The Effect of Unemployment on Fertility[1]

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Abstract: We analyze the causal effect of unemployment on fertility. Neoclassical theory of fertility has ambiguous (both positive and negative) predictions regarding the effect of unemployment for women. Additionally, existing empirical research shows contradictory results and makes a weak case for exogeneity of unemployment to fertility behavior. We suggest that (unexpected) firm closures constitute an exogenous source of unemployment and adopt it as an instrument to estimate husbands' and wives' fertility response, using a unique administrative panel data from Denmark, which includes *all* residents in Denmark between 1982 and 2006. It contains monthly information about employment, relationship and a very-detailed fertility history -including stillbirths and miscarriages- of individuals as well as information about the firms that they work in. We estimate our models separately for men and women. Our preliminary results show that unemployment as a result of a firm closure negatively affects both women's and men's completed fertility and positively women's timing of the first birth. Men do not appear to delay timing of the first birth due to unemployment.

Keywords: Unemployment, Firm closures, Fertility

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1. Introduction

Recent research showed an increasing tendency that countries with lower rates of female employment also experience lower rates of fertility (Adsera 2004; Adsera, 2005; Ahn & Mira 2002; Brewster & Rindfuss, 2000; Esping-Andersen, 1999; Engelhardt & Prskawetz, 2004; Esping-Andersen, 2009). This implies a reversal in the well-known negative correlation between these two aggregates [i.e. Total Fertility Rates (TFRs) and female labor force participation rates (FLFPRs)] across the OECD countries. A common explanation for the emerging positive correlation is the extended durations of high (female) unemployment in southern and central European countries especially throughout the 1990s (e.g. Ahn & Mira, 2002; Adsera, 2004; Engelhardt & Prskawetz, 2004). This explanation is also supported by the observation that the downward trends in fertility coincide with increasing unemployment rates of women especially in these countries (e.g. Ahn & Mira 2002; Adsera 2005).

A smaller group of researchers went beyond the analysis of aggregate trends and focused on the underlying mechanisms between unemployment experience and fertility behavior at the individual-level[2] (e.g. Kravdal 2002; Kohler and Kohler 2002; Tölke & Diewald 2003; Adsera 2005; Gonzalez & Jurado-Guerrero, 2006; Kreyenfeld 2009; Ozcan et al. 2010; Adsera 2011). However, the need for further analyses persists for three major reasons:

First, the findings of this literature are far from being conclusive. Some studies find either no association between unemployment and women's fertility timing (e.g. Kreyenfeld 2009; Kravdal 2002; Rindfuss et al. 1988; Kohler & Kohler 2002), or a positive association for women with lower education (Kreyenfeld 2009; Hoem 2000). Yet, others detect a negative association between unemployment and transitions to motherhood (e.g. Hoem 2000; Adsera, 2005; Gonzalez & Jurado-Guerrero, 2006[3]). Moreover, fewer studies analyze the relationship between men's fertility behavior and

[2] There are also other studies that look at the impact of aggregate unemployment on individual conception decisions (e.g. Kravdal, 2002, Dehejia and Lleras-Muney 2004), however, the theoretical mechanisms between the aggregate unemployment and childbearing decisions are different than the direct experience of unemployment and childbearing decisions, as we will discuss in the next section.

[3] Only for Italy, Spain and France.

unemployment and they also report similarly contradictory findings (e.g., Tölke and Diewald, 2002, Sullingham & Falkingham 1991; Kravdal, 2002; Ozcan et al., 2010)

Second, the hypotheses derived from the neoclassical fertility theory have ambiguous predictions regarding the direction of the effect. Especially for women the effect of unemployment on fertility timing can be both positive and negative. Furthermore; when its assumptions about gendered division of labor for childrearing and market work are relaxed, neoclassical fertility theory produces even more ambiguous predictions for men and women (e.g., Hotz et al. 1997; Kravdal 2002; Adsera 2004; Ozcan et al 2010 and Adsera 2011). Thus, we believe that there is a need for testing systematically the predictions of this theory.

Third, this literature often lacks a proper causal approach. Researchers typically use simple duration models to estimate fertility timing where the dependent variable takes the value one around nine-months to one year before the birthdate of the child. Lagging the dependent variable is a common practice to avoid potential reverse causation of fertility influencing the likelihood of becoming unemployed (e.g. Adsera, 2005; Ozcan et al., 2010 and others). Although this procedure breaks the time order, and hence, helps to avoid reverse causation, it fails to fully eliminate the endogeneity problem. Fertility outcomes and the likelihood of being unemployed may well be determined endogenously through a series of choices and preferences interwoven along the life-course (e.g., Angrist and Evans, 1998). For example, planning to become a parent might affect some individuals' work performance and attachment and consequently, might increase their probability of becoming unemployed. Alternatively, unobserved characteristics may select some women into motherhood and at the same time reduce their attractiveness in the labor market. Thus, a careful assessment of causal relationship between unemployment and fertility requires finding an exogenous source of unemployment (i.e. not depended on the individuals' observed or unobserved characteristics).

In this paper, we use (unexpected) firm/plant closures in Denmark as an exogenous source of being unemployed. Consequently, we analyze the impact of unemployment as a result of job displacement on the individuals' fertility timing and

completed fertility. In fact, recently, three other studies also used job displacements to predict various fertility outcomes[4] (e.g. Del Bono, Weber & Winter-Ebmer 2008; Lindo 2010; Huttunen & Kellokumpu 2010). Our research builds on these three studies but it departs from them in a number of ways:

First of all, these studies explored the relationship between job displacement and various fertility outcomes, but unlike our study, they did not always have a clear focus on "unemployment". For example, Lindo (2010) used husbands' job losses[5], as a negative shock to the family income to estimate wives' fertility responses. Because he primarily focused on the income-fertility relationship, he did not consider wives' unemployment. In contrast, Del Bono et al. (2008) looked at only wives' job losses instead of both partners. Their study aimed to analyze the effect of all career interruptions due to job displacements (i.e. irrespective of an unemployment experience) on women's fertility levels. Huttunen and Kellokumpu (2010) focused on both partners' job displacements during the recession in Finland in 1991. Yet, the emphasis in their research was placed on the non-economic channels through which fertility is affected, such as the influence of job displacement through divorce and employment probabilities (where unemployment is simply grouped with inactivity in the reference category).

Moreover, findings of these studies are also far from being conclusive and thus, call for more empirical research. For instance, Del Bono et al., (2008) found that women with a job-displacement experience at average have 5-10% lower fertility compared to those that never experienced a job displacement. They argued that this negative effect is not because of unemployment. Huttunen and Kellokumpu (2010) found a negative effect only for the educated women and on the timing of a birth but not on the completed fertility and that husband's job loss reduces couple's fertility more than wives' job loss. Yet, Lindo (2010) argued that husband's job loss generates a positive effect on fertility timing in the short-run and a negative effect on the completed fertility in the long-run.

[4]A forth paper with a causal approach might be Ananat and Gibson-Davis (2010) although their study uses county-level data (i.e. county-level plant closures and birth rates) rather than individual level data.
[5] His study considers job losses due to various factors, including "being fired" and states that restricting the sample to include only job losses that are strictly due to firm closures did not change the results.

Contrary to these studies, this paper focuses exclusively on unemployment and its impact on fertility timing and completed fertility of Danish residents. We use unexpected firm closures to instrument unemployment. We estimate our models separately for husbands' and wives' and, again, unlike previous literature, we do not limit our sample to only married couples and take into account births out of marriage.

While doing so, we benefit from the best possible data: an administrative (panel) data of *all* residents in Denmark between 1982 and 2006, which has the following advantages over these studies: First, it is a monthly data that allows us to measure the timing of conception and unemployment more precisely than the other studies. Second, as opposed to these studies, which use data that ends mid-1990s or earlier, our data spans from 1982 to 2006 and brings the analysis closer to the current date. Third, it includes a rich set of information about individuals' and their partners' socio-economic situation, their work and relationship history and their work places. Forth, and perhaps most importantly, with this data, we are able to overcome a number of measurement problems prevalent in the broader literature: For instance, due to data limitations, some studies derived fertility histories using the household structure indicators and the information about the age of cohabiting children (e.g. Kreyenfeld 2009; Kravdal 2002; Gonzalez & Jurado 2006; Adsera 2005; Schmitt 2008). This strategy gives an incomplete picture of birth events by excluding the children who left home, live with other relatives or with the other partner in broken marriages[6]. Yet, studies that benefited from available fertility histories are also problematic since they relied on a selected sample of live births. We believe that an ideal data should provide information about all types of *conception decisions*[7], i.e. not only those that results in live births but also those that result in abortions and still births since these events may also potentially correlate with unemployment-related stress. To our knowledge, no studies consider these conceptions in

[6] Gonzalez & Jurado (2006) and especially Adsera (2005) attempted, although imperfectly, to address this problem in their studies. Adsera sets the age of women to 40 and argues that the percent of women who do not live with their children and who are below the age 40 is very small.

[7] These should ideally include unsuccessful attempts to conceive, too. Moreover, although, often ignored in the literature adoption decisions may also be affected by unemployment. Lack of information on adoptions and step parenthood may be consequential, particularly, in comparative studies as countries might vary in the prevalence of these events. For example, Ozcan et al. 2010 reports that the transitions to fatherhood via adoptions and step-fatherhood in East Germany are about twice more often than those in West Germany.

their analyses. We aim to alleviate this problem by including stillbirths in the construction of our dependent variable.

The structure of the rest of the paper is as follows: In the next section, we outline the theoretical mechanisms through which unemployment may affect fertility outcomes and we provide a summary of the previous literature. After the theoretical background, we present our data and sample, we discuss our instrument and we report the preliminary results. The paper ends with conclusions.

2. Theoretical Background and Previous Literature

Individuals' unemployment experiences may affect their fertility outcomes either directly by influencing their childbearing decisions or indirectly by affecting partnership formation and dissolution processes (e.g. Eliason, 2004; Huttunen and Kellonkumpu, 2011). For reasons of space and scope, we ignore the indirect channels[8] and focus on the direct relationship between unemployment and childbearing decisions. The mechanisms that link unemployment directly to fertility decisions are derived from the neoclassical (economic) model of fertility developed mainly by Willis (1973) and Becker (1960 and 1981) and its extensions. In a synthesized way, many of the following arguments are based on the discussions regarding those extensions outlined in Hotz, Klerman and Willis (1997), Kravdal (2002), Adsera (2004 and 2011):

In a nutshell, the standard (static) microeconomic models of fertility build on three major assumptions: One, children are similar to the consumption goods and parents derive utility from having and raising children, which in turn, implies a positive relationship between income and demand for children. Two, nonetheless, children are costly both in economic and in social terms, and that they necessitate investments of time that are especially high for the months immediately following the birth. As a result, households face with a trade-off between quality and quantity of children under the budget constraints. Three, although less explicitly pronounced in the extant literature,

[8] These channels may also be less relevant in the Danish context since marital status and fertility behavior are less correlated and less normatively ordered in Denmark compared to many other industrialized societies (e.g. Esping-Andersen 2007)

these models assume that traditional gender roles are common and persistent even in advanced societies[9]. This assumption dictated researchers to consider only women's time relevant for childbearing and rearing, especially for the first birth (e.g., Del Bono et al 2008). Because the neoclassical model does not take into account men's time, it predicts that unemployment might have different effects on the fertility outcomes of men and women. Overall, the prediction is negative for men and it is directly related to unemployment's negative effect on total family income and resources, which is called *the income effect*. However, in addition to the income effect, the same model suggests a *substitution effect* for women. Substitution effect implies that unemployment may be positively associated with women's fertility decisions because it reduces the cost of having children, conveniently providing time for childbearing and child caring. As a result, according to this model, while unemployment is expected to influence fertility decisions of men negatively, for women the overall impact is ambiguous.

In this paper, we revisit and test these predictions, which constitute our first set of hypotheses about men and women's completed fertility, using firm-closure instrument. Because the static model relies on the trade-off between quality and quantity of children, it is better suited for understanding the relationship between *unemployment* and *completed (lifetime) fertility* (Hotz. et al 1997). In line with the predictions, while we expect that unemployment due to firm closures will have a clear negative effect on men's completed fertility, its effect on women's completed fertility will not be as clear, due to offsetting income and substitution effects.

In fact, this theoretical framework has provided foundations for most empirical research on the fertility, not only under unemployment but also under various other types of economic uncertainty; such as job insecurity/instability due to short-term contracts (e.g. De la Rica, 2008; Bernardi et al. 2008), general economic and institutional uncertainty, such as those experienced in transition countries (e.g. Kohler and Kohler, 2002), subjective and financial uncertainty (e.g. Krayenfeld, 2009; Bhaumik and Nugent, 2005). Recessions and economic crises also generate uncertainty and their impact on

[9] See critique of this assumption in Esping-Andersen (2009). Brodmann et. al. (2007) also find that father's time and involvement in childcare is quite high in Denmark and it is one of the important predictors of the second and higher order births.

fertility has long been studied, both to understand pro-cyclical nature of fertility (e.g. Butz and Ward 1979, Adsera 2005, Schaller 2011) and recently to take advantage of large-scale firm closures during recessions (e.g. Dehejia and Lleras-Muney 2004; Ananat-Oltmans and Gibson-Davis, 2010; Huttunen and Kellonkumpu, 2011). However, we believe that large fluctuations in unemployment rates (aggregate unemployment levels) during recessions might generate different behavioral responses on individuals than unemployment experienced under stable macroeconomic conditions. During recessions, men and women may post-pone childbearing decisions even if they do not experience unemployment themselves irrespective of an income or a substitution effect. It is true that aggregate unemployment might generate an overall decline in wage rates, which might be interpreted as an indirect income effect. Still, rather than a current income loss, an intensified feeling of economic insecurity during economic crises and recessions might be dominating fertility decisions (Adsera, 2011). In sum, those that are actually unemployed during recessions might also be experiencing a "recession effect".

While the static model of neoclassical fertility is better suited for completed fertility, dynamic (life-cycle) models are appealing because they provide a framework to incorporate timing of births more properly (Hotz et al 1997). However, these models also rely on a set of assumptions such as, lack of uncertainty, existence of perfect capital markets, etc. Under these assumptions, these models suggest that households aims to maximize their utility (smoothing the consumption goods) by choosing timing of their children and wife's allocation of time over the life cycle. The implication is that women will prefer to have their children early in the life cycle to enjoy them for longer periods. These models also imply that transitory unemployment will not affect completed fertility but will positively affect the timing of the births because women will prefer to give birth when wages are low, implying a dominating substitution effect (Hotz et al 1997; Lindo, 2010). Plus, sociological theories also suggest that substitution effects can be stronger for first births because there is a general social norm against remaining childless (Kravdal 2002). However, under the possibility of uncertainty and imperfect capital markets, transitory unemployment may have both income and substitution effects. Additionally, contrary to these models, Adsera (2011) stresses that the substitution effect might only dominate if the unemployment is perceived truly *temporary*. Yet, if unemployment

becomes persistent, then pregnancy might imply "a weaker commitment to labor market" especially "if it happens early in the life course where human capital accumulation is crucial" (2011:p.6). As a result, childbearing at younger ages combined with longer periods of unemployment might turn into "an unemployment trap" (2004:p.22). However, since how temporary an unemployment spell is often uncertain, women may also prefer to postpone childbearing. To sum up, we conclude that these models also do not unambiguously provide predictions about women's unemployment on their timing of their birth.

Taking these implications together, we hypothesize that for men unemployment as a result of firm closures will result in a delay in the timing of first birth, while for women, it will either positively affect timing of the first birth – due to an especially strong substitution effect for the first births or no effect at all (an offsetting income and substitution effect).

3. Data and Method

In Denmark all residents have a unique personal number which identifies the resident in great many transactions, such as tax forms, visits to the doctor, interactions with the welfare system, schooling, work status, work place, registration of residence, etc. The registers record some variables on a daily basis, others at weekly or monthly basis, and a few – like e.g. yearly income – is registered at a yearly basis. Statistics Denmark conducts a yearly collection of the information registered by this personal number, and makes these data available for statistical and research purposes. The available data is then, a panel which starts in 1982 and currently ends in 2006, containing all Danish residents, and which allows for a linkage of partners – married or cohabiting - and parents and children. From this data we know exactly when people conceive children (i.e. we know a child's birthday as well as the length of the mother's pregnancy) and which months they are unemployed. In addition, the data allows us to include the conception of

children who end up as stillbirths.[10] This makes the data useful for the analysis on unemployment and the probability of conceiving a child.

For this analysis, we use a sample of all Danes born in 1966 whom we can follow in the registers from their 16th years of age (in 1982) until they turn 40 (in 2006), i.e. the years during which childbirths are most likely. This cohort has 87,333 individuals. For the analysis on completed fertility we follow these individuals on a monthly basis until they turn 40 (and right censor them at the year). This leaves us with 26,206,200 individual per month observations. For the analysis on first births, we follow the individuals until they conceive their first child and right censor them afterwards. We right censor those who do not conceive before age 40, at age 40. These restrictions leave us with 16,719,719 individual per month observations, whereby we have 191 months pr. individual on average.

3.1. Variables

Because we focus on both completed fertility and the timing of the first child, we have two outcome variables. Our first outcome variable measures number of conceived children at a monthly level. Thus the month the individual conceives his or her first child, the indicator changes from 0 to 1 and continues being 1 until the month the individual conceives his or her second child – at which point it changes to 2, etc. As shown in table 1, the completed fertility in our sample is 0.44 for men and 0.86 for women. This obviously reflects that we observe the individuals for many months before they conceive their first child (in which the value of the variable is zero). From the data we know that our male sample has between 0 and 8 children, and our female sample has between 0 and 9 children. The total fertility rate is 1.25 for all men and 1.78 for all women, but 1.86 for men who actually have children and 2.17 for women how have children.

Our second outcome variable is a monthly indicator of the individual's first child conception that may result in a live or a stillborn baby. Obviously, this is not a perfect indicator of fertility behavior, as it does not take abortions into account, just as it also

[10] Before 1997 a stillbirth was defined as the birth of a non-living child after the 27th week of the pregnancy. From 1997 onwards the definition changed, as is now the birth of a non-living child after the 20th week of the pregnancy.

does not contain any information on true intentions to conceive – both are factors that the unemployment may potentially influence. However it is still far more precise than most other measures used in the literature. In our sample, 65,667 individuals (75.19 percent) conceive their first child during our observation period, corresponding to an average monthly conception rate of 0.003 for men and 0.005 for women (see table 1).

Our key explanatory variable is of course labor market status, i.e. whether the individual is unemployed in a given month or not. We create such indicator using the registers' information on benefit recipience and do not distinguish between insured and uninsured unemployed. 69,865 individuals (80.00 percent) experience unemployment for shorter or longer periods during our observation period, and the total number of months of unemployment in our sample is 1,779,554.[11]

To control for other events that may affect the probability of conceiving a child, we also control for age, cohabitation (whether cohabiting or not), marital status (whether married or not), previous unemployment, whether the individual is in education in any given month, and educational level. We also control for partners unemployment, educational level and whether the partner is in education in any given month. All these variables are time-varying.

As for age, we recode continuous age into to binary variables indicating whether the individual is younger than 25 or older than 27. We do so because we wish to have piece-wise constant duration dependence, rather than e.g. a linear specification that is not particularly realistic in our case (since individuals are neither increasingly nor decreasingly likely to have children as they age). Our choice of thresholds is based on the observed fertility behavior in our sample (conception peaks in the mid-twenties). Table 1 shows that in the sample used for calculating completed fertility, 36 percent of the individual per months observations are observed when the individual is below 25 years of age and 56 percent is observed when the individual is older than 27 years of age (for both men and women). For the sample used for the first birth models, 49 percent of the male

[11] This may seem quite extensive, however it reflects that our population entered the labor market in the 80'es where youth unemployment was unprecedentedly high in Denmark. Also it corresponds to an average monthly unemployment rate of 6.7 percent, which is quite reasonable for the time period studied.

individual per month observations are observed when the male is younger than 25 years of age and 60 percent of the women are observed when the women is younger than 25 years of age.

Table 1 also shows that our individuals cohabit between 25 and 50 percent of the observed months, and are married between 6 and 26 percent of the observed months[12]. The individuals are in education between 18 and 30 percent of the months. Educational level is measured on a scale from 0 to 9, where 0 indicates no schooling and 9 indicates having a PhD – which is the highest possible educational level one can achieve in Denmark. The average educational level varies between is 2.19 and 2.53, corresponding to approximately 13 years of schooling (which is equivalent to having completed Danish high school).

Table 1 also shows that our individuals have experienced between 6 and 11 percent unemployment prior to any given month (we define previous unemployment as the share of the months observed prior to month t in which the individual has experienced unemployment).

In addition, in any given month, between 8 and 19 per cent of the partners are unemployed, between 7 and 21 percent of the partners are in education and partner's average educational level lies between 2.67 and 3.00 2.84, corresponding to approximately 14 years of schooling.

Table 1: Summary Statistics of Main Explanatory Variables

	Completed fertility		First birth	
	Men	Women	Men	Women
Variable	Mean (std.)	Mean (std.)	Mean (std.)	Mean (std.)
Unemployment	0.10 (0.30)	0.14 (0.35)	0.11 (0.31)	0.10 (0.30)
Completed fertility	0.44 (0.80)	0.86 (1.07)		
First child			0.003 (0.06)	0.005 (0.07)
Excl. res.: firm closure	0.004 (0.06)	0.003 (0.06)	0.004 (0.06)	0.004 (0.06)
Married	0.20 (0.40)	0.26 (0.44)	0.06 (0.23)	0.06 (0.24)
Cohabiting	0.40 (0.49)	0.50 (0.50)	0.25 (0.43)	0.29 (0.45)

[12] Note that the small share of married people reflect large variations in marital status across ages – very few marries before age 20 and more than half of the sample are married at age 40.

Under education	0.18 (0.38)	0.19 (0.39)	0.24 (0.43)	0.30 (0.46)
Level of education	2.48 (1.56)	2.53 (1.56)	2.25 (1.50)	2.19 (1.48)
Previous unemployment	0.08 (0.13)	0.11 (0.15)	0.07 (0.13)	0.06 (0.11)
Younger than 25 years	0.36 (0.48)	0.36 (0.48)	0.49 (0.50)	0.60 (0.49)
Older than 27 years	0.56 (0.50)	0.56 (0.50)	0.40 (0.49)	0.31 (0.46)
Partner characteristics				
Unemployed	0.16 (0.37)	0.08 (0.27)	0.19 (0.39)	0.10 (0.30)
Under education	0.14 (0.34)	0.07 (0.26)	0.21 (0.41)	0.14 (0.34)
Level of education	2.97 (1.60)	3.00 (1.60)	2.67 (1.59)	2.89 (1.63)
Observations	13,412,400	12,793.800	9,742,381	16,719,719

3.2. Method

We analyze the effect of unemployment on completed fertility and conception using a standard discrete time duration model (see Yamaguchi, 1991, chapter. 2). However, due to the potential endogenous relationship between unemployment and child conception discussed earlier – unemployment may affect the decision to conceive a child, but having a child may also increase the probability of unemployment – we apply a two-step procedure, where we instrument unemployment. We present results from a model with both men and women and separate results for men and women.

3.2.1 Exogenous variation: Firm closure

While it has proven tricky to find useful exogenous variation for unemployment, firm closure has recently been established as a valid instrument (see e.g. Heinesen & Browning, 2010; Browning, Møller & Heinesen, 2004; Eliason & Storrie, 2004); it is the assumption that most employees fail to foresee that their work place is about to close down and that unemployment occurring as a result of such firm closure is uncorrelated with employee characteristics. And even if one can dispute this assumption of lack of anticipation, there are good examples of firms closing down from one day to another in Denmark in recent years (a recent prominent example is the closing down of the company IT Factory in December 2008[13])

We identify firm closures following the definition that is now standard in the Danish firm closure literature: From the registers we have yearly information on all Danish firms, which means that we know whether a firm (identified with a unique

[13] For a Danish reference on this, see http://da.wikipedia.org/wiki/IT_Factory

number) exists in November each year. If a firm – or the firm number - disappears from the data from one year to the next, it then means that the firm has closed down. The registers take into account that specific firms may cease to exist when new owners take over, when they move to a new address or change industry, and in the registers, such organizational changes do not equal firm closure. Consequently the register do not record the following changes as firm closures: If the firm 1) changes address, but has the same owner and works in the same industry, 2) changes address, but has the same owner and the same employees, 3) changes owner, but has the same employees and the same address, or 4) changes owner, but has the same employees and works in the same industry. The registers define the criterion "same employees" as the continued engagement of at least 30 percent of the employees from one year to the next.

However, for our study we need information on more than just the year of the firm closure; since we analyze the effect of unemployment on child conception in any given month, we need information on whether unemployment in a specific month is the result of the firm closure. Without that information we cannot be sure to identify the causal effect of the unemployment on child conception. Consequently we use information on the monthly unemployment rate of employees of each firm (as determined the year before the year of the closure), and determine the month of closure as the month in which the unemployment rate of these employees has increased by 50 percent or more compared to the preceding month.[14]

Firm closures occur 86,765 times in our sample.

[14] The firm closure literature argues that those who become unemployed are a selected sample of workers whose jobs are displaced. Especially the workers with more ability to foresee their company's closure might leave the firm without being unemployed, which is called "the early-leavers" problem. Additionally, some workers may be attractive enough in the labor market and do not experience unemployment after their firm is closed even if they do not foresee the firm closure. Typical way of treating early leavers problem in the literature is to include workers who left the firm a year before the closure. However, just as in Del Bono et al (2008) study on Austria, this option is not possible in Denmark either, because the law obliges mothers to take several months of maternity around the first birth. We also believe that firm closure instrument will not effect early leavers, since they will be gone before, (given LATE), we believe this is less of a concern in our study.

4. Results

In this section we report our preliminary results separately for each gender. While our main analyses are based on 2SLS models, we start out by presenting results from simple OLS models (with clustered standard errors), to provide a benchmark. Thus Tables 2 and 3 below show results from OLS models for completed fertility and the timing of the first births respectively, and Tables 4 and 5 show the result from our 2SLS model (first and second stages) for completed fertility and for the timing of the first births, respectively. The first column of these tables shows results for men and the second column for women.

Results from OLS models

Table 2 shows the non-causal relationships between our first outcome variable – completed fertility – and our choice of covariates. Both men and women, who experience unemployment in any given month, have lower completed fertility in that given month, compared to men and women who do not experience unemployment. The coefficients are not huge, but still highly significant. This suggests that unemployment results in lower number of births.

In addition, we see that being married or cohabiting raises the completed fertility, while both men and women who are in education experience lower completed fertility. However, while higher levels of education increases completed fertility for men, it decreases completed fertility for women. The opposite is true with regards to the correlation between previous unemployment and completed fertility – previous unemployment increases completed fertility for women, but decreases it for men. Also the correlation of age and completed fertility differs between men and women. With regards to partner's characteristics, we see that having an unemployed partner increases the completed fertility of men, but decreases it for women, just as completed fertility is positively correlated with partner's level of education for men, but negatively correlated with partner's level of education for women. In contrast, it decreases completed fertility of both men and women if their partner is in education.

Table 3 shows the results for the Linear Probability Model (LPM) relationship between first births and our covariates. As shown, experiencing unemployment raises the

probability of conceiving the first child for men, but decreases this probability for women. Again the coefficients are small, but highly significant.

Table 2: OLS models on completed fertility (with clustered standard errors)

	Men	Women
Parameter	Coefficient	Coefficient
Unemployed	-0.044 (0.003)***	-0.023 (0.003)***
Married	0.804 (0.006)***	0.779 (0.007)***
Cohabiting	0.141 (0.006)***	0.336 (0.008)***
Under education	-0.029 (0.002)***	-0.114 (0.003)***
Level of education	0.009 (0.001)***	-0.021 (0.002)***
Previous unemployment	-0.085 (0.017)***	1.437 (0.026)***
Younger than 25 years	0.072 (0.002)***	-0.084 (0.003)***
Older than 27 years	0.458 (0.003)***	0.594 (0.004)***
Partner characteristics		
Unemployed	0.030 (0.005)***	-0.047 (0.008)***
Under education	-0.219 (0.005)***	-0.254 (0.007)***
Level of education	0.038 (0.002)***	-0.006 (0.002)***
Intercept	-0.098 (0.004)***	0.123 (0.007)***
R^2	0.4414	0.4749
F-test	8,446.72***	13,460.22***

*** p<0.001; ** p<0.01; * p<0.05; † p<0.1

In addition, we see that being married or cohabiting and having higher levels of education raises the probability of conceiving one's first child for both men and women. However while being in education increases the probability of conception for men, it decreases this probability for women. In contrast, while previous unemployment lowers the probability of conceiving a child for men, it increases the probability for women. Moreover, being a man or a woman younger than 25 years of age and being a women older than 27 years of age lowers the probability of conceiving the first child, while being older than 27 years of age increases the probability for men

Table 3: LPM models on first births (with clustered standard errors)

	Men	Women
Parameter	Coefficient	Coefficient
Unemployed	0.0002 (0.000)***	-0.003 (0.000)***
Married	0.007 (0.000)***	0.007 (0.000)***
Cohabiting	0.008 (0.000)***	0.009 (0.000)***
Under education	0.000 (0.000)***	-0.002 (0.000)***
Level of education	0.000 (0.000)***	0.000 (0.000)***
Previous unemployment	-0.002 (0.000)***	0.005 (0.000)***
Younger than 25 years	-0.002 (0.000)***	-0.002 (0.000)***
Older than 27 years	0.002 (0.000)***	-0.003 (0.000)***
Partner characteristics		
Unemployed	-0.008 (0.000)***	0.001 (0.000)***
Under education	-0.005 (0.000)***	-0.004 (0.002)***
Level of education	0.001 (0.000)***	0.001 (0.000)***
Intercept	0.0006 (0.000)***	0.004 (0.000)***
R^2	0.0096	0.0072
F-test	2,390.42***	1,900.70***

*** p<0.001; ** p<0.01; * p<0.05; † p<0.1

Importantly we cannot make any causal claims with regards to the effect of unemployment on fertility behavior based on the models presented and described above. Thus we proceed to results from the 2SLS[15] models where we instrument unemployment using firm closures.

Results from 2SLS models

From the upper panel of table 4, we learn that our exclusion restriction – firm closures - increases the probability of unemployment both for men and for women, and that the effect is significant at the 0.1 percent level for both genders. In addition, we learn that married people, people who do not cohabit and under education are less likely to experience unemployment. Also, the probability of unemployment is lower between the age 25 and 27, relative to when the respondents are younger than 25 or older than 27. Moreover, having an unemployed partner increases the likelihood of own unemployment

[15] We also tried to estimate our models with Stata's Ivprobit command. However, due to the large sample size, Stata MP was unable to process and ran out of memory despite every effort to expand the memory. As a robustness check we will also try ivrprobit on a smaller random sample of individuals in the near future.

and that this likelihood decreases somewhat by partner's level of education for men and increases for women. We also see that both women and men with more spells of previous unemployed are more likely to become unemployed, as expected.

Table 4. 2SLS Models on *Completed Fertility*.

1. Stage: Outcome: the likelihood of unemployment		
	Men	**Women**
Parameter	Coefficient	Coefficient
Married	-0.008 (0.000)***	-0.027 (0.000)***
Cohabiting	0.004 (0.000)***	0.027 (0.000)***
Under education	-0.004 (0.000)***	-0.008 (0.000)***
Level of education	-0.000 (0.000)***	-0.001 (0.000)***
Previous unemployment	1.185 (0.001)***	1.180 (0.001)***
Younger than 25 years	-0.013 (0.000)***	-0.012 (0.000)***
Older than 27 years	-0.109 (0.000)***	-0.124 (0.000)***
Partner characteristics		
Unemployed	0.027 (0.001)***	0.069 (0.000)***
Under education	-0.001 (0.000)**	-0.000 (0.000)**
Level of education	-0.000 (0.000)***	0.002 (0.000)***
Ex. Res: Plant closure	0.023 (0.001)*** (z=19.13)	0.016 (0.001)*** (z=10.64)
Intercept	0.063 (0.000)***	0.079 (0.000)***
2. Stage: Outcome: Completed fertility		
Parameter	Coefficient	Coefficient
Unemployed	-1.981 (0.159)***	-4.649 (0.498)***
Married	0.788 (0.001)***	0.650 (0.014)***
Cohabiting	0.148 (0.001)***	0.460 (0.013)***
Under education	-0.036 (0.001)***	-0.150 (0.004)***
Level of education	0.015 (0.001)***	-0.025 (0.001)***
Previous unemployment	2.211 (0.188)***	6.896 (0.588)***
Younger than 25 years	0.046 (0.002)***	-0.139 (0.006)***
Older than 27 years	0.247 (0.017)***	0.020 (0.062)
Partner characteristics		
Unemployed	0.083 (0.004)***	0.274 (0.034)***
Under education	-0.221 (0.001)***	-0.225 (0.003)***
Level of education	0.038 (0.000)***	0.005 (0.001)***
Intercept	-0.024 (0.010)*	0.489 (0.039)***

*** p<0.001; ** p<0.01; * p<0.05; † p<0.1. Standard errors are clustered at the level of individual.

Table 4 also shows that marriage and cohabitation significantly increases the number of births for both genders. Interestingly, education has an opposite effect on men and on women. While a higher level of education decreases the number of total births for women, for men an extra educational degree increases the total number of births. In contrast, having an educated partner affects fertility positively both for men and for women, although the effect is very small for women. Note that having an unemployed partner increases the number of children both for men and for women however, this variable is endogenous and should be interpreted with caution.[16]

As discussed in the theory section, the effect of unemployment on the probability of conceiving a child is also likely to vary significantly by gender. For women the theory predicts both a positive (e.g. substitution effect) and a negative effect (e.g. income effect), whereas for men the theory predicts only a negative effect. Additionally, implications of the dynamic models and the predictions of sociological models often indicate a stronger substitution effect for the first births. Thus, Table 5 shows the 2SLS models (the first and second stage regressions) on the timing of the first birth for men and women. We find that while the exclusion restriction has reasonable power (table 5), however there is no effect of unemployment on the likelihood of conceiving a child for men and a positive effect for women (significant at the 5% level)[17]. This result is in fact, in line with the prediction that substitution effects may dominate income effect for women. It is surprising that there is no clear income effect for men who become unemployed due to firm closures. However, this is net of partner's being unemployed, which for men, is negative and significant.

As a robustness check, we have also run the models without partner characteristics. Results are shown in Table A1 and A2 in the appendix, and as can be seen, excluding the partner characteristics does not alter the overall conclusions.

[16] In future analyses we plan to instrument this variable.
[17] The coefficients in table 5 models should represent marginal effects expressed as hazard rates.

Table 5. First Birth.

1. Stage Outcome: Likelihood of Unemp.	Men	Women
	Coefficient	Coefficient
Married	-0.007 (0.000)***	-0.022 (0.000)***
Cohabiting	-0.000 (0.000)	0.004 (0.000)***
Under education	-0.003 (0.000)***	0.001 (0.000)**
Level of education	0.005 (0.000)***	0.004 (0.000)***
Previous unemployment	1.325 (0.001)***	0.016 (0.001)***
Younger than 25 years	-0.003 (0.000)***	0.010 (0.000)***
Older than 27 years	-0.108 (0.000)***	-0.089 (0.000)***
Partner characteristics		
Unemployed	0.038 (0.000)***	0.055 (0.001)***
Under education	-0.000 (0.000)	0.007 (0.001)***
Level of education	0.000 (0.000)	0.002 (0.000)***
Ex. Res: Plant closure	0.023 (0.001)*** (z=16.47)	0.016 (0.002)*** (z=9.25)
Intercept	0.224 (0.000)***	0.029 (0.000)***
2. Stage: Outcome: Likelihood of conceiving a child		
	Coefficient	Coefficient
Unemployed	-0.009 (0.013)	0.071 (0.036)*
Married	0.007 (0.000)***	0.008 (0.001)***
Cohabiting	0.008 (0.000)***	0.009 (0.000)***
Under education	0.000 (0.001)***	-0.002 (0.000)***
Level of education	0.000 (0.000)	0.000 (0.000)
Previous unemployment	0.014 (0.016)	-0.098 (0.050)
Younger than 25 years	-0.002 (0.000)	-0.003 (0.000)***
Older than 27 years	0.001 (0.001)	0.004 (0.003)
Partner characteristics		
Unemployed	-0.008 (0.001)***	-0.003 (0.002)
Under education	-0.005 (0.000)***	-0.004 (0.000)***
Level of education	0.001 (0.000)***	0.000 (0.000)***
Intercept	-0.001 (0.001)*	-0.001 (0.001)
F-test	2338.55***	1431.48***

*** p<0.001; ** p<0.01; * p<0.05; † p<0.1 Standard errors are clustered at the level of individual.

5. Conclusion and Future Steps

The results from the preliminary analyses presented in this draft show that experiencing unemployment has a negative causal effect on the number of births both for men and for women. However, when we look at the timing of first births, we see that the causal effect only applies to women. The findings about the completed fertility indicates that the income effect of unemployment surpasses the substitution effect of unemployment for women and that both women and men may end up having less children due to unemployment by firm closures. In other words, while unemployment may reduce the time cost of childbearing and rearing, the negative shock to the current income is more important for men and women in the long run.

However, the picture changes when we look at the timing of the first births. While we found a weakly significant positive effect for women, indicating a domination substitution effect, but we did not find any clear negative income effect for men. The latter finding is a bit surprising, although there are plausible reasons why timing of births for men might not be affected negatively by unemployment experience in the Danish context, given the fact that we do not distinguish insured versus uninsured unemployment.

In fact, these preliminary findings are somewhat in line with the findings of the previous studies. Del Bono et al (2008) found that job displacement decreases completed fertility about 5-10% - although they argue that it is not because of unemployment but because of the career interruption- and Lindo (2010) found that job losses may decrease completed fertility, but does not delay the timing of births. These effects may be possibly due to uncertainty about the future employment (Ahn and Mira, 2002) or higher levels of opportunity cost both monetary and in non-monetary terms (Hotz et al. 1997). Although, at this stage we are not able to distinguish these two reasons, our preliminary results suggest that uncertainty about future employment might be an important factor in Danish context. This interpretation may be supported by the previous research that claims Danish women do not suffer significant income loss due to childbirth when observed characteristics are controlled for (Gupta and Smith, 2002).

However this is a first draft of our analysis, and it is our ambition to extend the analysis in the near future with the following elements. First, we wish to include information from other cohorts. In order to observe complete fertility window (ages between 16 and 40) of women and their full set of conceptions, we restricted our sample only to the 1966 cohort for the moment. As a next step, we aim to expand our sample to cover everybody in Denmark born between 1964-1968 (5 birth cohorts). Second, we would like to try specifications with incorporate industry, region dummies as well as specifications with couple fixed-effects instead of partner characteristics.

Last, our causal estimate of unemployment relies strongly on the specification of our instrument – e.g. that we define the month of the firm closure as the month where the total unemployment of the employed doubles. To ensure that our results are robust, we need to conduct sensitivity analyses, where we test different specifications of the instrument.

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Appendix

Table A1: Completed fertility: Models without partner characteristics

1. Stage: Outcome: the likelihood of unemployment		
	Men	**Women**
Parameter	Coefficient	Coefficient
Married	-0.009 (0.000)***	-0.030 (0.000)***
Cohabiting	0.008 (0.000)***	0.041 (0.000)***
Under education	-0.004 (0.000)***	-0.008 (0.000)***
Level of education	0.003 (0.000)***	-0.001 (0.000)***
Previous unemployment	1.191 (0.001)***	1.191 (0.001)***
Younger than 25 years	-0.014 (0.000)***	-0.012 (0.000)***
Older than 27 years	-0.110 (0.000)***	-0.127 (0.000)***
Ex. Res: Plant closure	0.022 (0.001)*** (z=19.09)	0.016 (0.002)*** (z=10.58)
Intercept	0.063 (0.000)***	0.079 (0.000)***
2. Stage: Outcome: Completed fertility		
Parameter	Coefficient	Coefficient
Unemployed	-2.111 (0.271)***	-4.723 (0.830)***
Married	0.814 (0.007)***	0.651 (0.026)***
Cohabiting	0.226 (0.004)***	0.480 (0.034)***
Under education	-0.039 (0.002)***	-0.160 (0.008)***
Level of education	0.019 (0.002)***	-0.027 (0.002)***
Previous unemployment	2.362 (0.324)***	7.032 (0.989)***
Younger than 25 years	0.048 (0.005)***	-0.141 (0.012)***
Older than 27 years	0.247 (0.030)***	0.007 (0.105)
Intercept	0.017 (0.018)	0.498 (0.066)***

Note: Standard errors are clustered at the individual level.

Table A2: First births: Models without partner characteristics

1. Stage: Outcome: the likelihood of unemployment		
	Men	**Women**
Parameter	Coefficient	Coefficient
Married	-0.008 (0.000)***	-0.023 (0.000)***
Cohabiting	0.008 (0.000)***	0.016 (0.000)***
Under education	-0.004 (0.000)***	0.001 (0.000)***
Level of education	0.005 (0.000)***	0.004 (0.000)***
Previous unemployment	1.331 (0.001)***	1.408 (0.001)***
Younger than 25 years	-0.003 (0.000)***	0.010 (0.000)***
Older than 27 years	-0.110 (0.000)***	-0.090 (0.000)***
Ex. Res: Plant closure	0.023 (0.001)*** (z=16.42)	0.016 (0.002)*** (z=9.25)
Intercept	0.044 (0.000)***	0.029 (0.000)***
2. Stage: Outcome: Timing of First Births		
Parameter	Coefficient	Coefficient
Unemployed	-0.010 (0.012)	-0.069 (0.036)†
Married	0.008 (0.000)***	0.009 (0.001)***
Cohabiting	0.007 (0.000)***	0.009 (0.001)***
Under education	-0.039 (0.002)***	-0.002 (0.000)***
Level of education	0.000 (0.000)**	0.000 (0.000)
Previous unemployment	0.011 (0.016)***	-0.097 (0.050)†
Younger than 25 years	-0.002 (0.000)***	-0.003 (0.000)***
Older than 27 years	0.001 (0.001)***	0.004 (0.003)
Intercept	0.001 (0.001)	0.001 (0.001)

Note: Standard errors are clustered at the individual level.