

Modeling Abortion as a Process

An application to a French National Cohort on Reproductive Health

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ABSTRACT

We model women's recourse to induced abortion as resulting from a process which starts with sexual practice and contraceptive use (or non use), continues with the occurrence of an unplanned pregnancy, and ends with the decision to abort and the access to abortion services. We then relate each of these proximate determinants of abortion to the social and structural factors which shape them, such as women's resources, their relational situation, social norms on reproduction, and reproductive services. This model thus synthesizes and articulates the various proximate and structural factors of abortion, which may have different impact as the abortion process unfolds and bring together knowledge that is usually dispersed in the literature. The model helps in locating at one glance the source of abortion rate differentials. We illustrate it using data from a national cohort on reproductive health conducted in France in 2000-2004.

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In examining women's recourse to abortion, most existing quantitative research has focused on comparing variations in the frequency of abortion across populations or sub-populations. These studies are generally based on national abortion statistics and thus limited to countries where abortion is legal. The dependent variable is usually the abortion rate (annual number of abortion for 1000 women of reproductive age)ⁱ and they focus on differences across geographic regions or between different socio-demographic groups within a region.

Analyses focusing on geographic disparities capture the effects of macro-social factors on abortion, such as the extent of family planning programs, the content of abortion and contraceptive laws, or the structure of abortion care services. The main result in this area of research in the U.S. and Western Europe is that abortion rates are higher where contraceptive services are weaker (Finer and Henshaw 2003; David 1992; Matthews, Ribar, and Wilhelm 1997; Meier et al. 1996; Morgan and Parnell 2002; Trent and Hoskin 1999).

Research focusing on variations in abortion rates across socio-demographic groups investigates the effect on abortion of resources on the one hand and reproductive practices and norms on the other, which both vary over the life-course and across social groups. Being non-married, in the middle of the reproductive life span, or having a minority status are all associated with consistently higher abortion rates in Western countries (Bankole, Singh, and Haas 1999; Bettarini and D'Andrea 1996; Blayo 1995; David 1992; Henshaw, Singh, and Haas 1999; Jones, Darroch, and Henshaw 2002a; Powell-Griner and Trent 1987; Skjeldestad and Borgan 1994). The link between abortion and women's educational attainment, income, or socio-professional status is less clear: effects in both directions have been measured (Bettarini and D'Andrea 1996; Blayo 1995; Garbacz 1990; Jones et al. 2002; Matthews et al. 1997; Medoff 1997; Toulemon and Leridon 1992).

These findings raise many further questions. Why do abortion rates vary across countries with similar family planning infrastructures or where individuals have similar socio-economic profiles? Why are abortion rates relatively high in some countries, like France, where medical contraceptionⁱⁱ has been widely diffused? Why do women have more abortions at the ages where they also have more births? Why are foreign-born women more likely to have abortions than native-born? And why are unmarried women having more abortions?

Abortion as a process

Researchers have long acknowledged that the answers to these questions lie in women's differences in contraceptive use on the one hand, and in their decision to interrupt an unintended pregnancy should one occur on the other hand. These two issues have however usually been investigated separately from one another, and generally not in connection with abortion rate differentials, with survey data collected in the general population or in samples restricted to women who have had an abortion or an unintended pregnancy (the works of Toulemon and Leridon 1992, Larson et al. 2002, Bajos and Guillaume, 2004a being notable exceptions).

Results show that, compared to other periods of pregnancy avoidance, abortions are preceded by periods of weaker contraceptive coverage and the use of less effective methods (Bajos et al. 2003a; Henshaw and Silverman 1988; Ingelhammar et al. 1994; Jaffer and Newton 2000; Knutsen, Furnes and Moen 1999; Larsson et al. 2002; Marston et Cleland, 2002; Milsom, Sundell and Andersch 1991; Price et al. 1997; Rosenberg, Waugh and Long 1995; Sparrow 1997). Younger women have been shown to have higher rates of contraceptive failures, as well as women with a lower socio-economic status or a minority status (Bajos et al., 2004a; Brown and Eisenberg, 1995; Levine, 2001; Toulemon and Leridon 1992).

Researchers focusing on the abortion decision on the other hand show that while women often report multiple reasons for interrupting a pregnancy (Allanson and Astbury 1995; Larsson et al. 2002; Törnbohm et al. 1994; Torres and Forrest 1988), the reasons given all ultimately mean that their current life plans cannot accommodate a child, whatever these plans may be (Kellerhals and Pasini 1976). In particular, a higher social status and the absence of a stable conjugal relation are consistently linked to a greater propensity to interrupt an unplanned pregnancy (Barrett, Peacock and Victor 1998; Evans 2001; Kero et al. 2001; Sihvo et al. 2003; Skjeldestad and Borgan 1994; Soderberg et al. 1997; Törnbohm et al. 1999; Zavodny 2001).

Existing studies of the factors of abortion thus generally focus on one stage of the micro-level process leading to this event: researchers either work on contraceptive use and contraceptive failures (unintended pregnancies) and its link to abortion, or focus only on the abortion decision. Researchers examining the abortion decision consider that the study of unintended pregnancies lies beyond the scope of their work, and *vice et versa*. As a result, although each part of the abortion process has been carefully studied so far, very few quantitative works provide a global vision of all the determinants of abortion (Toulemon and Leridon 1992, Larson et al. 2002, Bajos and Guillaume, 2004) and no such analysis has been performed with population-based survey data.

To fill this gap, we propose here a framework which organizes the different micro-level determinants of abortion (sexual practices, contraceptive use, the occurrence of an unplanned pregnancy, the abortion decision, access to abortion services) and articulates them to the various social and structural factors shaping women's likelihood of having an abortion (such as resources, social norms, family planning and abortion services). Our aim is to help scholars organize existing, often scattered, knowledge pertaining to the multi-layered and complex process leading to an abortion.

The micro-level process leading to an abortion

The individual-level process leading to an abortion has been described in details (Bajos, Ferrand and the GINE Group 2002; Kellerhals and Pasini 1976; Luker 1975). When women (or couples) enter sexual activity, they find themselves concerned (or not) by the risk of an unintended pregnancy, depending on their wish to conceive with their partner and depending on their (perceived) risk of becoming pregnant. When they are concerned by the risk of unintended pregnancy, they may (or may not) use a contraceptive method. They are then exposed to the risk of contraceptive failure (if they use contraception), or to natural fertility rates (if they do not). Upon the occurrence of a conception, women (couples) define their pregnancy as planned or unplanned, and decide whether they want to interrupt it. Once the decision is taken to interrupt the pregnancy, they attempt to access (legal or illegal) abortion services.

Simplifying these observations, we propose to model the different stages of the micro-level process leading to an abortion as a series of events and behaviors characterized by a dichotomous outcome, arranged sequentially and conditional upon each other, and linked by transition probabilities. We define five basic stages in this process: 1) being sexually active and concerned by the risk of an unintended pregnancy; 2) using contraception or not; 3) having an unintended pregnancy while using contraception or: having an unintended pregnancy while not using contraception; 4) deciding to interrupt the pregnancy and having an induced abortion; 5) accessing abortion services.

Figure 1 about here

Let us first consider the last stage of this process, the probability A of having an abortion once an unintended pregnancy UP has occurred, $P(A|UP)$. In this model, induced abortions occur

only after unintended pregnancies; in the language of sets (Figure 1), this means that A is a subset of UP and $P(A | UP) = P(A) / P(UP)$.

Thus,

$$P(A) = P(A | UP) \times P(UP) \quad (1)$$

where A = induced abortion

UP = unplanned pregnancy

This equation is a useful conceptual tool in itself: it means that the frequency of abortions is the product of the frequency of unintended pregnancies and the likelihood of interrupting unintended pregnancies. A translation of this equation into a form applicable to aggregate period data will lead to the decomposition of abortion trends into trends of unplanned pregnancies rates on the one hand, and trends of the share of unplanned pregnancies ending in an abortion on the other.

Now, let us consider the probability of having an unplanned pregnancy among women concerned by this risk, $P(UP | E)$, where E is the state of being exposed to the risk of an unplanned pregnancy (i.e., sexually active, not sterile, and wanting to avoid a pregnancy). Let us assume that unplanned pregnancies occur only to women defined as exposed to the risk of such events, in other words, that UP is a subset of E . As before, $P(UP | E) = P(E) / P(UP)$, so by rearranging and combining, we can write:

$$P(A) = P(A | UP) \times P(UP | E) \times P(E) \quad (2)$$

where: E = being sexually active, not sterile, and wanting to avoid a pregnancy

Next, suppose unplanned pregnancies fall into two groups, some occurring while women use contraception (in set language: UP and C) while other occur when women do not use contraception (UP and $non\ C$).

$$P(UP) = P(UP\ and\ C) + P(UP\ and\ non\ C) \quad (3)$$

where: C = contraceptive use (any method)

Since $P(UP\ and\ C) = P(UP | C) \times P(C)$, we can write:

$$P(UP) = P(UP | C) \times P(C) + P(UP | non\ C) \times P(non\ C) \quad (4)$$

Likewise, we can decompose $P(A | UP)$ as:

$$P(A | UP) = P(D | UP) \times P(S | UP, D) \quad (5)$$

where: D = deciding to interrupt the pregnancy

S = accessing abortion services

Substituting and re-arranging produces out final equation:

$$P(A) = P(E) \times [P(UP | C, E) \times P(C | E) + P(UP | non\ C, E) \times (non\ C | E)] \times P(D | UP) \times P(S | UP, D) \quad (6)$$

The macro-level determinants of abortion

In a perspective close to that of the Bongaarts' model (1978, 1982), we propose to distinguish macro-level (or background) determinants from proximate (or micro-level, intermediate) factors of abortion (Figure 2). In our model, the effect of macro-level determinants on the likelihood of having an induced abortion is necessarily mediated by their effects on the proximate (or intermediate) factors of induced abortions. In other words, the relation between macro-level determinants and abortion risk can be decomposed into a series of relations between these variables and each variable representing successive stages of the micro-level abortion process.

Figure 1 about here

This theoretical framework allows social or structural factors to have varied effects at the different stages of the micro-level abortion process. Indeed, the meaning and modus operandi of macro-level factors may differ depending on the stage considered. For example, marital status may have a positive effect on contraceptive efficiency (and thus a negative impact on the occurrence of unintended pregnancies) because conjugal stability is likely to be associated to the use of more efficient method , such as the pill or the IUD. The link between marital status and the abortion decision (being married is likely to decrease the probability of interrupting an unintended pregnancy) mobilizes a totally different mechanism: conjugal stability means that both parents will be present to raise the child, so that an unwanted pregnancy is more likely to be welcomed by cohabiting or married couples than by single women.

Limitations of the model

We reduce exposure to the risk of an unplanned pregnancy to a dichotomous variable, when it is, in reality, a far more nuanced concept: women are often uncertain about their fecundity status and ambivalent about seeking a conception; the couple may even disagree on whether they want a pregnancy or not. Sexual activity is also somewhat difficult to measure: do women in unstable relationships and having (very) occasional intercourse define themselves as sexually active? Their responses in a survey may vary.

Similarly, our model reduces contraceptive use to a dichotomous variable: we contrast use with non-use of any contraceptive method, no matter its efficacy. We tested an alternative dichotomy, distinguishing medical contraceptive use from all other situations: a logistic regression of four socio-demographic background variables (age, nationality, marital status and educational status) on contraceptive use yielded identical results for both versions of the contraceptive use variable, except that the “medical methods / other situations” displayed less variation than the “any method/ no method” variable. The results encouraged us to hew to the last alternative. A more complex solution, which we did not apply here, would have been to use a multinomial or ordinal regression, which would have allowed for more than two outcome categories: we could then have distinguished medical contraceptive use, non medical contraceptive use, and no contraceptive use.

Categorizing pregnancies as unintended or intended in quantitative surveys is also difficult (Barrett and Wellings 2002; Fisher et al. 1999; Kaufman, Morris and Spitz 1997). In addition, we presume that abortions only occur from among unintended pregnancies, though we know this not to be precisely so: some pregnancies are terminated on medical grounds regardless of intention to conceive. Whenever possible, one should therefore exclude abortions that were undertaken for medical reasons from the model. Also, in a small number of cases, a pregnancy

may be fully planned, but circumstances other than medical and ulterior to (or revealed by) the pregnancy may lead women to seek an abortion; these cases, too, are ignored by our model. In the COCON survey examined here, only 4% of all (reported) abortions and which were induced for reasons other than medical happened after pregnancies declared as intended by the respondents.

Finally, the abortion decision may also be difficult to measure and to distinguish from barriers in access to abortion services. Women may hesitate until they learn whether and how easily they can have an abortion, and these parameters may influence the way they weigh their decision.

DATA AND METHODS

Sampling design

To estimate this model we use data from the French reproductive health survey COCON (CONtraceptive COhort). The first wave of COCON, which we will use here, was completed in 2000; the same sample was re-interviewed each year until 2004. For COCON 2000, a sample of 14,704 households including at least one eligible woman aged 18-44 was randomly selected from the French national telephone directory, which had been first stratified by region. When more than one eligible woman lived in the selected household, one of them was randomly selected. The response rate of eligible women was 74.6%. The 10,975 women who agreed to participate were asked whether they had had an abortion in the previous five years, or if the last pregnancy occurring during the previous five years was unintended. All women who fell into this category (n=1,034) were administered a questionnaire that took about 40 minutes to complete. Another 1,829 women were randomly selected from the remaining pool of eligible women, and answered the same questionnaire. Telephone interviews (total n= 2863) were conducted between September

2000 and January 2001. Each respondent has a sampling weight equal to the product of the number of eligible women in her household multiplied by the coefficient of random selection. The weighted sample was adjusted to be representative of the female French population aged 18-44 in 2000 (using age, marital status, occupational status, region distributions from census data) (for a detailed data description, see Bajos et al. 2003a).

As in other U.S and Western European surveys (Anderson et al. 1994; Jones and Forrest 1992; Rossier 2003; Toulemon and Leridon 1992), abortions are underestimated in COCON 2000 (Moreau et al. 2004). When comparing abortions collected retrospectively in COCON 2000 for the year 1997 (women aged 15 to 41 year old) to data pertaining to women aged 15 to 41 in the last year of available abortion statistics (1997), Moreau finds that about 60% of the expected abortions were reported in COCON 2000 (COCON data = 8.1 abortions per 1000 women aged 15 to 41 [5,9;10.,3] 95% confidence interval; national statistics = 13.6 per 1000 women aged 15 to 41), which is very similar to results found in U.S. fertility surveys (Fu et al., 1998). Moreau examined the question of the selection biases of the abortions collected in COCON, by comparing their distribution in the sample to their distribution in the national abortion statistics along a number of socio-demographic and medical variables. The distributions of the abortions collected in COCON 2000 are very similar to trends in national abortion statistics for nationality and marital status. The shape of the age distribution is similar in both data sets although abortions at both ends of the reproductive cycle, and especially among very young women, are underrepresented in COCON. In summary, these elements suggest that even if the COCON 2000 abortion data may not be ideal for estimating prevalence rates, they are acceptably representative for examining abortion differentials, as we will do here.

Questionnaire

COCON's questionnaire contains complete pregnancy histories, with questions on each pregnancy to determine if it was intended and the outcome of each pregnancy (birth, induced abortion, miscarriage). The survey also contains data on current contraceptive use and on current exposure to the risk of unintended pregnancy. This risk is approached through several questions: whether the woman is currently sexually active, whether she or her partner is sterile or sterilized, whether she is currently pregnant, and whether she is currently seeking a conception.

COCON also gathered retrospective contraceptive histories: 6 out of 10 of the women aged 18-44 interviewed for the COCON survey were asked for a detailed contraceptive history. These women were selected randomly from among those who had ever had sexual intercourse (those who had never had sexual intercourse were automatically excluded). The questions regarding contraceptive histories were linked to the fertility history obtained previously; 4 women for whom that history was incomplete (e.g. missing the year of a child's birth, or all information on one pregnancy) were excluded from the analysis. Reproductive intervals were calculated as the time between first intercourse and the beginning of the first pregnancy, that between the first birth and the beginning of the second pregnancy, and so on. Thus, all women who had been pregnant at least once had at least two reproductive intervals, except those who were currently pregnant for the first time at the time of the survey. In the COCON survey, the maximum number of intervals was 13 (corresponding to 12 pregnancies).

For each of these intervals the following question was asked: "From ... (age at the beginning of the interval) to... (age at the end of the interval), that is during... years (duration of the interval), between your... (event constituting the beginning of the interval) and your... (event marking the end of the interval), what are ALL the methods of contraception that you have used? For how long did you use each method? Don't forget any periods in which no contraception was

used.” The interviewer was required to note the first method mentioned and ask if other methods were used simultaneously (in combination). The woman could report not having used any method during this period. The duration of each contraceptive episode was asked in years and months. Women who had never been pregnant could report up to 10 episodes over their whole life (in practice, the maximum was 8). The women who had pregnancies could report up to 5 episodes in each reproductive interval; overall, the maximum number of episodes reported amounted to 23ⁱⁱⁱ. In total, our sample of 1,689 biographies includes 10,526 contraceptive episodes.

Estimating the model

Using these data, we performed a series of regressions to estimate each of the transition probabilities of equation (1) (see Table 1). Note that while we omit access to abortion services as a separate factor of the process leading to an abortion, in France difficulties in accessing abortion services do not seem to deter women from having a abortion; they “only” seem to render their experience more difficult (Moreau et al. 2003; Bajos et al. 2003b). Therefore, we estimate only $P(A | UP)$, which represents the abortion decision. $P(E)$, $P(non\ C|E)$ are estimated using logistic regressions, and the factors are those describing each women’s situation at the time of the survey. $P(E)$ is estimated as the likelihood of being non pregnant, non sterile, non sterilized, not trying to conceive and currently sexually active among all women aged 18 to 44 at the time of the survey. Among all these women concerned by the risk of unintended pregnancy, $P(non\ C|E)$ is estimated as the likelihood of not using contraception (we do not estimate $P(C|E)$, since this quantity is equal to $[1 - P(non\ C|E)]$). Since sterilization is irreversible, sterilized women are classified here as women who are not exposed to the risk of unintended pregnancy, rather than as women who are exposed to the risk of unplanned pregnancy and use contraception.

Table 1 about here

The other probabilities in the model are estimated using data on events that occurred during the five years preceding the survey. $P(A | UP)$ is estimated with a logistic regression as women's likelihood of having an induced abortion when faced with an unintended pregnancy (the unit of analysis is the unintended pregnancy). $P(A)$, $P(UP)$, $P(UP | C,E)$ and $P(UP | non\ C,E)$ are estimated using multiple-failures Cox regressions. In each case, the number of events (abortions or unplanned pregnancies) are reported to the time women spent at risk of these events. For $P(A)$ and $P(UP)$, the population at risk is defined as all women aged 15 to 44 years during the five years preceding the survey. The retrospective contraceptive histories are thus left-censored by a lower limit of 15 years of age or by the first of January 1995, and are right censored by the survey. For $P(UP | C,E)$, the population at risk is defined as all women aged 15 to 44 years who were using reversible contraception (any method) since the first of January 1995. Here, in addition to the restrictions already mentioned, women enter the pool of individuals at risk only when they start to use a contraceptive method, and they exit the pool when they stop. For $P(UP | non\ C,E)$ there is also left-hand censoring: women must have had their first sexual intercourse to enter the pool of women at risk. Finally, women are counted in the pool at risk only during times when they were 1) not pregnant, 2) not sterilized, 3) not using contraception, 4) and were also not in an episode of non contraceptive use ending in a wanted pregnancy.

Our estimates are based on data measured at two different times: at the time of the survey, and during the five years preceding the survey. The probability of experiencing an unplanned pregnancy, a contraceptive failure, or an abortion after an unplanned pregnancy can indeed only be calculated over several years, given the relative rarity of these events. Data on exposure to the risk of unintended pregnancy and on protection against this risk on the other hand are usually

collected only at the time of the survey since it is difficult to collect precisely dated retrospective information about sexual activity and intentions to conceive. As a result, we assume here that the data measured at the time of the survey accurately reflect the average situation over the last five years; this assumption adds another important limitation to the present analysis. A prospective study with data on sexual activity, intentions to conceive and contraceptive use would also help in computing longitudinal measures of contraceptive use when exposed to the risk of unintended pregnancy.

The same independent variables are used in each of the equations used to estimate the transition probabilities in order to illustrate how macro-level factors can be decomposed into their separate effects on each step of the abortion process. We thus choose four *structural* variables which have been shown to be linked to abortion rates: age, marital status, nationality and educational level. We also introduced parity and income in the model, but the effect of parity on the abortion process is very similar to that of age, and the effects of income very close to that of educational level and minority status. To avoid colinearity, we chose to keep a model with the first four independent variables only, but will report on the two other variables when they add something to the analysis. We tested alternative age, nationality, marital status and educational status categories (by exploring different cut points and category levels) and selected the classifications which yielded the most variation in abortion rates. This approach yielded four age groups: 15 to 19, 20 to 29, 30 to 39, and 40 to 44. We selected two categories for nationality (French citizen and foreign citizen), two marital status categories (cohabiting and non-cohabiting women). A dichotomous educational status variable gave the best results: less than high school diploma, and high school diploma or more.

When estimating $P(E)$ and $P(C|E)$, the independent variables are measured at the time of the survey. When estimating $P(A|UP)$, the independent variables are measured at the time of the

occurrence of the unintended pregnancies for age, parity and marital status, and at the time of the survey for nationality, income and educational level. When estimating $P(A)$, $P(UP)$, $P(UP | C,E)$ and $P(UP | non\ C,E)$, we constructed age and marital status as time dependent variables; nationality and educational level were those at the time of the survey. Dates of entry into unions had been collected only for the current cohabiting union; marital status thus varies in time only when women had not yet entered the present cohabiting union on January 1, 1995, and did so between that date and the time of the survey. Although educational level does vary with time especially at young ages, the level attained later in life is a good indicator of the category of educational level in which the individual found herself earlier; the same argument can be made for income level.

Results are presented here as odds ratios. Note that we could not calculate estimated probabilities, since Cox regressions do not yield constants: this calculation is thus impossible for $P(UP | C,E)$, $P(UP | non\ C,E)$, $P(UP)$ and $P(A)$. Therefore, we could not compare $P(A)$ as measured in our data against a modeled estimate. Each regression includes all background variables, and no other control is used.

RESULTS AND DISCUSSION

Age differentials in abortion rates

The last column, first row, of Table 2 shows that the age pattern of abortion follows an inverted U shape. In other words, women are more likely to have had an induced abortion during the middle of their reproductive period (using our data categorization, from age 20 to 39) than at both extremes of the reproductive period. Indeed, national abortion statistics show that abortion rates, very low at age 15, increase to reach a maximum in the early 20s, decline thereafter slightly until age 39, and drop sharply after age 40 (Vilain, 2004).

Table 2 about here

Why do women in their early 20s, and more generally, women in the middle reproductive ages, experience greater abortion risks than women at either end of the reproductive span, a pattern found in all Western countries, as we said earlier? Our decomposition allows us to have a global picture of all the different factors at play. First, teenagers have fewer abortions because they are less exposed to the risk of unwanted pregnancy than women above age 20 (Table 2, column 1, row 1). This trend is due to their gradual entry into sexual activity: many teens being not yet sexually active, as a whole they are less likely to be exposed to the risk of unwanted pregnancies than older women. At older reproductive ages, especially after age 40, women are also less prone to be at risk of an unwanted pregnancy since they are more likely to experience lowered fertility or secondary sterility. We hypothesize that women in their late 20's and 30's are at lower risk of an unintended pregnancy compared to women in their early 20's because these women more often seek to conceive.

Turning now to age patterns of contraceptive use (Table 2, column 2, row 1), we note a lower propensity of women in their 30's—and at risk of unwanted pregnancy—to use contraception. This is an unexpected result. One hypothesis is that women in their 30's are, on average, more ambivalent than other women about their desires for additional children, with the consequence that they may be less rigorous in protecting themselves against pregnancy. Similarly, Legoff (2005) has shown that Swiss women of parity 1 are more likely to use non medical methods compared to other parities. When introducing parity into the model, this age effect weakens somewhat: women at parity 1 are indeed more likely to not be using contraception when at risk of an unintended pregnancy than women at other parities (data not shown). There is

no other significant difference in contraceptive use according to age once other background factors and exposure to the risk of unwanted pregnancies are controlled for, which is plausible in a population where medical contraception has been available for three decades (Bajos, Leridon and Job-Spira 2004).

Trends in contraceptive failure rates by age (Table 2, column 3, row 1) show that younger women, especially teenagers, are more likely to become pregnant when using contraception than older women. This trend is explained by the greater inexperience of young women when using contraception, combined with older women's lower fertility. Trends in natural unwanted fertility (that is, the probability of having an unwanted pregnancy while being exposed to this risk yet not using contraception) (Table 2, column 4, row 1) are also as expected: women over 30 are less likely to become pregnant while not wanting to conceive but using no contraception; women over 40 even more so.

In combination, these different trends yield the inverted U-shape of unwanted pregnancy rates by age (Table 2, column 5, row 1). These differentials are driven by the effects described above: starting in their 30's, older women are less exposed to the risk of unwanted pregnancy and less prone to experience contraceptive failures whether using contraception or not, so they have fewer unwanted pregnancies. On the other hand, very young women (under age 20) are more likely to experience contraceptive failure but they are also more likely to be sexually inactive so that in total they, too, have fewer unwanted pregnancies than women in the middle reproductive ages.

Column 6, row 1 of Table 2 shows that age is not related to the abortion decision once other background factors are controlled (in particular marital status). Differentials in abortion rates observed for women of different age groups (Table 2, column 3, row 1), controlling for the

other background variables, are therefore mainly driven by the differentials in unwanted pregnancy rates, as described above.

Differentials in abortion rates by nationality

In our survey, foreign women are more likely than French women to have abortions (Table 2, last column, row 2), an observation which holds in most Western countries for most minority groups (one exception being Latino women in the US, who have a lower abortion rate than white U.S. women Jones et al., 2002a). Let us underline that in our data set, the nationality differential becomes weaker and hardly significant once income is introduced in the model, and that income and nationality have very similar effects (data not shown.) Why do foreign (low income) women have more abortions? They are more likely to have unwanted pregnancies (Table 2, column 5, row 2), especially because they have a lower probability to use contraception when exposed to the risk of unwanted pregnancy (Table 2, column 2, row 2); both results are not (very) significant for foreign women, but are strong for the income variable (data not shown). There is no difference in the abortion decision by nationality (or income) on the other hand (Table 2, column 6, row 2). So, altogether, abortion rates differentials by nationality (or income) are due to differentials in unintended pregnancy rates, and more specifically to a lower use of contraception when exposed to the risk of unwanted pregnancy.

Differentials in abortion rates by marital status

All other things being equal, abortion rates in our data are higher among women who do not live with a partner (Table 2, last column, row 3). These trends are also observed in most Western countries, as mentioned already. Why are women without a cohabiting partner having more abortions? After all, they are also having less sex, so that they may have less unwanted

pregnancies. Our model allows us to consider the effects of all the intermediary factors at once, and to see if they counteract each other or not. We see (Table 2, column 1, row 3), that non cohabiting women are less likely to be exposed to the risk of unwanted pregnancy, a trend linked to their greater propensity of being sexually inactive at the time of observation. Second, we see that non cohabiting women have a greater risk of contraceptive failure when using contraception (Table 2, column 3, row 3): methods used when cohabiting are certainly different (and more effective) than those used for women with a less regular sexual life. Moreover, irregular sexual activity may increase the misuse of certain contraceptive method like the pill (Bajos et al. 2003a). Also, a pregnancy happening to a cohabiting woman who uses contraception is more likely to be seen as “intended” and reported as such in surveys than a pregnancy occurring to a non cohabiting woman. Similarly, we see (Table 2, column 4, row 3) that non-cohabiting women who are not using contraception and not wanting to conceive are more likely to experiment an unintended pregnancy than cohabiting women.

The two contradictory trends (lower exposure, greater contraceptive failure rate or greater propensity to perceive pregnancies as unintended) combine to give altogether non cohabiting couples a lower propensity to have unintended pregnancies, all other things being equal (Table 2, column 5, row 3). But non cohabiting women are also more likely to interrupt an unintended pregnancy once it has occurred (Table 2, column 6, row 3): this last effect dominates the previous one so that, altogether, non cohabiting women have distinctively higher abortion rates than do cohabiting women (Table 2, column 7, row 3).

Differentials in abortion rates by educational level

Our survey data indicate that women with higher educational attainment have lower abortion rates (Table 2, column 7, row 4). Existing studies of the relation between education and abortion

rates in other Western countries give mixed results, as mentioned already. We see indeed that education has no relation to exposure (Table 2, column 1, row 4). Educational attainment, however, is very significantly linked in our model to whether contraception is used while exposed to the risk of unwanted pregnancy (Table 2, column 2, row 4): women with less than a high school diploma are less likely to use contraception (any method) when at risk of an unintended pregnancy. After controlling for these differences in contraceptive use rates, there is no longer much remaining variation in contraceptive failures rates (Table 2, column 3 and 4, row 4).

Since women with a lower educational attainment are less likely to use contraception when exposed to the risk of unwanted pregnancy, they have a greater risk of unwanted pregnancy (Table 2, column 5, row 4), which explains that altogether, they have more abortions than their more educated counterparts (Table 2, column 7, row 4), despite being less likely to decide to interrupt an unwanted pregnancy once it has occurred (Table 2, column 6, row 4).

The complex relation between education and abortion risk, like that between marital status and abortion rates, show that categories of women who are more likely to use contraceptive methods, or to use them more effectively, have fewer unwanted pregnancies. Fewer unwanted pregnancies often implies fewer abortions, but because they have a greater initial demand for fertility control, they also have a greater propensity to interrupt an unwanted pregnancy. In some cases, as for non cohabiting women, this combination of counteracting effects results in higher abortion rates; in other cases, as in our sample for educated women, it results a lower propensity to have an induced abortion.

Similar counteracting effects can explain why abortion rates have not decreased in countries like France where medical contraception is very widespread, or why, in a comparative perspective, abortion rates are higher in Northern European countries and in France than in the Netherlands or Germany. In countries where women have greater expectations towards fertility

control, that is, in countries with more equal gender relations and greater female labor force participation, the greater propensity to end unintended pregnancies may weight more at the end than the progresses made in terms of lower unintended pregnancies rates, so that abortion rate remain relatively stable as a result. Similar counteracting effects explain why women with a higher socio-economic status are more likely to have abortions in some countries, and less likely on other: in some countries, their greater ability to avoid unintended pregnancies will drive their abortion rate down, while in other, their greater propensity to interrupt an unintended pregnancy once it has occurred will drive their abortion rate up.

CONCLUSION

The purpose of the proposed framework is to help organize and make sense of the multiple factors, usually studied separately, which participate, at one point or another, at one level or another, to the complex process leading women to have abortions. With this model, differentials in abortion rates can be investigated systematically: do women of a particular category have more abortions because they use contraception less often, because they decide to abort unintended pregnancies once they occur more frequently, or both? Or are these two effects working in opposite direction, and in this case, which of these effects is stronger? In other words, the proposed model helps to identify the effects of structural and social variables at each stage of the process leading to an abortion. This systematic search can help reconcile seemingly contradictory results of previous studies and help solve some puzzles, such as why some countries with a high rate of contraceptive use still have relatively high abortion rates compared to other countries with a high contraceptive prevalence but lower abortion rates.

This decomposition effort also underlines the importance of contextualizing the variables we routinely use in demographic analysis. The same category can have different meanings

depending on the part of the abortion process under study: for example, the effect of being young on the probability of experiencing contraceptive failure is related to inexperience in contraceptive use, while the effect of being young on exposure works via the probability of having sexual intercourse.

This systematic model will also help in paying attention to some proximate factors of abortion which have been under-studied so far. Sexuality is for example a dimension which has heretofore been neglected in most studies on abortion and contraception. Our results show that teenagers' lower abortion rate is partly explained by their lower propensity to have sex, and that non cohabiting women would have an even higher unintended pregnancy and abortion rate if they had more regular sex. Other neglected components of the abortion process, such as access to abortion services, could easily be integrated in the model.

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TABLES

Table 1. Estimating the Risk of Experimenting the Different Steps Leading to an Abortion

The different stages of the abortion process							
Estimation	E	Not using contraception when concerned by the risk of unintended pregnancy	Having an unintended pregnancy while using contraception	Having an unintended pregnancy while not using contraception	Having an unintended pregnancy	Having an induced abortion	
		non C E	U C E	UP nonC E	UP	A UP	
						A	
Regression	logistic	logistic	Cox	Cox	Cox	logistic	Cox
Time unit	At the time of the survey	At the time of the survey	01/01/95 to survey date	01/01/95 to survey date	01/01/95 to survey date	01/01/95 to survey date	01/01/95 to survey date
Numerator	Women concerned by risk of unplanned pregnancy	Women not using contraception	Unplanned pregnancies	Unplanned pregnancies	Unplanned pregnancies	Induced abortions	Induced abortions
Denominator	All women aged 18-44	Women concerned by risk of an unplanned pregnancy	Women using contraception	Women concerned by risk of an unplanned pregnancy, and not using contraception	All women aged 18-44	Unplanned pregnancies	All women aged 18-44
n	2863	2225	1323	1323	2863	1060	2863

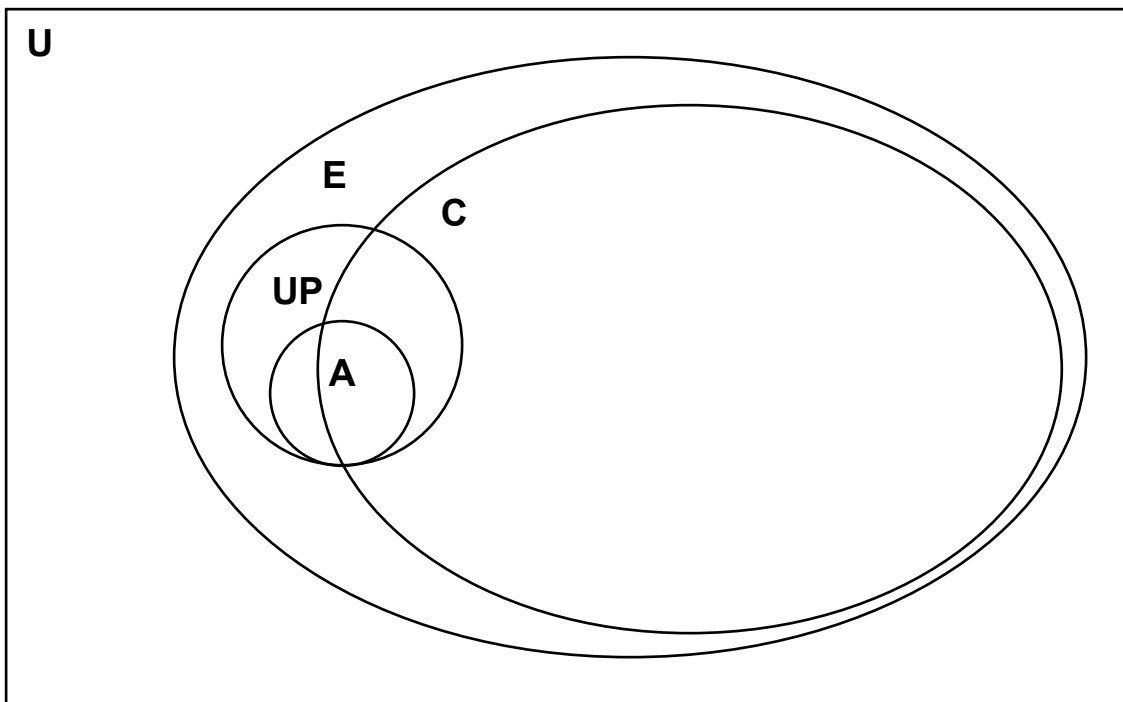
Table 2. Odds Ratios for Effects of Socio-Demographic Variables on Each Step Leading to an Abortion: France, 2000

Estimation	The different stages of the abortion process						A
	Being sexually active and concerned by the risk of unintended pregnancy	Not using contraception when concerned by the risk of unintended pregnancy	Having an unintended pregnancy while using contraception	Having an unintended pregnancy while not using contraception	Having an unintended pregnancy	Having an induced abortion after an unintended pregnancy has occurred	
	E	non C E	UP C,E	UP nonC,E	UP	A UP	
Age							
<20	0.61*	1.48	2.77***	0.88	0.18***	1.1	0.15***
20-29	ref.	ref.	ref.	ref.	ref.	ref.	ref.
30-39	0.78	2.21*	0.38***	0.44***	1.05	0.87	1.07
>=40	0.63**	1.88	0.09***	0.05***	0.31***	0.74	0.30***
Nationality							
French	ref.	ref.	ref.	ref.	ref.	ref.	ref.
foreign	0.73	1.74	0.45**	1.56	1.40	1.5	1.68**
Marital status							
not cohabiting	0.59***	1.94	1.47*	2.17***	0.81*	3.18***	1.49**
cohabiting	ref.	ref.	ref.	ref.	ref.	ref.	ref.
Educational level							
< HS diploma	ref.	ref.	ref.	ref.	ref.	ref.	ref.
>= HS diploma	1.04	0.44**	1.21	1.39	0.59***	1.64***	0.66**
n	2863	2225	1323	1323	2863	1060	2863

*** p < 0.01 ** p < 0.05 * p < 0.10 (two-tailed tests)

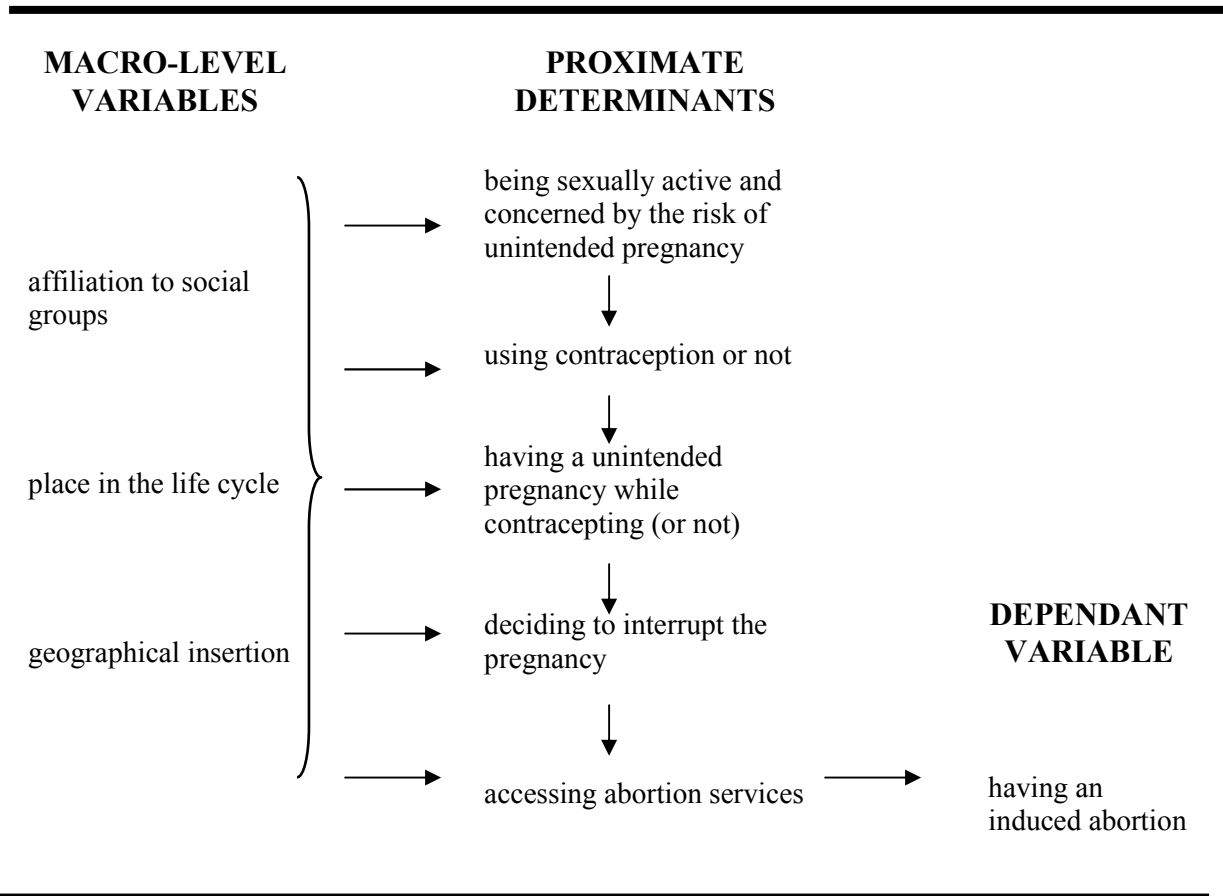
FIGURES

Figure 1: Modelling the Proximate Determinants of Induced Abortion Using a Venn Diagram



U = all women in reproductive ages; E = being sexually active, not sterile, and wanting to avoid a pregnancy; C = contraceptive use; UP = unplanned pregnancy; A = induced abortion.

Figure 2. Macro-level Variables and Proximate Determinants of Induced Abortion



ⁱ Another common measure of the frequency of induced abortion is the abortion ratio, that is, the number of abortions reported to the number of births. This measure of the frequency of abortion is relative to births: it cannot be used to compare levels of abortion across (sub) populations which have varying fertility rates. However, since fertility levels are relatively similar and stable in contemporary western countries, and since abortions and births follow grossly the same age pattern, the abortion ratio may be used as a short-hand to control for varying age-structures. The total abortion rate (TAR), which is the sum of age-specific abortion rates, remains the best way to measure the frequency of abortions while controlling for age.

ⁱⁱ We distinguish contraceptive methods implying the control of sexual intercourse (rhythm, withdrawal), from barrier methods (male or female condoms, spermicidal gels), from medical methods, i.e. methods delivered subsequently to an interaction with the health care system (IUD, pill, injectables, implant, sterilization). Medical contraceptive methods are more effective.

ⁱⁱⁱ We respected four consistency conditions when constructing women's contraceptive histories. First, the contraceptive method listed as the first method in women's contraceptive history had to match their answers on the method used at first sexual intercourse. Similarly, the methods women reported having used before each pregnancy in their contraceptive history had to match their answers about the method they used prior to their unplanned pregnancies. Third, the last method declared in the contraceptive history had to match women's answers about their current method of contraception. Finally; the cumulative lengths of contraceptive episodes had to match the duration

of each reproductive interval; given the rounded up nature of beginning and ending points as computed by the CAPI software during the interview, this latter condition was the most difficult to satisfy.