also observed in the fertility domain, especially at the aggregate level (Ajzen, 2010).

Behind the emphasis on fertility intentions, central to discussions of family planning and fertility rates, there is the implicit or explicit assumption that, at least in developed countries with readily available contraception, having a child is the result of a reasoned decision. Adopting the TPB theory on fertility studies means, therefore, that observed reproductive behavior does not depend solely on individual characteristics, but also derives from fertility intentions (e.g., Ongaro, 1982; Palomba, 1991; De Sandre et al., 1997; Sorvillo and Marsili, 1999; Goldstein et al., 2004; Testa and Grilli, 2006; Mills et al., 2008). Fertility intentions can be positive or negative: the former define the desire to have a(nother) child, while the latter the desire not to have a(nother) child.

Ajzen (2010) describes how the TPB can be used to model fertility decision-making process: as for other behaviors, when people formulate their intentions to have a(nother) child they rely on three conceptually distinct types of considerations: their attitudes, subjective norms and perceived behavioral control.

The so-called "attitudes toward the behavior", that can be favorable or unfavorable, are "readily accessible or salient beliefs about the likely consequences of a contemplated course of action" (Ajzen, 2010). In the case of fertility decision making, individuals would reflect – before forming their fertility intentions – on attitudes to having a child. Such attitudes are a person's internal evaluation that having a child will have positive or negative (i.e. desirable or non-desirable) consequences for her/him (Billari et al., 2009).

The second type of consideration, the so-called "subjective norms" have to do with the perceived normative beliefs and expectations of relevant referent groups or individuals, giving

social pressure to perform or not to perform the behavior (Ajzen, 2010). In case of fertility intentions, individuals would consider subjective norms for having a child, i.e. the individual perception of the psychological support or normative pressure that members of their close social circle exert on her/his fertility behavior.

Finally, people are assumed to take into account factors that may further or hinder their ability to perform the behavior, and these salient control beliefs lead to the formation of "perceived behavioral control", which refers to the perceived capability of performing the behavior (Ajzen, 2010). People are expected to carry out their intentions when the opportunity arises, and therefore intentions are assumed to be the immediate antecedents of behavior. However, because many behaviors pose difficulties of execution, it is useful to consider perceived behavioral control – in the case of fertility, over having a child – in addition to intentions. Like attitudes and subjective norms, perceptions of behavioral control are assumed to follow consistently from readily accessible beliefs, in this case beliefs about resources and obstacles or constraints that can facilitate or interfere with ability to have a child, such as income or wealth constraints, labor force status, education, housing, health (Billari et al. 2009). The emphasis is again on individuals' perceptions about the situation: i.e. not the actual income, but the individual feeling of the affordability to have a child.

The power of each control factor to facilitate or inhibit behavioral performance is expected to contribute to perceived behavioral control in direct proportion to the person's subjective probability that the control factor is present (Ajzen, 2010). Few studies have systematically explored beliefs about having a child in the context of the TPB. For example, Langdridge, Sheeran, and Connolly (2005) list 35 reasons for and against having a child. Measures of attitude, subjective norm, and perceived control with respect to having another child and with respect to not having another child provide different information, and that each may contribute independently to the prediction of intentions.

A schematic representation of the original TPB is shown in figure 1. As it can be seen in figure 1, the TPB does not deny the importance of background factors that can influence behavior indirectly by affecting behavioral, normative, and control beliefs. They can be global dispositions, such as personality characteristics or personal values, demographic factors, or other kinds of variables, selected by a "content-specific" theory, in this case i.e. economic and ideational theories of fertility behavior (Billari et al. 2009), that can complement TPB "by identifying relevant background factors and thereby extending understanding of a behavior's determinants" (Ajzen, 2010). Therefore a number of variables normally studied in demographic research are treated as external variables, i.e. in the group of individual or social background factors, such as age, parity, income, education, and the group of environmental aspects, such as welfare regimes provisions,

affecting the antecedents of fertility intentions. According to TPB, under ideal conditions and operationalization, the background factors should impact only the proximate determinants of fertility intentions and should not have a direct impact on the intentions themselves, although empirically they often have also a direct effect (Billari et al.2009).

Actually, having a child is not properly a behavior, but rather an "outcome or behavioral goal". According to TPB, behavioral goals – like behavioral intentions – should be predictable from attitudes, subjective norms and perceived control. In both cases of a behavior or attainment of a goal, intentions mediate between a set of explanatory factors and the outcome. Using the TPB as a model of a goal attainment, rather than behavior, provides a less reliable explanation, being the goal distant in time from the formation of the intention and reliant on intermediate behavior or intervening factors (i.e. divorce, loss of the partner, loss of fecundity, changing mind; Dommermuth et al. 2011). Measures of behavior or behavioral goals typically involve a specific action and target (e.g., having a child), and often also a specific context (e.g., with my current partner) and time frame (e.g., in the next 3 years). A suitable fertility behavioral goal can be identified by "having a child or another child in the next 3 years".

By way of contrast, general background factors, such as broad attitudes (e.g., toward children or overpopulation) and values (e.g. independence) identify only a target; they do not specify any particular action, context, or time element. Similarly, demographic characteristics, such as age, gender, and level of education, lack specificity in any of the four elements. This lack of compatibility is assumed by Ajzen to be responsible for the low, inconsistent, and often non-significant relations between general dispositions and demographic variables, on one hand, and specific behaviors, on the other (Ajzen, 2010).

There is an additional element to be taken into consideration in the study of the fertility decision making process and realization: fertility intentions can be individual, but the outcome depends on couple behavior. The intentions of a couple can be concordant or discordant, and in the latter case this may lead to a lower correspondence between intentions and actual behavior (Thomson 1997; Miller & Pasta 1995). However, Miller et al. (2004) suggest that, while males and females negotiate agreement about desires, the relevant conjunction of male and female motivations to have a child occurs at the level of behavior rather than at the intermediate level of intentions. Albeit the TPB is a model of individual cognition and behavior, not conceived to explain joint decision making or joint action, Dommermuth et al. (2011) sustain that TPB can be an appropriate framework for building a social cognitive model of fertility decision making for couples. Infact, extending the logic of Miller et al. (2004) model to the TPB, influences on the intentions of males

and females can be model separately, taking into account the relative influences of one member of the couple on the other individual's intentions, but not modeling joint intentions.

Demographic research directed towards explaining or predicting intention to have a child within the reasoned action tradition of the TPB focused primarily on the decision to have a child relative to the decision to not have a child (Billari et al., 2009; Jaccard & Davidson, 1975; Jorgensen & Adams, 1988; Thomson, 1997) and on the timing of the intentions (intentions in the short run versus intentions in long run, Dommermuth et al. 2011).

Here we would like to analyze the complete path leading to fertility behavior also taking into consideration the last very important step, i.e. the relationship from intentions to realization of the behavioral goal of having a child, within the explanatory framework of TPB and considering the most common background variables and determinants of fertility behavior.

Figure 1: A schematic presentation of Theory of Planned Behavior for fertility decision-making
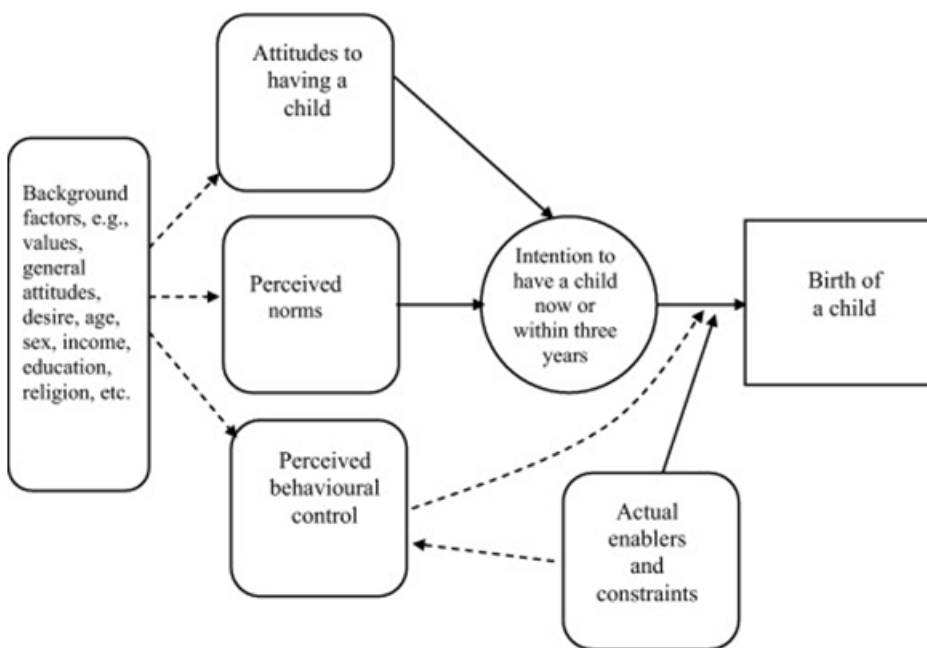
Source: Dommermuth et al. 2011

2.2. Empirical evidence on the determinants of fertility intentions and realizations

A plethora of empirical research has scrutinized which determinants affect fertility intentions suggesting that they depend to several demographic, socio-economic, and gender-related factors. On the contrary, the literature investigating the correlates of the realization of fertility intentions is scarce, especially due to severe lack of appropriate longitudinal data. Overall, the factors that have been found in the literature to increase (or decrease) the gap between positive

fertility intentions and their subsequent realization (or, conversely, non-realization) are not much different than the ones affecting positive (or negative) fertility intentions in itself.

The main point is how to envision the amount of empirical evidence that have been produced so far on the determinants of fertility intentions and realization within the TPB framework. Overall, the risk of multi-factor study of features affecting fertility is that, in the end, everything can matter, as it seems the case with the role of background factors (Billari et al., 2009). But TPB, with its focus on three types of proximate determinants of fertility intentions, provide us with an approach for a systematic study of determinants of fertility. According to TPB, in fact, the distinction between attitudes, norms, and perceived behavioral control should entirely filter the role played by background factors on fertility intentions that, in turn, will determine the subsequent realization. The present study explicitly aims at verifying the validity of TPB in that respect. We addresses this issue focusing on a set of background factors that has been traditionally proved to influence both fertility intentions and realization, as the following review highlights.

Factors affecting fertility intentions have been suggested to be demographic and socio-economic. Among the pure demographic factors, the parity and woman's age play a crucial role in the definition of fertility intentions (Morgan, 1982; Noack and Ostby, 1985; Bongaarts, 1992, 2001; Thomson, 1997; Berrington, 2004; Meggiolaro, 2009, Mamolo et al, 2008; Liefbroer, 2009; Rinesi 2010). Overall, documented findings illustrate an inverse relationship between fertility intentions and parity (Thomson, 1997; Menniti, 2003, Bühler, 2008; Mamolo et al, 2008; Meggiolaro, 2009). In the case of women who already have had one or more children, fertility intentions tend to decrease with the increse of the age of the youngest child (Thomson, 1997; Menniti, 2003). As regards women's age, positive fertility intentions seem to be less frequent among older women for at least two reasons. First, because they are closer to the boundaries of the reproductive life-span. Second, because they implicitly take into account the reproductive history (i.e., the number of children they eventually have had). On the contrary, the intentions declared by the young women are closer to the ideal of fertility (i.e., the social norm) than the behavior they will ultimately adopt (De Sandre et al., 1997; Meggiolaro, 2009). The effect of the type of union, too, has been widely investigated. In a recent study, Liefbroer (2009) showed that those who have a stable relationship or who are married have higher average fertility intentions, respectively, to those who do not have a partner or who are cohabiting. Accordingly, Vignoli and Régnier-Loilier (2009) found that cohabiting couples desire fewer children than married ones in Italy. On the contrary, for France, there is no such effect (Toulemon and Testa, 2005; Vignoli and Régnier-Loilier 2009).

The role of education was emphasized in a cross-country study (Heiland et al, 2008): in many European societies, higher educational levels are confronted with a greater number of desired

children. The positive association between educational level and fertility intentions is also confirmed by a study for France (Toulemon and Testa, 2005) as well as by a study for Bulgaria and Hungary (Philipov et al, 2006). This finding can be explained as an income effect, assuming that women's educational attainment represents a valid marker of women's labor market chances as well as women's wage (Kreyenfeld, 2002). Higher educated women may also have a greater bargaining power within the couple that would underline a more equal division of housework and childcare between partners that, in turn, facilitates fertility intentions (Mills et al., 2008). The latter study also highlights that lower fertility intentions are also frequent among those women who are used to work outside in a heavy commitment in terms of number of hours worked.

Moving to the determinants of fertility realization, a pivotal role is played, again, by demographic factors: in particular women's age and parity are crucial (e.g., Noack and Østby, 2002; Quesnel-Vallée and Morgan, 2003; Testa and Toulemon, 2006; Rinesi, 2009): postponing motherhood results in fewer children than those expected. Moreover, the larger the distance between actual and expected number of children, the faster the transition towards childbearing in a short period (Thompson et al, 1990; Symeonidou, 2000). The type of union, too, is important. Married couples are more likely to realize their intention of having (another) child in the United States (Schoen et al, 1999; Quesnel-Vallée and Morgan, 2003) and Italy (Regnier-Loilier and Vignoli, forthcoming). In France the type of union plays out differently according to the time-span of the expressed fertility intentions: married couples are more likely to realize their positive fertility intentions in the short-run (Regnier-Loilier and Vignoli, 2011), while such an effect is not recorded in the long-run (Toulemon and Testa, 2005).

The impact of education, ceteris paribus, is similar in France and Italy: the gap is the lowest for highly educated women (Toulemon and Testa, 2005; Rinesi, 2009; Regnier-Loilier and Vignoli, forthcoming). Among the pure economic factors, Rinesi (2009) shows for Italy that individuals in a more stable situation (i.e. those who work and are home-owners) are more likely to realize the desired parity. Also as regards France, economic uncertainty appears to play a potent role: in the paper by Testa and Toulemon (2006), being unemployed significantly widens the gap between fertility intentions and realizations. Finally, the effect of gender roles also seems to vary in different contexts: in Greece, the less traditional women are confronted with a more difficult realization of their positive fertility intentions (Symeonidou, 2000), in other contexts such as Sweden there is a reversed trend (Thomson, 1997).

On the basis of the literature review outlined so far, it is clear that the basic background determinants of realizations are generally the *same* of intentions. However, it is not clear whether the strong influence of demographic, socio-economic, and gender-related background factors on

fertility decision-making process is effectively mitigated by the three dimension of TPB, i.e. attitudes, norms, and perceived behavioral control.

Finally, we should consider that here are also (obvious) not-background factors that influence *only* realization and not intentions, such as the degree of intentions, and partners' agreement/disagreement of fertility intentions. Those declaring that they would certainly like to have (or not to have) a child are more likely to realize their whish than their more "uncertain" counterparts (Regnier-Loilier and Vignoli, forthcoming). Moreover, the level of agreement in fertility intentions between partners has a strong predictive power for reproductive behaviors: the stronger the agreement of the two members of the couple, the higher the level of fertility realization (Thomson et al, 1990; Thomson, 1997; Rosina & Testa, 2009). Then, there can be unexpected couples' problems, subsequent to the moment in which the intentions were expressed (i.e., the disruption of the couple), that inhibit the realization (Regnier-Loilier and Vignoli, 2011).

3.   The Italian case

The Italian context is particular relevant for this research question, being one in which fertility is stable at very low levels, with a strong increase in mean age at first child and marked postponement and with a high gap between desired and realized fertility.

Despite the strong position of the Catholic Church, the attachment to the family and the prevalence of traditional family forms, Italy have experienced marked declines in childbearing, and currently belong to the countries with the lowest fertility levels in Europe. In Italy, the process of fertility decline started in the 1970s. The Period Total Fertility Rate (PTFR) plummeted to lowest-low levels, reaching its lowest point of 1.18 in Italy in 1995. Although in the following years the country experienced slight improvements in period fertility, the PTFR has remained relatively low (1.4 children per woman in 2010, Istat 2011). This downward trend in childbearing was partly driven by a postponement of first births. The country experienced increases in the mean age at the entry to motherhood (the mean age at childbearing reaches almost 32 years old in 2010, Istat 2011). Nevertheless, quantum effects also played an important role in the process of fertility decline: according to analyses by Sobotka et al. (2005), around 50 per cent of births lost over the period 1978-1996 in Italy had been missing due to quantum effects, after accounting for changes in the generation size of women at childbearing age.

The Italian low fertility has often been linked in the literature to the difficulties of reconciliation between childbearing and women's work (Salvini 2004). Italy constitutes, in fact, not only a case of lowest-low fertility, but also of extremely low female labor market participation and

low gender equity. In stark contrast to other European countries, in Italy only 46 percent of women are employed and there are noticeable differences by number of children: just over 57 percent of women without children are in the labour market, percentage which drops to below 55 percent when they have their first child and more sharply to 45 percent in the presence of 2 or more children (OECD data, 2008).

Although childcare services in Italy are highly subsidized, the main problem is the scarcity of public childcare for children under three years old and the extreme rigidity in the number of hours that services for both preschool and school children are available. These tensions between work and fertility derive by a peculiar situation regarding family policies, labor market structure and social norms. First, Italy is characterized by a very low supply of public childcare facilities for small children, aged 0-2: 12.0% as compared to the 20% of the EU. Second, the labor market structures create certain barriers to women's employment due to rigid working hours, scarcity of part-time jobs and a strong insider-outsider divide. The exceptionally high level of women's unemployment relative to that of men points to the presence of strong barriers to women's employment. Large gender gaps in unemployment are typical of Southern European labor markets, which Adsera (2005) explains with a delay in the adjustment of labor market institutions to the pronounced increases in women's labor supply in recent decades. Finally, the gender division of household chores is heavily asymmetric, and the social disapproval of mothers who work when their children are young is widespread (e.g. Mencarini and Tanturri 2006). Recent studies have shown how this gender inequity in role-set of parents, inside and outside the household, is a determinant of lower fertility intentions and realization (Cooke 2003, Mencarini and Tanturri 2004, Mills et al. 2008), as stated by theory of the link between gender equity and fertility by McDonald (2000).

4. Data

4.1. Italian GGS survey and descriptive results of fertility realizations

In this study we use the Italian Gender and Generation Survey and its corresponding follow-up survey (2003, round 1 – 2007, round 2). The Italian variant of the GGS is a prospective and retrospective survey conducted by the Italian National Statistical Office (Istat) called "Family and Social Subjects" in 2003 – GGS-FSS (2003). Its follow-up survey, named "Critical points in life histories from a gender perspective", was jointly conducted by Istat and the Ministry of Labor in 2007. GGS-FSS (2003) counts a sample of about 24,000 households and 50,000 individuals. The follow up counts 10,000 interviews to people aged 18-64.

Our investigation focuses on women's and men's fertility intentions to have a child within the next three years (as reported at the interview on the 2003 first wave of the survey): "*Do you intend to have a child in the next three years?*" that allow a set of four possible answers "*Definitely not*", "*Probably not*", "*Probably yes*", and "*Definitely yes*". By limiting the question about childbearing intention to a foreseeable time frame we overcome some of the problems associated with the surveying of intentions. Answers to questions about an individual's fertility intention in general are likely to capture a social norm, that is the number of children individuals think they should have rather than what they will have. Questions on intentions that cover an overseeable time period and that therefore are "*in close temporal proximity to the prospective behavior*" (Ajzen and Fishbein 1973: 49) are generally considered to be the better predictors of actual behavior (Billari et al. 2009; Philipov 2009). They offer the possibility to draw inferences from a person's current status about which economic, institutional, and familial conditions are crucial in her/his decision process to have a(nother) child.

We excluded women who do not have a partner from our analysis because their childbearing intentions may not reflect a realizable plan. Overall our sample selected counts 5,742 individuals (in 2,871 married or cohabiting couples). Linking the two Italian GGS waves we could check if the expressed fertility intentions were followed by a realization. Overall, we covered the time-span 2003-2007, when 368 children born were registered. Note that the intention to a have a child actually means progressing to the next parity in a specific "thinkable" time windows, so they are indeed "parity–progression intentions" (Billari et al. 2009). However, we could not stratify out analysis by parity due to the small-scale sample.

According to the results from the second round of the FFS survey, in 2007, in Italy, about 15% of respondents have had a child, irrespective of the birth order. These results are relatively consistent with the handful of other studies, based on different data (e.g., Rinesi, 2009). Figure 2 illustrates the link between intentions and those who have had a child in the inter-weave period. The association turns out to be particularly strong at the extremes: the stronger the intention to have – or not have – children, the greater – the lower – the observed proportion of respondents who realized this intention. In particular, we found that negative fertility intentions are a potent predictor of subsequent fertility behavior. In fact, the highest proportion of persons who actually realized their intentions is found among those who initially stated that they definitely did not intend to have any (or any more) children. On the contrary, positive fertility intentions tend to overestimate fertility realizations: 38% in Italy who firmly intended to have a child in the following three years did not achieve their goal.

Figure 2. Intended fertility and subsequent outcomes in Italy: proportion of men or women who had at least one child, according to initial intentions.
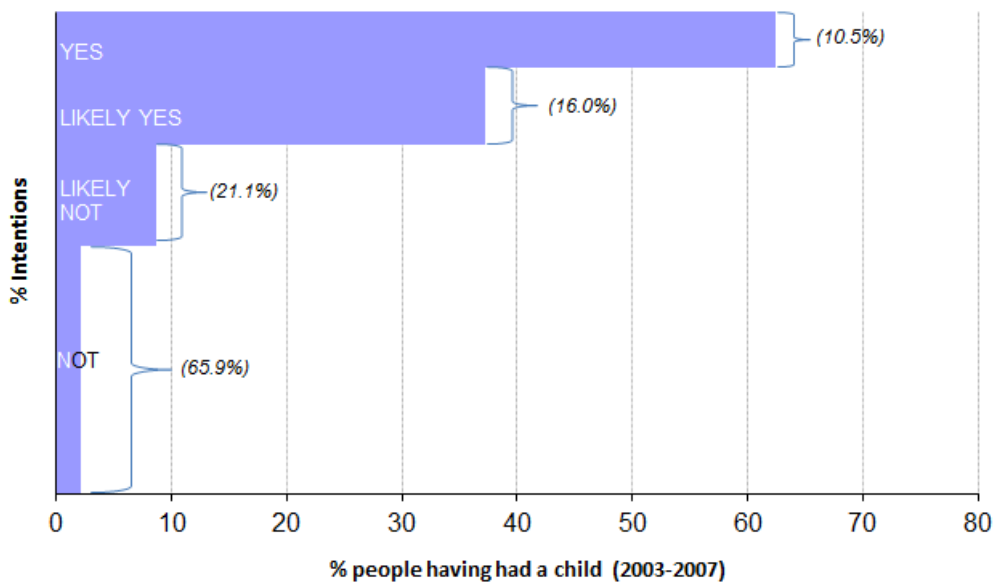
4.2.   The relevant variables and dimensions for TPB model

as in all the Gender and Generation Surveys, in the 2003 Italian FFS survey there are all the questions to implement the TPB theory (Vikat et al., 2007).

In fact, in addition to questions about intention to have a child, three blocks of questions are used to operationalize attitudes, subjective norms and perceived behavioral control. The items that we used appear in Table 1. Ten items are available to characterize attitudes to having a child. Each of these items is introduced by the question: ''*Let us assume that you will have a child or another child in the next 3 years. Would it be better or worse in relation to...*'', that allows answers alike: "*Much better*", "*Better*", "*Not better, nor worse*", "*Worse*", "*Much worse*". Subjective norms are measured through three questions: the respondents were asked to rate the extent to which they agree that different groups of people think they should have a(nother) child. All three items were introduced by the following question: ''*If you were to have a child in the next 3 years, how much would the following persons agree with your choice?*'', that allow answers alike: "*Would very much agree*", "*Would agree*", "*Would not agree, nor disagree*", "*Would be contrary*", "*Would be very much contrary*". Finally, the survey provides ten items to capture perceived behavioral control. The respondents answered the question: ''*The decision whether to have children or not can depend on various situations. How much could your decision whether to have a child or not in the next 3 years depend on...*'', that allows answers alike: "*A lot*", "*Sufficiently*", "*Not much*", "*Not at all*". In the case of perceived behavioral control we reversed the scale, because this made it easier to show the

possible positive effect of perceived ability to overcome constraints with a positive coefficient in the regression model.

We used factor analysis to confirm that the items acted as valid and reliable measures of the proposed TPB variables (Billari et al., 2009, Dommermuth et al. 2011). We used alpha factor analysis with oblimin rotation and tested both a three factor solution (the proposed factors were attitudes, subjective norms and perceived behavioral control) and a four factor solution (which allowed for attitudes to fall into two groups, as they did in Billari et al. 2009 and Dommermuth et al. 2011.

As Table 1 shows, four factors were identified: two attitudes factors, one factor to measure subjective norm and one to measure perceived behavioral control. The existence of two attitudes items is consistent with the two attitudes factors found by Billari et al. 2009 for Bulgaria and Dommermuth et al. 2001, for Norway). We named the first of these factors ''Positive Attitudes'' because it represents beliefs about the benefits of having a child, while we named the second attitudes factor, ''Negative Attitudes'' because it represents beliefs about the costs or personal losses associated with having a child.

Table 1 Factor loadings and factor alpha coefficients of items of perceived behavior control, subjective norms and attitudes towards the intention to have a(nother) child within the next three years.

Items	Factor 1 Negative attitudes	Factor 2 Positive attitudes	Factor3 Subjective norms	Factor 4 Perceived behavioral control
Let us assume that you will have a child or another child in the next 3 years. Would it be better or worse in relation to…				
The possibility of doing what you want	0.58			
Your employment opportunities	0.55			
Your partner's job opportunities	0.30			
Your financial situation	0.59			
Your sexual life	0.42			
What people think of you		0.41		
The joy and satisfaction you get from life		0.64		
The closeness between you and your partner		0.65		
The closeness between you and your parents		0.55		
Certainty in your life		0.63		
If you were to have a child in the next 3 years, how much would the following persons agree with your choice?				
Most of your friends			0.62	
Your mother			0.78	
Your father			0.71	
The decision whether to have children or not can depend on various situations. How much could your decision whether to have a child or not in the next 3 years depend on...				
Your economic situation				0.72
Your job				0.67
Your housing conditions				0.68
Your health				0.56
Your partner's job				0.70
Help from non-cohabitant relatives in caring for the children				0.65
Help from partner in caring for the children				0.69

Source: 2003 FFS – Italy, own calculations

Note: Loadings shown are only those useful to place the item in the factor (>.04).

5.   Method: the implementation of TPB theory with graphical models
5.1.   Graphical models in general

Graphical models[1] are a class of multivariate models useful to study, estimate, describe and visualize the relationships among an entire set of variables of interest. A multivariate model is *graphical* whenever its conditional independence structure can be univocally depicted by a graph, where nodes represent variables and the absence of connection between two nodes represents a conditional independence. Graphs are therefore utilized to give a theoretically rigorous, but intuitively easy to understand, representation of the complex relationships among variables, on the basis of their joint distribution. These relationships are described in terms of conditional independence, which is the key concept of graphical models. Two variables, X and Y are independent given a third variable, denoted by $X \perp Y|Z$ following Dawid (1979) notation, whenever, controlling for Z, then X does not provide additional information on the distribution of Y and vice versa. A conditional independence statement is visualized in the graph by the absence of connection between two nodes. Different classes of graph can represent different kinds of relationship, with different semantics. *Chain graph models* (Lauritzen and Wermuth, 1989) are particularly useful whenever variables admit a partial ordering on the basis of subject-matter considerations. Variables are then partitioned into blocks. Variables belonging to a same block can be connected by undirected edges and are considered to be on an equal standing. Variables belonging to different blocks can be joined by arrows, representing a directed, "causal-like", association. In short, chain graphs models seem particularly useful whenever the interest is focused on an entire system of variables, at the presence of both symmetric and asymmetric association. Consequently, unlike regression models, the entire structure of the association is estimated, checked and efficiently visualized in a graph.

This kind of approach seems the most appropriate in order to empirically implement the TPB which suggests in itself the temporal sequence for the process leading to the decision to have a child. Namely the sequence is produced by "background variables" (block a), "perceived behavioral control", "subjective norms", "positive and negative attitudes" (block b), "fertility intentions" (block c), "actual constraints" (block d), and "fertility outcome" (block e) – see Table 2. Variables in the second block (b) are derived variables, obtained as a score from the original variables concerning positive and negative attitudes, subjective norm and perceived behavioural control. The

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[1] See Lauritzen (1996) for a comprehensive introduction of graphs and graphical models.

derived variables have been obtained by summing the original variables and then considered as ordinal variables[2].

5.2. Chain graphs models

As mentioned above, graphical models are a class of multivariate probability models whose conditional independence structure can be depicted by a graph. A graph G = (V;E) consists of two finite sets, a set *V* for nodes and a set *E* collecting edges between nodes. The edges in a graph can be undirected (lines), or directed (arrows). A graph with only undirected edges is called *undirected graph*, while a graph with only arrows, but without any directed cycle is called *Directed Acyclic Graph*. A *chain graph* is a graph with both directed and undirected edges, without semi-directed cycles. In these graphs, it is sometimes useful and always possible to partition nodes into an ordered sequence of blocks. Nodes in a same block can be joined only by undirected edges, while arrows connect nodes from different blocks. These graphs are also called *Block-recursive graphs*.

In graphical models, the multivariate model is associated to a specific graph describing the assumed conditional independence structure. Each variable in the model corresponds to a node in the graph. Two nodes are not connected whenever a kind of conditional independence occurs between the two variables. The reading of the conditional independencies encoded in the graph is due to sets of rules, called *Markov properties*, which are specific for each kind of graph.

A chain graph model is a graphical model associated with a chain graph. As mentioned before, variables are assumed to admit a partial ordering, corresponding to temporal and/or causal structure. Given the partial ordering, variables are partitioned into a sequence of blocks. Variables in a same are regarded on equal footing, while associations between blocks is assumed directional. Consequently, one can distinguish pure response variables (in the last block), pure explanatory/background variables (in the first block) and intermediate variables, which are response for variables in previous blocks and explanatory for the subsequent variables.

For illustration purpose, Figure 3 represents a chain graph consisting of three blocks. The first block on the left collects the two nodes associated with the two pure explanatory variables X_1 and X_2. The second block collects the intermediate variables X_3 and X_4. They are assumed to be responses for X_1 and X_2 and explanatory, together with the pure explanatory variables, for the pure responses. Here we are adopting the convention of ordering blocks from left to right. Arrows are oriented consequently.

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[2] See Cox (2008) for the properties of sum derived variables.

Table 2 Variables considered in our analysis and descriptive statistics

BOX BACKGROUND VARIABLES

name vars		modalities	FREQ
NC h	Number of children	0 (Ref.)	12.66 %
		1	30.26 %
		2+	57.08 %
AgeW	Age of women	<30	9.55 %
		30-40 (Ref.)	54.18 %
		>40	36.27 %
CDur	Couples' duration	0-4	15.49 %
		5-9 years (Ref.)	20.92 %
		?10	63.59 %
CTy	Type of couple	Married (Ref.)	96.22 %
		Cohabiting	3.78 %
Re g	Region of residence	North (Ref.)	48.86 %
		Centre	17.00 %
		Mezzogiorno	34.14 %
MunS	Municipality size	Big (Ref.)	16.75 %
		Medium	39.63 %
		Small	43.62 %
CEd	Couples' level of education	Both low (Ref.)	24.06 %
	(Ref. =)	Both medium	29.66 %
		Both high	6.09 %
		Her > Him	22.95 %
		Him > Her	17.24 %
WE	Women's employment situation	Public sector (Ref.)	20.95 %
		Priv. sect. / perm. contr.	35.47 %
		Priv. sect. / temp. contr.	4.83 %
		Not working	38.75 %
ME	Men's employment situation	Public sector (Ref.)	19.94 %
		Priv. sect. / perm. contr.	73.84 %
		Priv. sect. / temp. contr.	2.90 %
		Not working	3.32 %
CHD	Current housework division	<95% women (Ref.)	65.62 %
		? 95% women	34.38 %
SHD	Women's satisfaction on housework division	Yes / Moderate (Ref.)	4.34 %
		Not at all	95.66 %
PRP	Partents' residential proximity	Mother/mother in law both far (Ref.)	12.45 %
		At leat one at medium distance	28.93 %
		At leat one at close distance	58.62 %
Rel	religiosity	At least once per month (Ref.)	55.19 %
		Rarely/Never	44.81 %
Sib	siblings	Both partners without siblings	2.38 %
		At least one partner with large family	29.91 %
		Other	67.72 %

BOX ATTITUDES TOWARDS BEHAVIOUR

PAtt	Positive attitudes	Class 1	8.85 %
		Class 2	79.68 %
		Class 3	11.47 %
NAtt	Negative attitudes	Class 1	5.42 %
		Class 2	86.50 %
		Class 3	8.08 %
SubN	Subjective norms	Class 1	12.03 %
		Class 2	71.56 %
		Class 3	16.40 %
PB C	Perceived behavioural control	Class 1	13.92 %
		Class 2	70.76 %
		Class 3	15.32 %

BOX OF INTENTIONS

Fint	Fertility intentions	Definitely not	48.65 %
		Probably not	24.66 %
		Probably yes	16.19 %
		Definitely yes	10.49 %
Agr	Partners' agreement over fertility intentions	Yes (Ref.)	92.79 %
		No	7.21 %

BOX CONSTRAINTS 2003-2007

CDis	couple's disruption	No (Ref.)	96.08 %
		Yes	3.92 %

BOX REALISATIONS

Child	Fertility outcome	No (Ref.)	84.05 %
		Yes	15.95 %

Figure 3. Example of a chain graph with three blocks explanatory variables, for the pure responses.
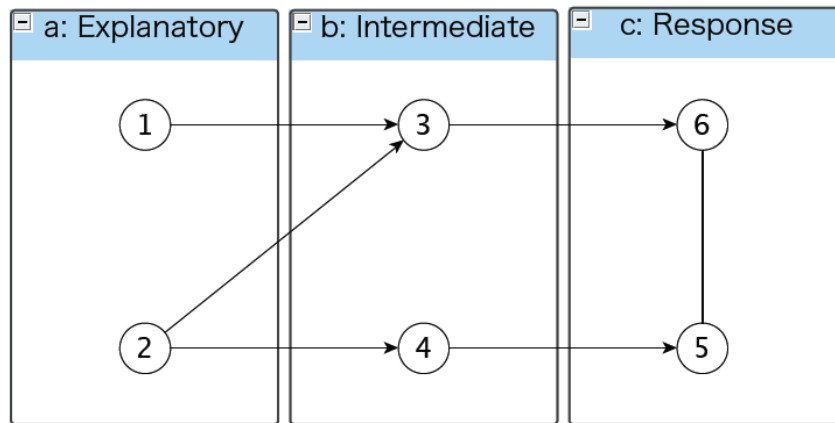
For a given graph, the so-called Markov properties yield a list of conditional in- dependence statements that, jointly with distributional assumptions, are assumed in the graphical model. Different set of Markov properties are possible giving different classes of chain graph models (see Drton, 2009, for a summary). Here we adopt the Lauritzen-Wermuth-Frydenberg (LWF) class of Markov properties (see Lauritzen and Wermuth, 1989; Frydenberg, 1990). The simplest LWF Markov property to read conditional independencies off a graph is the so-called *pairwise* block-recursive Markov property. According to this property, the absence of an edge between two nodes in a same block, implies that the corresponding random quantities are conditionally independent, given all the remaining random quantities in their block and in the preceding blocks. Moreover, the absence of an arrow between two nodes (in different blocks), suggests that the corresponding variables are conditional independent given all the remaining variables in the block of the nodes pointed by the missing arrow and of the previous blocks.

For example, in Figure 3, the lack of the edge between node 1 and 2, corresponds to the marginal independence statement $X_1 \perp X_2$, as no previous blocks are present. On the other hand, the absence of between node 3 and 4, state that $X_3 \perp X_4 \mid X1;X2$. The absence of the arrow form node 3 to node 5 implies that $X3 \perp X5 \mid X1;X2;X4;X6$, as the node 5 pointed by the missing arrow is in the last block. Similar statements can be deduced for the other missing arrows. Further Markov properties propose how to reduce the conditioning set of variables for the independencies implied by the pairwise block-recursive Markov property, and how to detect independencies among subgroups of variables.

6.   Results of graphical: Structure of (in)dependence among the variables of TPB.

The TPB can be used to model fertility decision-making process: as for other behaviors, when people formulate their intentions to have a(nother) child they rely on three conceptually separated types of considerations: their attitudes, subjective norms and perceived behavioral control. According to our outcomes, not all the dimensions considered in the TPB are interrelated. Our results show that the index identifying the "perceived behavioral control" is independent of the index standing for "subjective norms", given "positive" and "negative attitudes" as well as the background variables (Figure 4).

Looking at Figure 4 we can also notice that the "perceived behavioral control" depends on the number of children, the current gender division of housework in the couple, and women's age. The "positive attitudes" depend on the degree of religiosity, the number of children, and the duration of the couple. The "negative attitudes" depend on the number of children, current housework division, and the area of residence. The "subjective norms" depend on the number of children, the number of siblings, the duration of the couple, women's age, and the number of children.

Corroborating the scheme of TPB, the level of fertility intentions depend on all predicted types of considerations: attitudes, subjective norms and perceived behavioral control (Figure 5). Interestingly, the agreement between partners on fertility intentions is independent of all these type of considerations, given the level of intentions and the background variables.

Moving to the constraints that may intervene between the time when people express their fertility intentions and the moment of the subsequent realization, we focus on the likelihood of couples' disruption (Figure 6). This event is independent of the level of intentions, and agreement between partners on the decision to plan a child as well as of attitudes, subjective norms and perceived behavioral control, given the background variables.

Figure 6 also offers a validation for the TPB. As predicted from the theory, having a child is independent of attitudes, subjective norms and perceived behavioral control that, instead, influences the previous step (the formation of intentions). In other words, the intentions act as a filter between attitudes, subjective norms and perceived behavioral control and the subsequent behavior. Together with the likelihood of couple's disruption and the level of intention, some of the background variables act directly on the fertility behavior without being filtered by prior blocks. In particular, the most important determinants of the transformation of fertility intentions in subsequent outcomes results to be the proximate determinants (mainly the demographic ones such as women's age, number of children, couples' duration). Moreover, it seems also to emerge the role a constrain

typical of the Italian context: namely, the couples' gender role-set is crucial for making the step from fertility intentions to the subsequent behavior. Those women who perceive as fair their housework involvement are more likely to have a child, given the whole multi-factor structure of dependence considered.

More equal is the division of household labor within the couple, higher the fertility intentions are (confirming the previous result for Italian context of Mills et al. 2008). This positive effect of male household chores is not filtered by the variables belonging to the "block B" representing the personal considerations. Furthermore, and more striking, the perception of gender roles has an effect on fertility realizations, without being filtered nor by the personal consideration (i.e. block B) nor by intentions. As stated in the TPB theory, this individual subjective perception of the division of labor is particularly relevant, and when the woman perceives as not satisfactory the division of household chores the likelihood to have a(nother) child is significantly lower.

Figure 4 - Structure of the associations between background variables (block a) and peoples' own consideration (block b).
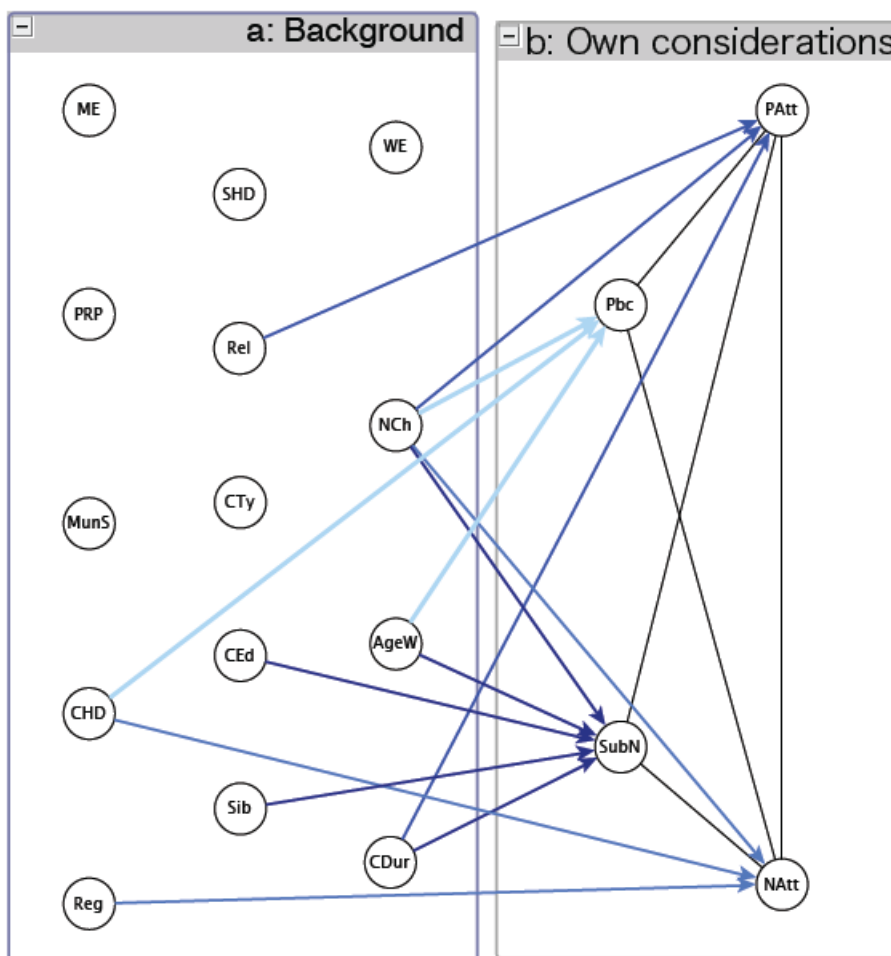
Figure 5 – **Structure of the associations among background variables (block a), peoples' own consideration (block b), and fertility intentions (block c).**
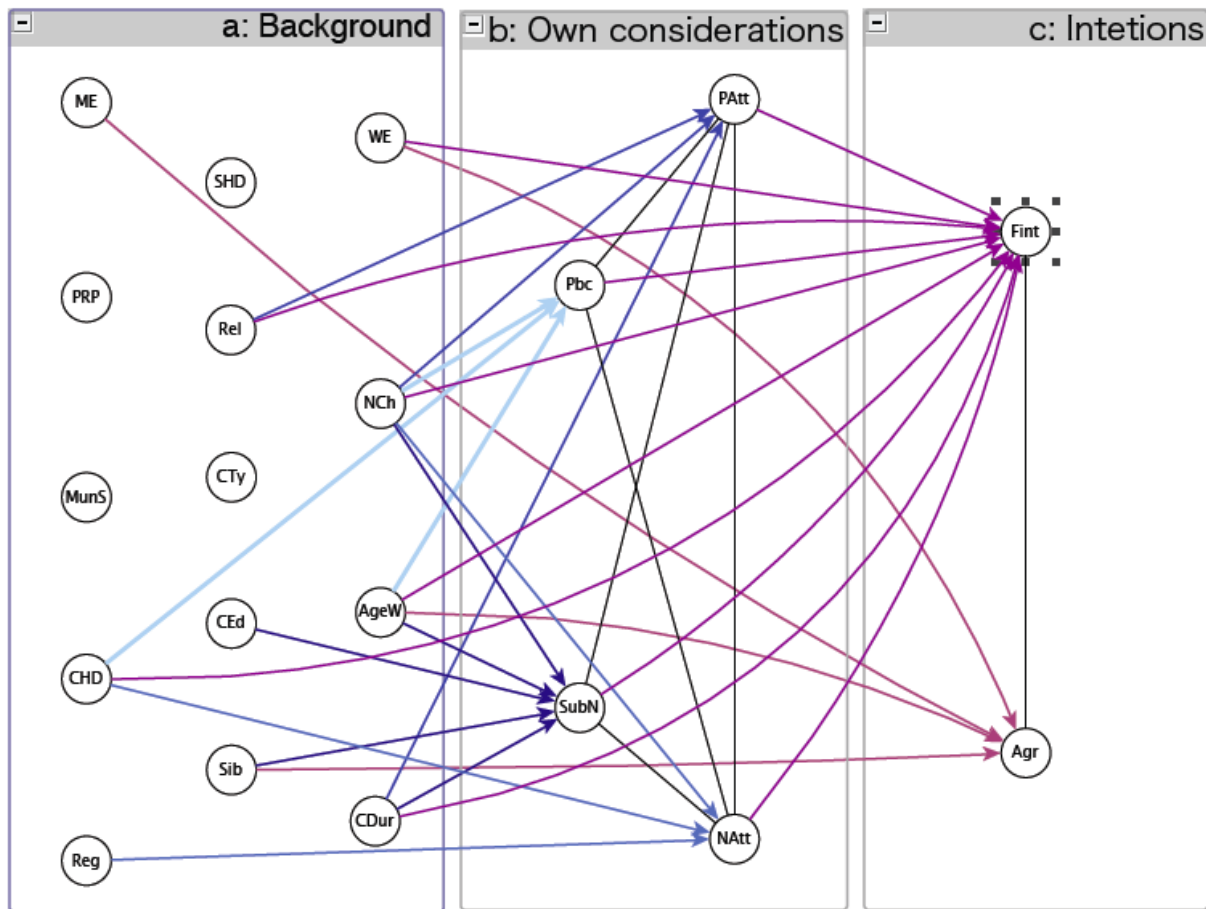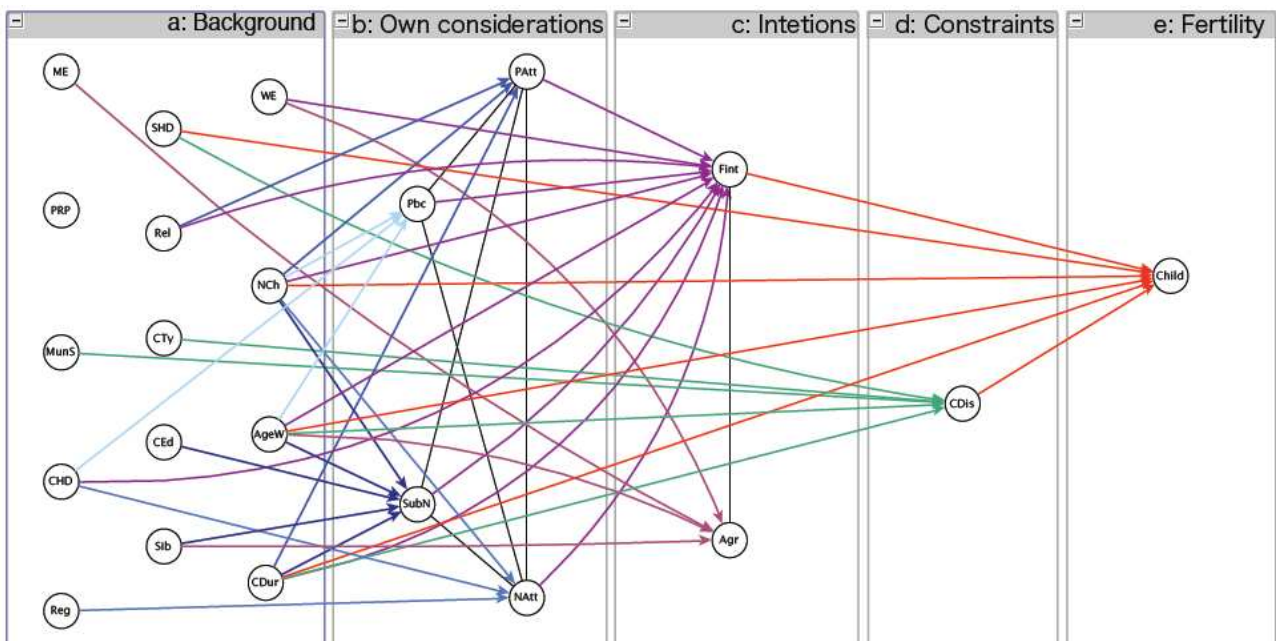

Figure 6 – **Structure of the associations among background variables (block a), peoples' own consideration (block b), fertility intentions (block c), actual constraints (block d), and fertility outcomes (block e).**

7. Conclusions

In this paper we followed a common paradigm, expecting individuals to make their procreative choices intentionally, based on an evaluation, however imperfect, of the costs and benefits of reproduction (e.g., Livi Bacci, 2001). Beside this starting point, we relied on a framework built from the social-psychological Theory of Planned Behavior (TPB) (Ajzen 1988, 1991) and its further adaptation to the fertility decision-making process (e.g., Billari et al., 2009).

In this framework, fertility outcomes are seen as directly dependent by fertility intentions which, on their side, directly depend on attitudes (related to the perceived benefits and/or costs of reproduction), subjective norms (related to the social approval of behavior from relevant others) and perceived behavioral control. Obviously, in this approach, the possible constraints that can intervene from the time of fertility intention to the subsequent behavior (such as a couple's disruption) should be accounted for. Altogether this multi-factor paradigm is expected also to depend on several background factors (such as socio-economic, social capital-related, and other factors).

In our paper we move beyond existing research and use the theory of graphical models to have a precise understanding and a formal description of the developmental process of the fertility-making process, by representing possible dependencies among all the variables of a multivariate distribution with a chain graph. Graphical models are appropriate in our study because we are dealing with a complex phenomenon over time and the relationships among all the factors should be jointly considered. We focused on the case of Italy, a lowest-low fertility country, in which it was possible, in 2003, to implement a specific module within the country-specific GGS survey targeted towards the collection of the relevant dimension of the TPB. Then, using the 2007 follow-up of that survey, it was possible to look at the fertility behavior of women and therefore complete the study of the whole process leading to the decision to have a child.

Overall our analysis strongly supports the validity of TPB for the Italian context and, therefore, provides an input to the systematic study of fertility behavior as a key to understanding contemporary fertility decision-making process. In this respect the crucial finding of our study is that the distinction among attitudes, norms and behavioral control is a strategy that allows simplifying the overarching complexity of factors leading to fertility behavior. In fact, attitudes, norms and perceived behavioral control are simultaneous determinants of fertility intentions, even after adjusting for possible confounding background factors. And, none of these three dimensions have an effect on fertility behavior: as predicted by the theory, they are all prior filtered by fertility intentions.

However, our analysis also provides some chandelling evidence that partly complicates the application of TPB to fertility research, especially regarding the role of background factors. Contrary to the theory asserts, in the course of fertility decision-making process not all background factors are mediated by attitudes, subjective norms, and perceived behavioral control. Some of the background factors, in fact, directly influence fertility intentions and others even fertility behaviors. Moreover, differently to what is anticipated by the TPB, not all the three dimensions formed by attitudes, subjective norms, and perceived behavioral control seem to be independent each other. Only the "perceived behavioral control" is independent of subjective norms, given the attitudes and the background variables.

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APPENDIX – Detailed model results

BLOCK B: OWN CONSIDERATIONS

Cumulative logit model predicting "positive attitudes" towards childbearing

Variables	Categories	Coeff.	St. Errors	t-stat
Number of children	0 (Ref.)	0		
	1	-0.205	0.16088	-1.274
	2+	-0.5899	0.17813	-3.312
Couples' duration	0-4	-0.2653	0.16217	-1.636
	5-9 years (Ref.)	0		
	≥10	-0.6709	0.15817	-4.242
religiosity	At least once per month (Ref.)	0		
	Rarely/Never	-0.2277	0.09874	-2.306
Negative attitudes	Class 1	-1.4711	0.19717	-7.461
	Class 2	-2.9825	0.25348	-11.766
	Class 3 (Ref.)	0		
Subjective norms	Class 1	0.7916	0.15308	5.171
	Class 2	2.4255	0.20465	11.852
	Class 3 (Ref.)	0		

Cumulative logit model predicting "negative attitudes" towards childbearing

Number of children	0 (Ref.)	0		
	1	-0.19777	0.1983	-0.9975
	2+	0.40824	0.2003	2.0377
Region of residence	North (Ref.)	0		
	Centre	0.09115	0.156	0.5843
	South	-0.323	0.1294	-2.4964
Current housework division	<95% women (Ref.)	0		
	≥ 95% women	-0.27129	0.1217	-2.2299
Positive attitudes	Class 1	-1.62262	0.1661	-9.7679
	Class 2	-2.90566	0.2495	-11.6441
	Class 3 (Ref.)	0		
Subjective norms	Class 1	-0.71266	0.1653	-4.3107
	Class 2	-0.7825	0.2379	-3.2891
	Class 3 (Ref.)	0		
Pbc	Class 1	0.18878	0.1693	1.1148
	Class 2	0.84455	0.2086	4.0482
	Class 3 (Ref.)	0		

Cumulative logit model predicting "subjective norms" towards childbearing

Number of children	0 (Ref.)	0		
	1	-1.19382	0.1433	-8.33042
	2+	-2.27849	0.1605	-14.1929
Age of women	<30	0.188561	0.1776	1.06149
	30-40 (Ref.)	0		
	>40	-0.39132	0.1061	-3.68776
Couples' duration	0-4	-0.15937	0.1627	-0.97945
	5-9 years (Ref.)	0		
	≥10	-0.68561	0.1718	-3.98969
Region of residence	North (Ref.)	0		
	Centre	-0.43486	0.124	-3.5059

	South	0.003892	0.1018	0.03823
Couples' level of education	Both low (Ref.)	0		
	Both medium	0.155024	0.1241	1.24914
	Both high	0.608644	0.2029	2.99921
	Her > Him	0.06882	0.1318	0.52226
	Him > Her	-0.09994	0.1407	-0.71034
Siblings	Both partners without siblings	0.630571	0.3014	2.09239
	At least one partner with large family	0.393604	0.2922	1.34687
	Other (Ref.)	0		
Positive attitudes	Class 1	0.97135	0.1545	6.2861
	Class 2	2.478906	0.2076	11.94028
	Class 3 (Ref.)	0		
Negative attitudes	Class 1	-0.0882	0.198	-0.44539
	Class 2	-0.69655	0.2492	-2.79528
	Class 3 (Ref.)	0		

Cumulative logit model predicting "perceived behavioural control" towards childbearing

Number of children	0 (Ref.)	0		
	1	0.5649	0.14067	4.0156
	2+	0.4067	0.13748	2.9579
Age of women	<30	0.3512	0.14719	2.3863
	30-40 (Ref.)	0		
	>40	-0.3346	0.08915	-3.7529
Current housework division	<95% women (Ref.)	0		
	≥ 95% women	-0.2722	0.08712	-3.125
Positive attitudes	Class 1	-0.5816	0.1487	-3.9115
	Class 2	-0.1936	0.19281	-1.0043
	Class 3 (Ref.)	0		
Negative attitudes	Class 1	0.1019	0.18655	0.5461
	Class 2	0.9777	0.23478	4.1642
	Class 3 (Ref.)	0		

BLOCK C: FERTILITY INTENTIONS

Cumulative logit model predicting fertility intentions

Number of children	0 (Ref.)	0		
	1	-0.9612	0.1299	-7.4
	2+	-2.1946	0.14266	-15.384
Age of women	<30	0.2775	0.14949	1.857
	30-40 (Ref.)	0		
	>40	-1.125	0.09955	-11.301
Couples' duration	0-4	-0.3786	0.13888	-2.726
	5-9 years (Ref.)	0		
	≥10	-1.1438	0.14691	-7.786
Women's employment situation	Public sector (Ref.)	0		
	Priv. sect. / perm. contr.	0.1182	0.10851	1.089
	Priv. sect. / temp. contr.	-0.5021	0.20194	-2.487
	Not working	0.2177	0.10946	1.989
Current housework division	<95% women (Ref.)	0		
	≥ 95% women	-0.1968	0.08563	-2.298
religiosity	At least once per month (Ref.)	0		
	Rarely/Never	-0.3033	0.07989	-3.796

Positive attitudes	Class 1	0.8926	0.18465	4.834
	Class 2	1.7587	0.21942	8.015
	Class 3 (Ref.)	0		
Negative attitudes	Class 1	-0.1885	0.17083	-1.103
	Class 2	-1.034	0.24522	-4.217
	Class 3 (Ref.)	0		
Subjective norms	Class 1	0.5392	0.14604	3.692
	Class 2	1.3063	0.18011	7.253
	Class 3 (Ref.)	0		
Pbc	Class 1	0.3608	0.12001	3.006
	Class 2	0.1879	0.15072	1.246
	Class 3 (Ref.)	0		
Partners' intentions agreement	Yes (Ref.)	0		
	No	-0.2931	0.14399	-2.036

Logit model predicting partners' agreement over fertility intentions

Age of women	<30	-0.61258	0.20344	-3.011
	30-40 (Ref.)	0		
	>40	0.59738	0.21304	2.804
Women's employment situation	Public sector (Ref.)	0		
	Priv. sect. / perm. contr.	0.18103	0.20065	0.902
	Priv. sect. / temp. contr.	-0.05656	0.33048	-0.171
	Not working	0.64351	0.21181	3.038
Men's employment situation	Public sector (Ref.)	0		
	Priv. sect. / perm. contr.	-0.03089	0.20676	-0.149
	Priv. sect. / temp. contr.	-1.15029	0.37234	-3.089
	Not working	-0.38608	0.41703	-0.926
Siblings	Both partners without siblings	-1.8935	1.03485	-1.83
	At least one partner with large family	-1.86562	1.02759	-1.816
	Other (Ref.)	0		
Fertility intentions	Definitely not (Ref.)	0		
	Probably not	-1.30088	0.22141	-5.875
	Probably yes	-1.93849	0.22766	-8.515
	Definitely yes	0.08773	0.37019	0.237

BLOCK D: CONSTRAINTS BETWEEN 2003 AND 2007

Logit model predicting couples' disruption

Age of women	<30	0.6091	0.4286	1.421
	30-40 (Ref.)	0		
	>40	-0.8409	0.4596	-1.829
Couples' duration	0-4	-1.2236	0.5064	-2.416
	5-9 years (Ref.)	0		
	≥10	-0.34	0.4852	-0.701
Type of couple	Married (Ref.)	0		
	Cohabiting	3.9058	0.3688	-10.59
Municipality size	Big (Ref.)	0		
	Medium	-1.056	0.4687	-2.253
	Small	0.0352	0.4075	0.086
Women's satisfaction	Yes / Moderate (Ref.)	0		
on housework division	Not at all	1.8529	0.5167	-3.586

Logit model predicting having a child				
Number of children	0 (Ref.)	0		
	1	0.4662	0.1784	2.613
	2+	0.156	0.2257	0.691
Age of women	<30	0.3748	0.1863	2.012
	30-40 (Ref.)	0		
	>40	-1.4943	0.2909	-5.137
Couples' duration	0-4	-0.8854	0.1787	-4.954
	5-9 years (Ref.)	0		
	≥10	-1.5533	0.2124	-7.314
Women's satisfaction	Yes / Moderate (Ref.)	0		
on housework division	Not at all	-2.2065	0.7541	2.926
Fertility intentions	Definitely not (Ref.)	0		
	Probably not	0.6467	0.2322	2.785
	Probably yes	1.9501	0.2285	8.536
	Definitely yes	3.236	0.2502	12.935
couple's disruption	No (Ref.)	0		
	Yes	-1.4867	0.4143	-3.589

Note: Stepwise procedure for model selection with comparison of the reduced model to the full model by means of the Likelihood Ratio test, to take into account for multiple test problem (cut-off point set at p>0.05).