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Direct and indirect paths leading to contraceptive use in urban Africa

An application to Burkina Faso, Ghana, Morocco, Senegal

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Résumé
Cet article examine le recours à la contraception dans les capitales de quatre pays africains, le Burkina Faso, le Ghana, le Maroc et le Sénégal. L'article cherche à répondre à deux questions : (i) quel est l'ordre hiérarchique des relations causales entre les caractéristiques individuelles associées au recours à la contraception dans les quatre populations urbaines considérées ? Plus particulièrement, (ii) comme l'instruction est un facteur majeur de la transition démographique, les données confirment-elles les deux chemins indirects allant de l'instruction au recours à la contraception qui ont été proposés dans la littérature, à savoir un chemin union-reproduction et un chemin socio-culturel ? À partir d'une analyse secondaire des Enquêtes Démographie et Santé (EDS), la méthodologie se base sur des modèles structurels récursifs représentés par des graphes acycliques orientés. L'analyse empirique confirme l'importance de variables telles que le désir d'enfants et l'accord parental en matière de planification familiale pour expliquer le recours à la contraception. L'analyse met aussi en relief un chemin structurel union-reproduction associant instruction féminine et recours à la contraception. En revanche, l'analyse aboutit à rejeter l'existence d'un chemin socioculturel, celui-ci étant infirmé par les données disponibles. La validité de ces résultats est discutée.

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Mots-clé
Recours à la contraception, instruction, Afrique urbaine, causalité, modélisation structurelle, graphes acycliques orientés.

Abstract
This study examined contraceptive use in the capital cities of four African countries, Burkina Faso, Ghana, Morocco and Senegal. The article sought to answer two questions: (i) what is the *hierarchical ordering* of causal relationships among the individual factors involved in the use of contraception in the four urban populations considered? More particularly, (ii) as education is a major factor of fertility transition, are two main *indirect pathways* that have been proposed in the literature (a union-reproductive path and a socio-cultural one), leading from women's education to contraceptive use, confirmed by the data? Having recourse to a secondary analysis of *Demographic and Health Survey* (DHS) data, the methodology is based on recursive structural models represented by directed acyclic graphs. The empirical analysis confirms the importance of variables such as the desire for children and partner agreement on family planning in explaining contraceptive use. It also highlights a structural union-reproductive path linking female education and contraceptive use. On the contrary, the analysis leads to a tentative rejection of the socio-cultural path, as it is falsified by the data available. The validity of these results is discussed.

Keywords
Contraceptive use, education, urban Africa, causality, structural modelling, directed acyclic graphs.

Introduction and Context

A city is a favoured place for the diffusion of news ideals and practices relating to fertility control. This study examined contraceptive use in the capital cities of four African countries. Three West African countries, an English-speaking one (Ghana) and two French-speaking countries (Senegal and Burkina Faso), and a country from North Africa (Morocco) are considered. Comparing these four countries places procreative practices into perspective, in distinct contexts from social, demographic and economic points of view but particularly regarding their family planning policies and procreative norms. Morocco was chosen as a relevant counterpoint to the three West African countries because, even if this country shares various societal norms with the other countries, social stigmatization of premarital sexuality is much more pronounced (Équipe ECAF, 2013). Furthermore, this country is particularly interesting due to its fertility transition, which is well under way; fertility has experienced

a rapid decline, to a present total level of 2.3 children nationally to 2.1 in the city of Rabat. The decrease in total fertility has been more moderate in Ghana (at time of writing, 4.4 nationally and 2.7 in Accra), while total fertility still remains high in Senegal (5.0 nationally and 3.4 in Dakar) and in Burkina Faso (6.2 nationally and 3.1 in Ouagadougou). In the three latter capital cities, these results reveal the adoption of fertility lowering behaviours compared with the rest of the country.

Morocco and Ghana are characterized by an early adoption of population policies. The latter are considered pioneers in Africa because they were set up at the end of the 1960s, while in Senegal and Burkina they were only launched in the 1990s. These policies have implemented family planning programmes promoting the diffusion of contraceptive methods through both the public and private health sectors, or through non-governmental organizations (such as family welfare associations), which sometimes stand in for the state for distributing contraception. In Morocco, where the small family model has been adopted, the success of these programmes is evident as they affect women in both rural and urban areas regardless of their level of education. However, the shortcomings of these programmes are that their target population is restricted to married women. The norm of preservation of prenuptial virginity is socially important, and extramarital sexuality is still subject to social prohibition. It is important to note that in Moroccan fertility surveys, only married women are interviewed, indicating the social denial of premarital sexuality. According to this viewpoint, the end of a woman's sexuality is procreation, placing her in the middle of a marriage-sexuality-procreation triptych controlled by her spouse and the family.

In the three West African countries, this same procreative end is in force, but even if sexuality outside of marriage remains socially stigmatized, it has tended to spread and become commonplace. Unlike in Morocco, these new trends are taken into account by the family planning programmes in these countries, since they also include young people. However, accessing these programmes remains often difficult because centres specifically devoted to youth do not exist and health workers are sometimes reticent to prescribe contraceptive methods to young people. However, the youth's contraceptive needs are increasing because of greater opportunities for love and sexual experience outside marriage. This is creating a growing gap between social norms that reject sexuality outside marriage and the daily practices of both young men and women (Adjamagbo *et al*., 2013).

Indeed, in these three countries, the duration of celibacy tends to lengthen, with a general increase in age at marriage for both men and women,

and even an increasing frequency of celibacy. A period of premarital sexuality is developing, with all the risks of both sexually transmitted diseases (STDs) and unwanted pregnancies. This issue of unplanned pregnancies is acute in these countries where access to abortion is restricted. Access is subject to specific conditions and authorizations which make this right more theoretical than real, in particular because of the stigma surrounding this practice both from the point of view of society and from health workers. Thus, abortion remains largely a clandestine practice and a risk to women's health and lives. Emergency contraception, which was introduced in 2002-2003 in these West African countries and in 2008 in Morocco, should improve the management of risks associated with non-protected sexuality.

The four countries are characterized by different levels of contraceptive prevalence, but also by the effectiveness of the methods used. The important recourse to the condom and to natural methods such as withdrawal and periodic abstinence puts women in a situation of dependence relative to their partner. Contraceptive practice remains dependent upon the cooperation of the male partner, which may prove difficult in male dominant societies. Indeed, these societies are characterized by an important societal control, in particular on women's sexuality and reproduction, resulting in the prohibition of premarital sexuality and of extramarital sexuality for women on the one hand, and sometimes in difficult access to methods of fertility control on the other. In contrast, this type of sexuality is recognized or encouraged for men. This situation is, however, changing due to exposure to new societal models, in particular through the media, and also due to certain legislative changes. In Morocco for example, the adoption in 2004 of the *Mudawana* (the Family Code) aimed at contributing to greater equality between men and women, which in the other countries has also been recognized by the law, even if it is not always translated into practice in these four countries. Legal changes relating to marital conditions, with the imposition of a minimum legal age at marriage (set for men and women in Morocco and Ghana at 18 years, at 16 and at 17 for women in Senegal and Burkina Faso, and at 20 for men in these two latter countries), the prohibition of forced marriage in the four countries and the limitation of polygamy, also contribute to this equality, even if they sometimes run up against traditional practices which continue to govern the union.

Improvement in education has contributed to reducing inequalities between men and women but, in these countries, progress is far from equal; whatever the educational level considered, school enrolment rates are higher in Morocco and to a lesser extent in Ghana, compared to

Senegal and Burkina Faso, but enrolment of boys is always higher than that of girls. This evolution has a significant impact on fertility control, the lengthening of the period of studies contributing to a notable postponement of the entry of women into reproductive life. It has also increased social capital, which should give women better access to professional life, thus modifying the perception of their future (Moguerou, 2006). Basu (2010) offers the view that *primary* schooling by itself often enforces discipline and obedience to authority figures, and thus does not necessarily lead to personal empowerment and autonomy that subsequent education (secondary and post-secondary) can deliver.

Considering the specificities of the four contexts examined above, it is interesting to compare the direct and indirect paths leading to contraceptive use. More specifically, this article seeks to answer two questions: (i) what is the *hierarchical ordering* of possible causal relationships among the individual factors involved in the use of contraception in the four urban populations considered? In particular, as education is a major factor of fertility transition (Ainsworth *et al*., 1996; Shapiro, 2012), (ii) are the two main *indirect pathways* that have been proposed in the literature (a union-reproductive path and a socio-cultural one), leading from woman's education to contraceptive use, confirmed by the data? Of course, these two paths are not independent as they have, among other factors, education in common. Moreover, there is no opposition between the paths and individuals may follow both pathways.

Actually, as pointed out by Gordon *et al*. (2011), few papers have focused on the intervening factors mediating the association between education and contraceptive use. For this purpose, a recursive causal (or structural) model is developed, represented by a *directed acyclic graph* (DAG), linking putative causes and effects, with the aim of expressing the mechanism or data generating process (DGP) accounting for the links between factors and outcomes. Most studies on the individual determinants of contraceptive use resort to models which do not take into account the causal ordering of the variables, though the use of a path model by Gordon *et al*. (2011) is an interesting rather recent exception. Demography should have more recourse to causally-ordered models when representing social mechanisms, as the latter can actually be considered as generative processes in a causal approach (Fararo, 2011; Wunsch *et al.*, 2014).

The paper is structured as follows. The first section considers the relevant background knowledge and develops the conceptual framework. The following section deals with data, the operational model and methods. The third section analyses the direct effects of individual factors on

contraceptive use and on their proximate determinants, then tests two indirect pathways leading from woman's education to contraceptive use. The paper ends with a discussion and conclusion.

Background and conceptual model

Despite numerous family planning programmes introduced in developing countries since the 1960s, the prevalence of modern contraceptive methods in Africa is still low, with the exception of southern Africa (especially South Africa, Zimbabwe and Namibia), even among women in a relationship who do not want any more children or who would like a larger interval between their children (Measure DHS, 2010). According to background knowledge, use of contraception is the result of the accessibility and quality of health services, the couple's union and reproductive histories, gender relations and the social and economic capital of both the man and the woman (including education, employment and income). These domains, largely described in the literature as directly determining contraceptive use, are also interrelated (Tsui, Ochoa, 1992; National Research Council, 1993; Jejeebhoy, 1995; Stephenson *et al*., 2007). Many explanatory factors have been put forward for the low take-up of modern contraceptive methods in sub-Saharan Africa: the value placed on fertility, high levels of infant mortality, difficulty in accessing health services (for geographical or financial reasons), the quality of service provision (including the scarcity of female healthcare practitioners) and the fear of side-effects caused by hormonal methods (Bongaarts, Bruce, 1995; Guillaume, Desgrées du Loû, 2002). It is commonly acknowledged that access to health services and use of contraception depend on motivation to practise birth control and the perceived costs of doing so (Easterlin, Crimmins, 1985; Oliver, 1995). These «costs» include financial, cultural, physical and psychological factors among others (Bulatao, Lee, 1983; Bamikale *et al.*, 1996). In societies where women have little public power, their decision-making ability in private life is also limited. Deciding whether to use contraception or to have sexual intercourse is not something over which they have sole control, and it will depend on gender relationships and in particular on communication between the spouses (Gage, 1995; Oheneba-Sakyi, Takyi, 1997; Bajos, Ferrand, 2009). This factor can give rise to asymmetrical power situations between the partners, which will influence sexual and reproductive practices.

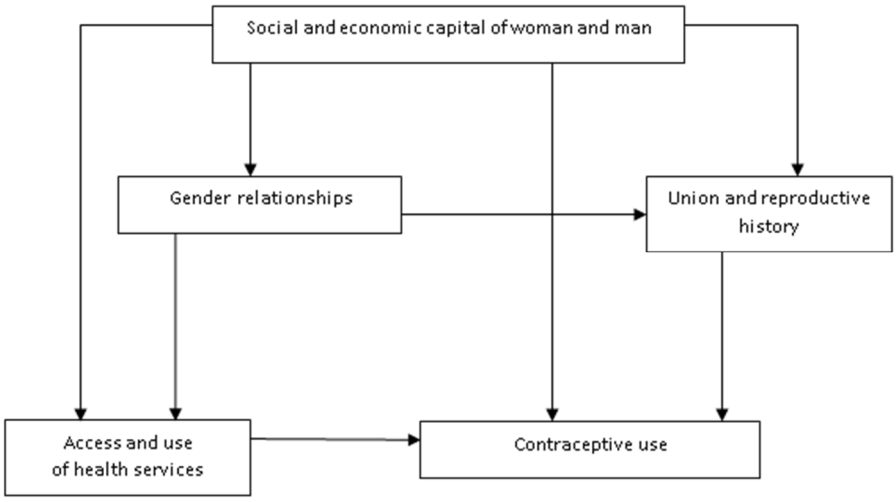
Of particular interest is the relationship between education and fertility. «Educational differentials are among the best established and most widely studied socio-economic differentials» in the field of fertility (Bongaarts, 2003, p. 321). The relationship is however highly context-dependent, varying by stage of fertility transition, level of development, region of the world, the average level of education, its content and the skills and social values imparted in school (Jejeebhoy, 1995; Bledsoe *et al.*, 1999; Diamond *et al*., 1999; Cleland, 2002; Bongaarts, 2003). Education could therefore be a determinant of fertility decline or a covariate associated with other factors impacting on fertility decline (Eloundou-Enyegue, 1999). The relationship is also often non-linear; increasing education is associated with lower fertility, except at very low levels of education in the least developed countries where it can be associated with higher fertility or have no impact at all (Cochrane, 1979; Cochrane, 1983; Ainsworth *et al*., 1996). Numerous variables have been proposed in the literature to explain this relationship (Cochrane, 1979; Kasarda, 1979; United Nations, 1995; Ainsworth *et al*., 1996; Diamond *et al.*, 1999; Basu, 2002; Cleland, 2002). In addition to access to contraceptive methods, considered as a main mediator between education and fertility, the following variables can be pointed out: age at marriage, age at first birth, number of living children, exposure to mass media, female employment and the existence of strong family planning programmes. Other characteristics that have been discussed and could be related to the education-fertility relationship include education of the partner/husband, husband-wife communication and infant mortality. Fertility aspiration is also an important variable but is often poorly recorded (Cochrane, 1979; Castro Martin, 1995). One should also note the role of urban/rural residence and the possibility that religion could have an impact on both education and fertility (Heaton, 2011; Zanin *et al.*, 2014).

As already pointed out by Cochrane (1979) and Kasarda (1979), or more recently by Jejeebhoy (1995) and Bongaarts (2010), the variables affecting fertility and contraceptive use should be ordered to distinguish between direct and indirect effects, leading to different pathways in a recursive model. However, none of these four authors have actually submitted their ordered-variable frameworks to empirical testing. Based on the background information relating to contraceptive use and fertility summarized above, the following hypothetical conceptual framework is put forward (see Figure 1).

Social and economic capital influences all the other factors in the system, whereas union and reproductive histories only affect contraceptive use. The union and reproductive histories also depend upon gender re-

lations among partners (Blanc, 2001; Blanc, Wolff, 2001). Both the relationship among partners and the woman's and the man's social and economic capital influence access to health services and their use. One can consider that socio-economic characteristics impact on sexual and contraceptive practices by way of the socialization and living environments, employment and schooling (Moreno, 1993; Shapiro, Tambashe, 1994; Montgomery *et al*., 2001). Contraceptive practices take place in the context of marriage and childbearing patterns that, in traditional African societies, are characterized by early marriage for women, late marriage for men and by high birth rates (Bozon, Hertrich, 2004; Tabutin, Schoumaker, 2004). This age-difference between men and women entering into a relationship reinforces the unequal power between partners, as age hierarchy is combined with gender inequality (Zlidar *et al.*, 2003; Barbieri, Hertrich, 2005). As to urban environment, health services are more easily accessed and children are more likely to attend school, because these structures are geographically closer. Women's employment, and the economic independence it can lead to, facilitates access to health services (Defo, 1997). Education increases exposure to attitudes and behaviours that are likely to promote birth control or larger intervals between children, and may lead to greater acceptance and use of modern contraceptive methods (Castro Martin, 1995; Heaton, Forste, 1998; Ayoub, 2004).

FIGURE 1 A conceptual model of the determinants of contraceptive use



Data and methods

Data and operational model

The data used were those available from the most recent *Demographic and Health Survey* (DHS) carried out in Morocco, 2003-2004 (Ministère de la Santé, Ligue des États Arabes Projet Papfam, ORC Macro, 2005), to which were added for temporal comparability the DHS for Ghana conducted in 2003 (Ghana Statistical Service, 2004), for Burkina Faso, 2003 (Institut National de la Statistique et de la Démographie, ORC Macro, 2004) and for Senegal in 2005 (Ndiaye, Ayad, 2006). The Conclusions and Discussion section briefly examines more recent results for the last three countries. The populations included in the analysis were composed of women aged between 15 and 49 that were in a relationship, living in an urban setting in the capital region (Ouagadougou, Accra, Rabat, Dakar), already sexually active, *i.e.* being exposed to the risk of becoming pregnant, socialized in the country considered, and for which there were no missing values for the variables taken into account in the multivariate analysis. Focusing on women living in an urban setting, as defined in the censuses on which the DHS surveys were based, excluded rural populations with more difficult geographic access to family planning services from the analysis. The decision to analyse data only from women in a relationship, excluding women who had declared themselves as «single», was made because in Morocco questions on contraceptive use and number of children were only put to married women. The resulting sample sizes were as follows: 873 for Burkina Faso, 745 for Ghana, 3'424 for Morocco and 1'652 for Senegal. For the purpose of the analysis, women were subdivided into two large age groups, 15-29 and 30-49, and further sub-divided by five-year age intervals. This made it possible to take, to some extent, cohort effects into account, and to construct more relevant categories for some of the variables, such as parity.

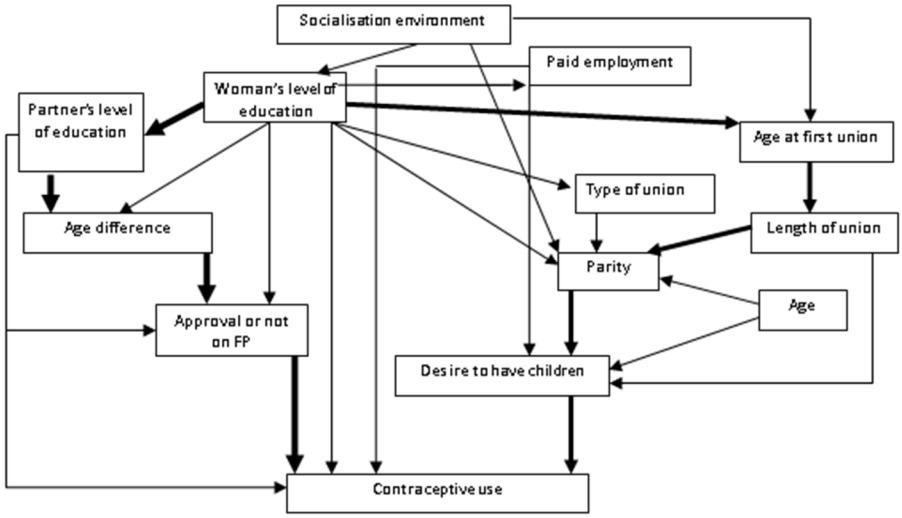
The determinants incorporated into the theoretical or conceptual framework, developed in Section 2, should be represented by a set of variables drawn from the databases. However, this secondary analysis of survey data placed significant constraints on the operationalization of the conceptual framework. Consequently, the concept «*Access and use of health services*» was not taken into account when operationalizing the model due to a lack of relevant data, and the other concepts were only partly represented by the DHS data. Among the latter, for example, concerning union history, the length of the first union was known but if a

woman entered into a second union its duration was not known, as age at entry into this second union has not been collected. Furthermore, data for the woman's partner (age, level of education and views on family planning) were taken from the answers given by the woman herself. Figure 2 presents the operational model taking the available data into account. It has been applied to the two large age/cohort groups in the four capital cities. Figure 2 is of course a highly simplified representation of a much more complex reality, as is the case with all models. As such, a model can always be criticised.

The social and economic capital of the couple was represented by the woman's level of education (none, primary, secondary or more), her socialization environment during childhood (capital/city, small city or rural), whether she undertook paid employment in the 12 months prior to the survey or not and her partner's level of education (same categories as for women) (Ainsworth *et al*., 1996; Kimuna, Adamchak, 2001; DeRose, Ezeh, 2005). For *union and reproductive histories*, the relevant information taken from the database related to age at survey date, age at entry into a first union, duration of first union (in years) and whether the woman had married more than once or not, type of union (monogamous or polygynous), number of live births and desire for a child (in the next two years, other or no more children) (Locoh, 2002). Possible confounders of the relation between *desire for a child* and *contraceptive use* were controlled for, such as woman's education and paid employment, in order to avoid endogeneity issues among choice variables (Bollen *et al*., 1995). No direct path between *education of woman* and *desire for a child* was assumed in the DAG, as it was considered that the relation is mediated by the variables on the various paths leading from education to desire for a child, taking the appropriate control variables into account[3]. Other mediators could be fertility aspirations and attitudes, exposure to the media, *etc.*, for which unfortunately no indicators are available in the dataset. Future research should deal with this issue in greater depth and with better data, in particular with longitudinal data.

3. For the choice of control variables, see Mouchart, Wunsch and Russo (2016).

FIGURE 2 An operational model of the determinants of contraceptive use[4]



Sexual history, such as age at first intercourse, was not taken into account, as this information was not available in the Moroccan data. *Gender relationships* were addressed by means of two variables: the age difference between the partners and their views on practising family planning: both approved, both disapproved, opposite views or no communication (Salway, 1994; Lasee, Becker, 1997; Peterson, 1999). As pointed out above, *Access and use of health services* did not feature in the operational model, since the DHS data did not cover these issues. In this study, the problem of geographical accessibility was however relatively minor, since only women living in an urban area were considered. Access from a financial and cultural point of view was covered partly by the woman's level of education and by whether or not she undertook paid employment during the past 12 months. For the outcome variable *contraceptive use*, a distinction was drawn between women who practised birth control (modern methods and natural methods) at the time of the survey and those who did not (including folk practices). The *modern methods* considered were: the pill, intrauterine device (IUD), injectables, implants, spermicides, female condom, female sterilization and male condom. *Natural methods* included withdrawal, periodic absti-

4. This model has been applied to each of the two large age/cohort groups in each capital city.

nence, and the lactational amenorrhoea method (LAM). Finally, *folk practices* referred to amulets and other methods based on folklore.

Methods of analysis

Many analyses of contraceptive use have resorted to statistical methods without taking into account a possible causal ordering among the variables, implicitly assuming that all the putative determinants had a direct effect on the dependent variable. However, the impact of these various factors on the use of contraception can be direct or indirect, meaning in the latter case that the effect of some putative causes can be mediated by one or more intermediate factors; on the role of mediators in causal analysis, see *e.g.* Baron and Kenny (1986). In this paper, the links among variables are expressed by a recursive causal model ranking the variables according to their status as cause or effect. Figure 2 above actually represents a *directed acyclic graph* (DAG) where each variable or node in the graph depends upon the variables upstream, *i.e*. upon their «ancestors», in the absence of retroactive or feedback effects (Pearl, 2000). Each arrow or link represents a putative causal effect and each endogenous variable (*i.e.* one that is determined by other variables in the model) is conditioned on its immediate causes or «parents», *i.e*. the variables that have a direct effect upon this endogenous variable. The woman's age at the time of the survey and her socialization environment were regarded as exogenous variables, *i.e.* they do not depend upon other variables in the model. As the variables are in categorical format, structural equation models are not adequate. Logistic regressions were used throughout, in a sequential conditioning approach better suited to the analysis of successive sub-mechanisms.

More formally, as discussed in Mouchart *et al.* (2010), a causal (or structural) model has three main features: (i) a recursive decomposition of the multivariate distribution interpretable as a mechanism composed of various sub-mechanisms, (ii) congruence with background knowledge and (iii) invariance or stability of the recursive decomposition across contextual changes. A recursive decomposition is a systematic marginal-conditional decomposition of the joint distribution of the data. The whole recursive decomposition can be interpreted as a global mechanism or data generating process (DGP) in which several sub-mechanisms act (Wunsch *et al.*, 2014). It can be represented graphically by a DAG. Each component of the decomposition (an effect and its immediate causes) stands for one of the sub-mechanisms that compose the joint DGP. The recursive decomposition is built in such a way that the sub-

mechanisms are derived from background knowledge. Finally, invariance or stability of the model is required, as a major aim of structural modelling is to distinguish incidental from structural components of the data generating process.

If the model is, to the best of one's knowledge, a suitable representation of the DGP, then the approach takes into account the possible confounders of each sub-mechanism*, i.e.* it ensures the exogeneity of the sub-mechanisms (Mouchart *et al.*, 2009). Indeed, conditioning each effect on its immediate causes, or «parents» in the graph jargon, takes into account all paths entering into the effect/outcome variable. This is actually a more stringent procedure than just controlling for a set Z of confounders of an «X causes Y» relation. In addition to confounders, nodes of all the arrows in the DAG, which are not members of Z, targeting the outcome variable, are also conditioned upon as they lead to variations in Y. Another advantage of this approach is that each effect is conditioned upon a much smaller number of variables than would be the case if a dependent variable was conditioned on all other variables in a single-equation model. It is helpful in keeping a sufficient number of units per cell of the data matrix, as the conditional distributions are based on a smaller number of variables. The present approach respects the principle of parsimony and avoids incorporating non-informative variables into the model, in particular in each of the sub-mechanisms. In the recursive decomposition framework, no global model is fitted simultaneously to the data. The parameters of each sub-mechanism are estimated separately, each outcome or effect variable being conditioned on its immediate «parents» in the DAG, in the present case by logistic regression.

Referring to the DAG (Figure 2) representing the recursive decomposition of the multivariate distribution, the direct effects on contraceptive use by women are assessed by a logistic equation reflecting the following conditional expression, the symbol «|» meaning «conditioned on»:

> *Contraceptive use* | partner's level of education, approval of family planning, woman's level of education, paid employment in the past twelve months, desire to have children.

In other words, woman's contraceptive use is conditioned on its immediate «parents» in the DAG: partner's level of education, agreement on family planning, etc. The other sub-mechanisms can be estimated by logistic regressions using the conditional expressions set out below, each expression or sub-mechanism including the variables that have a direct effect (represented by arrows in Figure 2 targeting each successive variable) on every outcome considered:

Parity | age, type of union, woman's socialization environment, length of the relationship, woman's level of education.

Desire to have children | parity, length of the union, age, paid employment in the past twelve months.

Approval of FP | age difference, partner's level of education, woman's level of education.

Age at first union | woman's socialization environment, woman's level of education.

Length of union | woman's age at first union.

Type of union | woman's level of education.

Paid employment | woman's level of education.

Partner's level of education | woman's level of education.

Woman's level of education | woman's socialization environment.

Age difference | woman's level of education, partner's level of education.

The exogenous variables in the global model or mechanism are *woman's age* and her *socialization environment in childhood*; they are not dependent upon other variables in the model. We recall once again that the model has been applied to the two large age/cohort groups in the four capital cities.

Results

Description of determinants of contraceptive use

Appendix Tables A1 and A2 present the characteristics of the four samples for each variable considered in Figure 2. Summarizing the main results, it can be seen firstly that for *age at union* the lowest age was observed in Senegal and the highest in Morocco, for both groups of cohorts. *Polygyny* was more frequent in Senegal and monogamy was the rule in Morocco. In all of the countries, most of the women had been *socialized* in an urban environment (the capital or a town). The highest levels of *education* were seen in Ghana, for both men and women, and the differences between this country and the other three countries were more pronounced for the age group 30-49 than for the 15-29 age group. A large majority of women had undertaken *paid employment* in the past 12 months, except in Morocco (both age groups) and in Senegal (for the 15-29 age group). As to *age differences between partners*, whatever the group of cohorts, more than 50% of women in Senegal were in a rela-

tionship with a man at least ten years older. For the 15-29 age group, the proportion of childless women was highest in Senegal. This characteristic needs to be considered in the light of the higher percentage of very young women in the sample, but also of the fact that a majority of women *wanted to have a child* within the next two years. For the 30-49 age group, the highest modal *parities* were recorded in Senegal and Burkina Faso, and the lowest in Morocco. Asked whether or not they wanted any more children, more than two-thirds of the Moroccan women answered that they did not. While the vast majority of couples were in favour of *family planning*, the situation was somewhat less clear-cut in Senegal. It was also in Senegal that more couples disagreed on this point, or that women said they did not know their partner's opinion.

Concerning the outcome variable at the time of the surveys, *use of contraception* by women in a relationship and living in an urban environment varied considerably among the four countries in terms of prevalence and method used. *Contraceptive prevalence* was the highest in Morocco where, however, available data on contraception concerned only women in unions. In the capital region, nearly two-thirds of women in unions (63.8%) used a modern contraceptive method, predominantly the pill. In the three other capital cities, contraceptive prevalence of sexually active women was weaker: in Ouagadougou, 44.1% used a modern method, in Accra, 34.4% and in Dakar only 27.7% of the women used a modern method. In Burkina Faso and Ghana, condoms were largely used: the emergence of the HIV epidemic and the launch of campaigns against it have had a wide influence on the development of prevention policies and on making condoms available through social marketing programmes. Concerning the two large age groups considered here, among women aged 15-29, modern contraceptive use ranged from 21% in Senegal to 66% in Morocco, while the corresponding figures for Ghana and Burkina Faso were 37% and 50% respectively. The ranking was the same for women aged 30-49, with rates ranging from 32% in Senegal to 63% in Morocco. Once again, Ghana and Burkina Faso came in-between these figures: 33% and 39% respectively.

The *contraceptive methods* used can be subdivided into those over which the man had greater control (condom, withdrawal and periodic abstinence) and those where the woman had greater control (hormonal methods, IUD, sterilization, spermicides, LAM and female condom; see Table 1). In the 30-49 age group, almost three-quarters of the women in all countries used methods over which they themselves had more control, with the lowest rate being found in Ghana. The situation for women aged 15-29 was rather more mixed: most women in Morocco and Sene-

gal used methods over which they had more control, in contrast to Burkina Faso and Ghana. In the latter two countries, respectively, almost 40% and 50% of the methods used were those over which men had more control.

TABLE 1 Percentage of contraceptive use according to which spouse had control

	Burkina Faso	Ghana	Morocco	Senegal
Women aged 15-29				
Methods controlled by man	41	51	11	30
Methods controlled by woman	59	49	89	70
Women aged 30-49				
Methods controlled by man	29	36	21	17
Methods controlled by woman	71	64	79	83

Sources: Demographic and Health Surveys: Burkina Faso (2003), Ghana (2003), Morocco (2003-2004), Senegal (2005).

Direct paths leading to contraceptive use and to their determinants

Direct paths leading to contraceptive use

Direct paths are those leading from the immediate causes, proximate determinants or «parents» in the graph jargon, to an outcome. They contain the influence of all the variables preceding the «parents» in the DAG, following the Markovian property of Bayesian networks (Pearl, 2000). Standing for the impact of the closest cause on an outcome, direct paths are of prime interest in a causal approach.

Figures 3a (for women aged 15-29) and 3b (for women aged 30-49) show the impact of variables that had a direct effect on *contraceptive use*: paid employment, desire to have a child, approval of family planning, woman's education and partner's education. As stressed by Cochrane (1979), though it is difficult to evaluate the precise impact of each variable (given the tentative nature of the model), the *direction* of the relations can nevertheless usually be established. In order to visualize the result, an arrow pointing upwards means that the explanatory variable increases contraceptive use, while a downwards pointing arrow shows the contrary. A straight horizontal line indicates that there is no significant effect of the predictor variable on contraceptive use. In

each case, the relevant control variables have been taken into account[5]. The numerical results are presented in Appendix Tables B1 and B2. The significance level was set at 0.05; $p \leq 0.05$ indicates the acceptance of up to 5% type-I errors or false positives with a null hypothesis of odds ratio (OR) equal to one.

FIGURE 3A Women aged 15-29: direct paths on contraceptive use

	Burkina Faso	Ghana	Morocco	Senegal
Woman's level of education	↗	–	↘	↗
Paid employment during the last 12 months	–	–	–	–
Partner's level of education	–	↗	–	↗
Disapproval of FP	↘	–	–	↘
No desire for child in the next two years	↗	↗	↗	↗

FIGURE 3B Women aged 30-49: direct paths on contraceptive use

	Burkina Faso	Ghana	Morocco	Senegal
Woman's level of education	↗	–	↗	↗
Paid employment during the last 12 months	–	–	–	–
Partner's level of education	↗ a	–	↗	–
Disapproval of FP	↘	↘	↘	↘
No desire for child in the next two years	↗	↗	↗	↗

a: only for primary level of education.

It should be noted that in the absence of longitudinal data, the causal impacts are not studied here across time for the same individuals but across individuals at a given point in time. For example, the impact of an increase in the level of education from x to x' on contraceptive use does not refer to what the change in the use would be if a particular set of women increased their level of education from x to x' over time, but shows the difference in contraceptive use between women having a level of education of x and others a level of education of x' at the time of the survey.

Paid employment had no direct effect on contraceptive use, irrespective of broad age group or country. The lack of impact of this variable may be

5. Control variables are the other «parents» of each outcome, following the rule given in Mouchart, Wunsch and Russo, 2016.

due to the fact that it was only a distant proxy of the resources available to the woman, and hence of the affordability of contraception. Conversely, *not wishing to have a child* in the next two years increased contraceptive use, compared to those who wanted another child within the next 2 years, for all ages and countries (for the 15-29 year old, the lowest OR was 1.64, for Senegal; for the 30-49, it was 4.04, also for Senegal). *Disapproval of family planning* by one or the other partner (opposite views) reduced contraceptive use in all four countries for women aged 30-49 (OR ≤ 0.59, for Morocco). For women aged 15-29, this category reduced contraceptive use in Burkina Faso and Senegal but had no effect in Ghana and Morocco. In Ghana, where contraceptive use was lower than in Burkina Faso, this lack of impact might indicate that women were less dependent upon their partners' opinion. It should be noted that the category «no communication» between the partners (according to women's statements) had an effect in all countries and on all age groups, and significantly reduced contraceptive use.

Women who underwent primary or secondary *education* were more likely to use contraception in Burkina Faso and Senegal (both age groups) and in Morocco (30-49 age group). More surprisingly, education had the reverse effect among Moroccan women in the 15-29 age group, leading to a decrease in contraceptive use (OR = 0.61 for primary and 0.51 for secondary). The fact that this variable had no effect in Ghana is worth noting, and should be considered in the light of high primary and secondary schooling rates in that country, especially in an urban environment. Finally, in Ghana and Senegal, women in the 15-29 age group whose *partners* had undergone *schooling* were more likely to use contraception, except in Senegal at the primary schooling level. This variable had no effect on the same age group in Burkina Faso and Morocco. In contrast, the results observed for the 30-49 age group showed no effect in Ghana and Senegal and a positive effect in Burkina Faso (but only for primary education) and Morocco.

Direct paths leading to the proximate determinants of contraceptive use

The previous section examined the impact of the direct causes (or «parents» in the graph jargon) on contraceptive use. The present section examines the impact, on each of these «*parents*» of contraceptive use, of their direct determinants, *i.e*. the so-called «*grand parents*» of contraceptive use in the causal ordering of the variables, moving upwards from contraceptive use in the graph (refer to the DAG presented in Figure 2). For each «parent», the respective impact of the «grand parents»

(noted in italics), derived from the logistic regressions, are presented in Tables 2a and 2b. For example, the outcome variable «desire (or no desire) for children in the next two years» was regressed on its direct causes in the DAG: parity, length of union, age of woman and paid employment. Once again, the significance level was set at 0.05.

For the younger age group (Table 2a), the main significant results were as follows. First, women with a high parity (3+) tended to desire no more children in the next two years, and vice versa for childless women. The most recent cohorts (aged 15-19) had less desire for a child in the next two years than the reference group, except in Burkina Faso. Secondly, Ghana excepting, having been socialized in an urban area had a strong impact on women's education. Lastly, there was a high homogamy between women's and partner's education level.

For the older age group (Table 2b), once again women with more children had less desire for more children than childless women. Moreover, the greater the age, the lower the desire for children. However, the fact of being in a second (or higher order) union increased the desire to have a child compared to women remaining in their first union. Concerning approval of family planning, compared to those with no education, a partner's higher education increased approval of family planning in Morocco and Senegal. For this same variable, women's education had on the whole a positive impact in the four countries. Similar to the younger age group, being socialized in an urban area was associated with a higher education for women. As mentioned previously, male and female education levels were highly correlated.

TABLE 2A Direct paths leading to the determinants of contraceptive use
Women aged 15-29

«Parents»	Burkina Faso	Ghana	Morocco	Senegal
«Grand-parents»[6]				
No desire for child in next two years				
Parity				
0	0.01	0.16	0.04	0.06
3+	4.88	8.12	4.61	2.32
1-2 (ref.)				
Length of union				
0-4 Years	n.s.	n.s.	n.s.	n.s.
Two + unions	n.s.	0.42	n.s.	0.30
5 + years (ref.)				
Age of woman				
15-19	n.s.	4.28	2.71	2.03
20-24	n.s.	3.84	n.s.	1.62
25-29 (ref.)				
Paid employment				
No	n.s.	n.s.	n.s.	1.51
Yes (ref.)				
Approval of family planning				
Age difference				
Man older: 5-9	n.s.	n.s.	n.s.	n.s.
Man older: 10 +	n.s.	0.37	n.s.	n.s.
Woman older or same age (+/- 5 years) (ref.)				
Partner's education				
Primary	n.s.	n.s.	n.s.	1.73
Secondary or more	n.s.	n.s.	2.84	2.17
Do not know	n.s.	n.s.	n.s.	n.s.
No education (ref.)				
Woman's education				
Primary	n.s.	2.98	n.s.	1.84
Secondary or more	2.60	n.s.	n.s.	1.94
No education (ref.)				
Paid employment				
Woman's education				
Primary	n.s.	n.s.	n.s.	n.s.
Secondary or more	1.08	n.s.	2.9	n.s.
No education (ref.)				
Increase in woman's education				
Woman's socialization				
Capital/city	2.1	n.s.	7.5	1.9
Small city	3.3	n.s.	7.7	3.1
Rural (ref.)				
Increase in partner's education				
Woman's education				
Primary	2.6	6.4	2.4	2.7
Secondary or more	10.1	13.3	6.8	15.3
No education (ref.)				

Significant odds ratios, p = 0.05.

6. For the «Parents» and «Grand-parents», refer to the variables in Figure 2.

TABLE 2B Direct paths leading to the determinants of contraceptive use
Women aged 30-49

«Parents»	Burkina Faso	Ghana	Morocco	Senegal
«Grand-parents»[7]				
No desire for child in next two years				
Parity				
0-1	0.2	0.1	0.1	0.1
4-5	2.4	2.8	2.6	2.3
6+	5.1	5.6	2.8	4.7
2-3 (ref.)				
Length of union	n.s.	n.s.	n.s.	1.7
0-9 Years	0.5	0.6	0.7	0.4
Two + unions				
10 + years (ref.)				
Age of woman	n.s.	n.s.	n.s.	2.0
35-39	3.0	n.s.	1.8	1.7
40-44	3.5	3.7	1.5	5.6
45-49				
30-34 (ref.)				
Paid employment	0.6	n.s.	0.6	n.s.
No				
Yes (ref.)				
Approval of family planning				
Age difference				
Man older: 5-9	n.s.	n.s.	n.s.	n.s.
Man older: 10 +	n.s.	n.s.	n.s.	n.s.
Woman older or same age (+/- 5 years) (ref.)				
Partner's education				
Primary	n.s.	n.s.	1.53	1.86
Secondary or more	n.s.	n.s.	3.67	1.54
Do not know	n.s.	0.32	n.s.	n.s.
No education (ref.)				
Woman's education				
Primary	2.02	2.14	n.s.	2.07
Secondary or more	n.s.	1.65	2.76	3.53
No education (ref.)				
Paid employment				
Woman's education				
Primary	n.s.	n.s.	n.s.	n.s.
Secondary or more	2.46	n.s.	6.31	n.s.
No education (ref.)				
Increase in woman's education				
Woman's socialization				
Capital/city	3.4	1.9	11.7	3.1
Small city	7.7	1.9	17.7	4.1
Rural (ref.)				
Increase in partner's education				
Woman's education				
Primary	4.1	n.s.	3.7	2.9
Secondary or more	16.8	7.6	19.4	7.9
No education (ref.)				

Significant odds ratios, p = 0.05.

7. For the «Parents» and «Grand-parents», refer to the variables in Figure 2.

Other relationships

Looking at the direct effects on the *reproductive and union history variables*, women's education led to an increase in age at first union and a smaller number of children. Conversely, women with more children were less likely to want to have a child in the next two years. Women in the 15-29 age group were more likely to want to have a child in the next two years, while the reverse was true for the 30-49 age group. As to the direct effects of the variables that operationalize *social and economic capital*, an urban socialization environment had a positive impact on a woman's level of education, and a higher level of the latter was associated with homogamy of men and women's educational level, especially among women who had undergone secondary education. The direct effects of the partner's level of education, and especially of the woman's level of education, were also observed on the variables that operationalize gender relationships, where higher levels of education were associated with a smaller age difference between partners and greater approval for family planning.

Indirect paths leading from education to contraceptive use

As Figure 2 shows, multiple indirect paths also determine the use of contraception in addition to the direct paths set out in a previous section. Indirect paths retrace the route of causal influences in a sequence of successive sub-mechanisms. Lack of space prevents us from discussing all these indirect paths here (available upon request from the authors). As women's education is a key variable in the study of reproductive health, only two main paths that have been traditionally proposed in the literature, leading from education to contraceptive use, are considered here (United Nations, Population Division 1995; Kirk, Pillet 1998; Gordon *et al*., 2011). From Figure 2, one can highlight these two particular paths: the *union-reproductive path* and the *socio-cultural path*. The first corresponds to the path: woman's level of education → age at first union → length of union → parity → no desire to have an additional child in the next two years → contraceptive use. The second is represented by the path: woman's level of education → partner's level of education → age difference between partners → approval of family planning → contraceptive use. For each sub-mechanism, the appropriate control variables were taken into account, *i.e*. the «parents» of each outcome other than the cause of interest. For example, in the sub-mechanism

«Woman's level of education → Age at first union», Woman's socialization environment was taken as sole control.

In non-linear models such as the logistic one, regression coefficients relating to the various sub-paths composing the total path cannot easily be combined, contrary to the case of linear models such as Sewall Wright's path analysis (Pearl, 2012). The analysis is therefore restricted to the fact that a cause can lead to a statistically significant increase or decrease in an outcome variable, or possibly have no effect at all on the latter, as indicated by the values of the odds ratios. These changes relating to each sub-path or sub-mechanism can then be examined over the whole path. For example, in the causal chain *X causes Y causes Z*, an increase in X may lead to a decrease in Y which, in turn, leads to an increase in Z. The direction of the change in the outcome variable (increase, decrease or no change) conditional to a change in the predictor variable is indicated in Figures 4 and 5 of the following sections by, respectively, an upward-pointing arrow, a downward-pointing arrow, or a horizontal line (numerical results available upon request).

The union-reproductive path

In Figures 4a and 4b, the direction of the arrow shown in the upper part of the cell in each column is taken from the lower part of the cell in the preceding column. Consider the three categories of a woman's education, moving from the lowest to the highest level (first column). The direction of the arrow in the «age at first union» column (shown in the *lower* part of the cell) is conditional to this increased level of education (shown in the *upper* part of the cell). Age at first union, in turn, influenced the length of the union. The latter had an impact on parity, which in turn affected whether (or not) women wanted children, and this in turn had a direct effect on contraceptive use. The logistic regressions performed (results available on request) showed that an increase in the level of education among women led to a higher age at first union, a shorter length of union for a given age, a lower parity, a decline in the likelihood that the women did not want to have a child within the next two years, for a given age and length of union, and hence to a decline in contraceptive use. Each of these relations was statistically significant. Control variables were taken into account in each sub-mechanism; for example, in the sub-mechanism «Parity → Desire for child», Length of union, Woman's age, and Paid employment, were taken as controls.

FIGURE 4A Woman's level of education and contraceptive use: a union-reproductive indirect path

Women aged 15-29

a: only for women with secondary level of education.

FIGURE 4B Woman's level of education and contraceptive use: a union-reproductive indirect path

Women aged 30-49

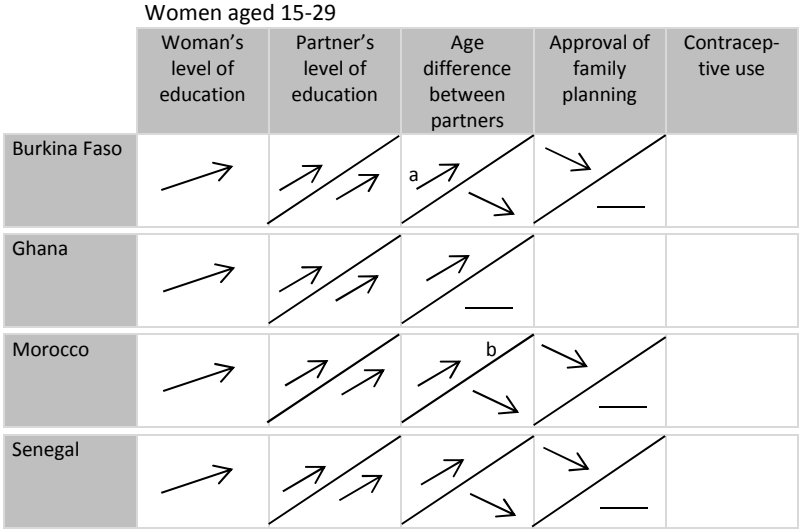
a: only for women with secondary level of education.

The union-reproductive path showed a remarkable stability between countries and between the two large age groups. The directions of the relations remained the same and were always statistically significant. It

can therefore be concluded that there was a structural relationship between these variables for the populations considered in this paper.

FIGURE 5A Woman's level of education and contraceptive use: a socio-cultural indirect path

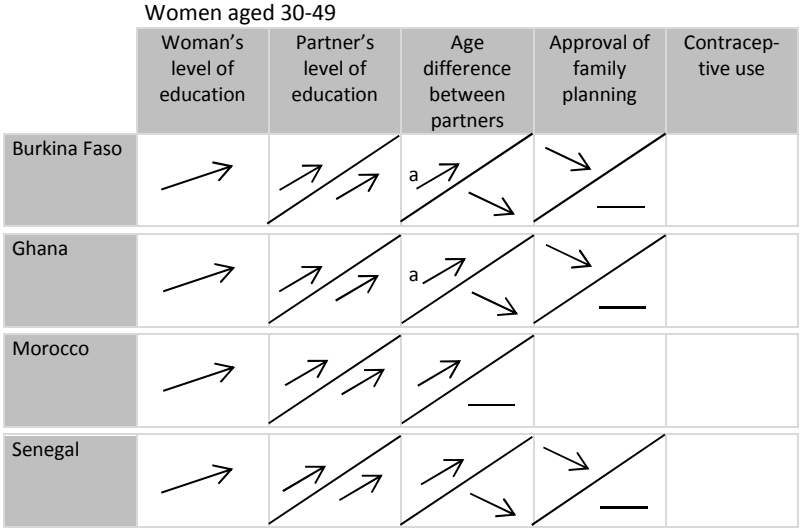
Women aged 15-29



a: only for women with secondary level of education; b: only for primary level of education.

FIGURE 5B Woman's level of education and contraceptive use: a socio-cultural indirect path

Women aged 30-49



a: only for women with secondary level of education.

The socio-cultural path

The socio-cultural path, in Figure 2, was as follows: According to this path, the woman's level of education was associated with her partner's level of education, the latter having an effect on the age difference between the partners. This latter variable affected approval of family planning, which in turn influenced contraceptive use (Figures 5a and 5b). For this analysis, the following dichotomous variable of approval was constructed: Both approve versus both disapprove + opposite view + no communication. Once again, the relevant control variables were taken into account.

Figures 5a and 5b show that the hypothetical causal path proposed above is not borne out by our results; this proposition is thus falsified in the Popperian sense (Popper, 1959). In fact, all the paths are broken, as shown in the figures by a horizontal line indicating that there was no statistically significant relation between the dependent variable and the explanatory variable. In most cases, except for women aged 15-29 in Ghana and 30-49 in Morocco, the path is broken at the link between age differences between the partners on the one hand and approval of family planning on the other. In Ghana and Morocco, the path is broken between man's level of education and age difference between spouses. The absence of statistical significance of such a relationship (which is nonetheless described in the literature) could, however, in the present case be the consequence of insufficient sample size or, more to the point, of defective indicators or of latent variables not incorporated into the model, such as the access and use of family planning services, which could possibly confound the observed relationship.

Discussion and conclusions

The purpose of this article was to compare and analyse the use of contraception by women living in the capitals of four African countries (Burkina Faso, Ghana, Morocco and Senegal), using a structural model based on the causal ordering of the explanatory variables outlined in the operational framework (Figure 2). In particular, two main indirect pathways proposed in the literature were tested, leading from education to contraceptive use.

Levels of contraceptive use varied considerably between the urban populations considered, with the highest rate of use being observed in Mo-

rocco where three out of four women in each large age group (15-29 and 30-49) practised birth control. The lowest rates of use were observed in Senegal, where contraception was used by slightly less than one in five women in the 15-29 age group, and slightly over one in three women in the 30-49 age group. Ghana and Burkina Faso were somewhere in-between, with contraceptive use slightly higher in Burkina Faso. The contraceptive pill was the most widely used method in all countries and for both age groups (except for women aged 15-29 in Ghana), followed by condoms and periodic abstinence. The methods used were generally those over which the woman had more control. However, in Ghana and Burkina Faso more women aged 15-29 said that they used methods controlled by the man, compared to women aged 30-49. This result is explained by the use of condoms, a method that is generally adopted by young people who are sexually active and unmarried. Condom use is obviously a response to a desire for protection from sexually transmitted diseases, and a direct result of HIV awareness campaigns that have been conducted in these countries. It might also indicate that men are taking more responsibility for managing sexual relations. More recent figures for Ghana (DHS, 2008) and for Senegal (DHS, 2010-2011) indicated that the most common methods of modern contraception have become injectables, followed by the pill and male condoms (the latter in Ghana but not in Senegal). In Burkina Faso (DHS, 2010), injectables then implants and male condoms, were the most common methods used. Modern methods of contraception among currently married women declined slightly in Ghana from 2003 to 2008, while they increased slightly in Senegal between 2005 and 2010 and much more strongly in Burkina Faso from 2003 to 2010.

The direct effects on *contraceptive use*, derived from the causal model, show that contraceptive use fell when the couple, or one of the partners, disapproved of birth control. Conversely, as can be expected from rational behaviour, use of contraception increased when the woman did not want to have a child in the next two years. Female education also increased contraceptive use, except for women aged 15-29 in Morocco. In the latter case, women with a higher level of education were less likely to use contraception than women who did not attend school. This effect might be the result of later marriage among women who had been educated, leading them to want to start a family quickly once they were married.

As education plays a key role in fertility transition and contraceptive use, various possible paths between education and contraceptive use have been examined. The *direct* path shows the expected effect: a higher

level of education increased contraceptive use. In addition, according to the literature, the model (Figure 2) considers that the impact of female education also follows (among others) two *indirect paths,* one of which can be referred to as the union-reproductive path and the other as the socio-cultural path. As stated earlier, these two paths are not independent as they have education in common. Furthermore, individuals may follow both paths. Though levels of fertility and of contraceptive use differed among the four countries, the results showed – with appropriate controls – that the union-reproductive path could be considered structural, since the relations between variables were significant and of the same nature for all countries and age groups considered. A higher level of education led to an increased age at first union, which itself led to a shorter relationship length. A shorter union length reduced the number of children, and a lower parity increased the wish to have a child in the next two years, for a given age, length of union and employment status, which in turn reduced contraceptive use in this particular case.

On the other hand, the hypothesis of a socio-cultural path was falsified, *i.e.* not confirmed by the DHS data. A higher level of education for the woman was associated with an increased level of partner's education, but the connection then broke down: in women aged 15-29 in Ghana and in women aged 30-49 in Morocco, no relation was observed between an increase in the partner's level of education and a decrease in age difference between the partners. This means that the paths came to a dead end in both these cases. Similarly, those paths that did still show a significant link between the partner's level of education and the age gap between partners, broke down at the next stage, as no significant relationship was observed in this case between the age difference between partners and disapproval of family planning. This path therefore appears much more contextual and could, for example, be associated with a generally high level of education (as in Ghana and Morocco) and, in addition for the latter, with high contraceptive use as an indicator of almost universal approval of contraception.

It should be stressed that, though the data available do allow a relatively appropriate description of the union-reproductive path, the same cannot be said for the socio-cultural path, because the variables used as indicators of gender relationships and of social and economic capital were far from allowing a good operationalization of these concepts. In all cases, conclusions depended upon the data set and could be modified if more relevant data were available. For example, it would be useful to study the characteristics of educated men marrying the more educated

women, as the former may have «come from backgrounds which were already relatively modern to begin with» (Basu, 2002, p. 1'783). More importantly, though cross-sectional data do not necessarily preclude the use of causal analysis (Wunsch *et al.*, 2010), longitudinal data would provide a much sounder basis for the latter. It could show, among others, possible patterns of reverse causation where childbearing could compromise further education (Eloundou-Enyegue, 1999). With longitudinal data, one also could follow various groups differing *e.g*. by level of education and observe the temporal paths leading to their use of contraception. Results obtained in this paper, especially concerning the two paths examined, should thus be considered with some degree of caution.

In conclusion, from a methodological point of view, the advantage of a recursive decomposition of the multivariate distribution (represented by a DAG) is that it allows researchers to tentatively propose an explanatory mechanism for the data generating process composed of various sub-mechanisms, subsuming in particular the distinction between mediators, moderators, and confounding variables. Each sub-mechanism (*i.e.* an outcome variable and its causes) only takes into account the subset of variables having a direct effect on the dependent variable, thus avoiding inappropriate control and the possible introduction of «noise» resulting from an excess of «explanatory» variables. Finally, the empirical analysis confirmed the importance of variables such as the desire for children and partner agreement on family planning in explaining contraceptive use. It also highlighted a structural union-reproductive path linking female education and contraceptive use. Conversely, the results lead to tentatively rejecting the socio-cultural path. These conclusions are of course dependent upon the quantity and quality of the variables available in the DHS data set. Once again, the analysis could be refined if longitudinal data were available.

The true structural relations between variables are obviously latent. Nevertheless, a structural modelling approach, such as that used here, has the merit of offering a possible explanatory mechanism based on the current state of knowledge, bearing in mind that the conclusions drawn from the model can always be called into question in the future, in the light of new hypotheses, methods and data.

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Appendix Table A1. Distribution of women aged 15-29 in urban areas according to their socio-economic characteristics

Characteristics	Burkina Faso		Ghana		Morocco		Senegal	
	N	%	N	%	N	%	N	%
Age groups (years)								
15-19	55	13.5	17	6.5	66	7.8	125	18.0
20-24	157	38.7	95	36.5	323	38.1	280	40.3
25-29	194	47.8	148	56.9	458	54.1	290	41.7
Woman's level of education								
No education	163	40.1	45	17.3	309	36.5	300	43.2
Primary	124	30.5	51	19.6	219	25.9	280	40.3
Secondary or more	119	29.3	164	63.1	319	37.7	115	16.5
Socialization environment								
Capital/City	59	14.5	75	28.8	296	34.9	310	44.6
Small city	238	58.6	137	52.7	210	24.8	215	30.9
Rural	109	26.8	48	18.5	341	40.3	170	24.5
Paid employment in the last 12 months								
No	189	46.6	62	23.8	750	88.5	492	70.8
Yes	217	53.4	198	76.2	97	11.5	203	29.2
Age at first union (completed years)								
≤ 15	62	15.3	48	18.5	110	13.0	173	24.9
16-19	233	57.4	119	45.8	382	45.1	297	42.7
≥ 20	111	27.3	93	35.8	355	41.9	225	32.4
Length of first union and number of unions								
0-4 years	183	45.1	116	44.6	426	50.3	362	52.1
≥ 5 years	197	48.5	99	38.1	395	46.6	236	34.0
2 unions or more	26	6.4	45	17.3	26	3.1	97	14.0
Type of union								
Monogamy	340	83.7	239	91.9	834	98.5	551	79.3
Polygenous	66	16.3	21	8.1	13	1.5	144	20.7
Parity								
0	68	16.7	57	21.9	156	18.4	218	31.4
1-2 children	246	60.6	163	62.7	562	66.4	338	48.6
3 children or more	92	22.7	40	15.4	129	15.2	139	20.0
Age difference								
Woman older or same (+ or - 5 years)	100	24.6	133	51.2	218	25.7	142	20.4
Man older: 5-9 years	133	32.8	61	23.5	259	30.6	157	22.6
Man older: 10 years or more	173	42.6	66	25.4	370	43.7	396	57.0
Partner's level of education								
Do not know	18	4.4	9	3.5	6	0.7	97	14.0
No education	160	39.4	26	10.0	180	21.2	259	37.3
Primary	88	21.7	11	4.2	284	33.5	144	20.7
Secondary or more	148	36.5	214	82.3	377	44.5	195	28.1
Desire for child								
In the next two years	187	46.1	91	35.0	242	28.6	416	59.9
Other	219	53.9	169	65.0	605	71.4	279	40.1
(Dis)approval of FP								
Both disapprove	13	3.2	15	5.8	3	0.4	147	21.2
Both approve	286	70.4	202	77.7	820	96.8	230	33.1
Opposite views	40	9.8	24	9.2	10	1.2	118	17.0
No communication	67	16.5	19	7.3	14	1.7	200	28.8
Total	406		260		847		695	

Sources: Demographic and Health Surveys: Burkina Faso (2003), Ghana (2003), Morocco (2003-2004), Senegal (2005).

Appendix Table A2. Distribution of women aged 30-49 in urban areas according to their socio-economic characteristics

Characteristics	Burkina Faso		Ghana		Morocco		Senegal	
	N	%	N	%	N	%	N	%
Age groups (years)								
30-34	155	33.2	158	32.6	622	24.1	311	32.5
35-39	143	30.6	144	29.7	702	27.2	276	28.8
40-44	111	23.8	121	24.9	725	28.1	218	22.8
45-49	58	12.4	62	12.8	528	20.5	152	15.9
Woman's level of education								
No education	270	57.8	99	20.4	1'308	50.8	473	49.4
Primary	97	20.8	77	15.9	501	19.4	290	30.3
Secondary or more	100	21.4	309	63.7	768	29.8	194	20.3
Socialization environment								
Capital/City	65	13.9	149	30.7	971	37.7	483	50.5
Small city	236	50.5	240	49.5	568	22.0	262	27.4
Rural	166	35.5	96	19.8	1'038	40.3	212	22.2
Paid employment in the last 12 months								
No	143	30.6	39	8.0	2'032	78.9	378	39.5
Yes	324	69.4	446	92.0	545	21.1	579	60.5
Age at first union (completed years)								
≤ 15	65	13.9	69	14.2	360	14.0	249	26.0
16-19	262	56.1	183	37.7	847	32.9	352	36.8
20-24	90	19.3	154	31.8	750	29.1	225	23.5
≥ 25	50	10.7	79	16.3	620	24.1	131	13.7
Length of first union and number of unions								
0-9 years	49	10.5	64	13.2	391	15.2	114	11.9
≥ 10 years	343	73.4	244	50.3	1'917	74.4	488	51.0
2 unions or more	75	16.1	177	36.5	269	10.4	355	37.1
Type of union								
Monogamy	298	63.8	380	78.4	2'452	95.1	526	55.0
Polygenous	169	36.2	105	21.6	125	4.9	431	45.0
Parity								
0-1	30	6.4	67	13.8	312	12.1	99	10.3
2-3	120	25.7	161	33.2	1'056	41.0	236	24.7
4-5	141	30.2	167	34.4	762	29.6	249	26.0
≥ 6	176	37.7	90	18.6	447	17.3	373	39.0
Age difference								
Woman older or same (+ or - 5 years)	149	31.9	231	47.6	1'251	48.5	224	23.4
Man older: 5-9 years	135	28.9	102	21.0	683	26.5	252	26.3
Man older: 10 years or more	183	39.2	152	31.3	643	25.0	481	50.3
Partner's level of education								
Do not know	23	4.9	28	5.8	17	0.7	11	1.3
No education	242	51.8	62	12.8	870	33.8	382	44.6
Primary	74	15.8	16	3.3	708	27.5	138	16.1
Secondary or more	128	27.4	379	78.1	982	38.1	326	38.0
Desire for child								
In the next two years	123	26.3	132	27.2	380	14.7	342	35.7
Other	119	25.5	139	28.7	453	17.6	236	24.7
No more children	225	48.2	214	44.1	1'744	67.7	379	39.6
(Dis)approval of FP								
Both disapprove	11	2.4	26	5.4	13	0.5	188	19.6
Both approve	317	67.9	339	69.9	2'441	94.7	420	43.9
Opposite views	50	10.7	66	13.6	71	2.7	168	17.6
No communication	89	19.1	54	11.1	52	2.0	181	18.9
Total	467		485		2'577		857	

Sources: Demographic and Health Surveys: Burkina Faso (2003), Ghana (2003), Morocco (2003-2004), Senegal (2005).

Appendix Table B1. Direct effects on contraceptive use, women aged 15-29, in urban areas in Burkina Faso (BK), Ghana (Gh), Morocco (MO) and Senegal (SE), (p = 0.05)

Characteristics	BF		GH		MO		SE	
	Signif.	Exp(B)	Signif.	Exp(B)	Signif.	Exp(B)	Signif.	Exp(B)
Woman's level of education								
No education (ref.)								
Primary	0.06	1.81	0.93	0.96	0.05	0.61	0.02	1.93
Secondary or more	0.00	3.58	0.59	1.27	0.01	0.51	0.00	3.06
Paid employment in the last 12 months								
No	0.65	0.89	0.50	1.24	0.26	0.72	0.38	1.24
Yes (ref.)								
Partner's level of education								
No education (ref.)								
Primary	0.80	1.09	0.04	6.40	0.37	1.27	0.94	0.97
Secondary or more	0.49	1.26	0.01	5.48	0.21	1.41	0.04	1.88
Do not know	0.31	1.91	0.04	7.78		/	0.00	4.17
Desire for child								
In the next two years (ref.)								
Other	0.00	5.83	0.00	2.81	0.00	21.89	0.03	1.64
(Dis)approval of FP								
Both disapprove	0.61	0.19		/	0.19	0.90	0.00	0.03
No communication	0.00	0.27	0.00	0.20	0.00	0.38	0.00	0.06
Opposite views	0.00	0.18	0.37	0.66	0.13	0.30	0.00	0.43
Both approve (ref.)								

Appendix Table B2. Direct effects on contraceptive use, women aged 30-49, in urban areas in Burkina Faso (BK), Ghana (Gh), Morocco (MO) and Senegal (SE), (p = 0.05)

Characteristics	BF		GH		MO		SE	
	Signif.	Exp(B)	Signif.	Exp(B)	Signif.	Exp(B)	Signif.	Exp(B)
Woman's level of education								
No education (ref.)								
Primary	0.10	1.65	0.17	1.63	0.29	0.87	0.00	2.13
Secondary or more	0.00	2.78	0.13	1.55	0.01	1.51	0.00	2.29
Paid employment in the last 12 months								
No	0.12	1.53	0.62	0.84	0.48	1.10	0.83	1.04
Yes (ref.)								
Partner's level of education								
No education (ref.)								
Primary	0.01	2.16	0.78	1.20	0.01	1.43	0.49	0.85
Secondary or more	0.10	1.72	0.20	1.55	0.00	1.52	0.72	0.93
Do not know	0.97	0.98	0.82	1.14	0.84	0.89	0.91	1.03
Desire for child								
In the next two years (ref.)								
Other	0.00	4.37	0.00	9.07	0.00	9.87	0.00	4.04
No more children	0.00	4.05	0.00	5.51	0.00	13.46	0.00	2.94
(Dis)approval of FP								
Both disapprove	0.01	0.12	0.00	0.06	0.00	0.08	0.00	0.08
No communication	0.00	0.39	0.00	0.18	0.00	0.10	0.00	0.07
Opposite views	0.01	0.34	0.00	0.23	0.05	0.59	0.00	0.22
Both approve (ref.)								