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BUSINESS CYCLES AND FERTILITY: THE IMPACT OF UNEMPLOYMENT ON THE BIRTH RATE

Bachelor's Thesis

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I hereby declare that this thesis is entirely the result of my own work except where otherwise indicated. I have only used the resources given in the list of references.

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Prague, May 17th, 2012

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Abstract

This paper investigates how aggregate fertility responds to business cycle fluctuations and attempts to quantify this effect. The results of a first differences regression analysis on a 2003 to 2010 panel data sample of 31 member states of the Organization for Economic Co-operation and Development indicate procyclical fertility behavior over the business cycle. Ceteris paribus, a one percentage point increase in the general unemployment rate decreases the crude birth rate by 0.054. Tertiary educational attainment of the labor force, the average wage, the female-to-male wage ratio and the marriage and divorce rates are all positively related to fertility, while the employment rate of women exerts a fertility-depressing effect.

Keywords: fertility, crude birth rate, unemployment, business cycles, recession

JEL classification: J13, J11, E24

Abstrakt

Práce si klade za cíl kvantifikovat vliv hospodářských cyklů na porodnost. Regresní analýza s použitím prvních diferencí provedená na panelových datech 31 členských států Organizace pro hospodářskou spolupráci a rozvoj v letech 2003 – 2010 potvrdila procyklický charakter porodnosti. Ceteris paribus, růst obecné míry nezaměstnanosti o jeden procentní bod vede k poklesu hrubé míry porodnosti o 0.054. Univerzitní vzdělání, průměrná mzda, poměr mezd žen a mužů, sňatečnost a rozvodovost mají na porodnost kladný vliv, míra zaměstnanosti žen naopak záporný.

Klíčová slova: plodnost, porodnost, hrubá míra porodnosti, nezaměstnanost, hospodářský cyklus, recese

JEL klasifikace: J13, J11, E24

Table of Contents

1. Introduction

If you lose your job, are you more or less likely to have a child? When the economy enters a slowdown, does the birth rate go up or down? The academic literature provides the following answer to both: it depends. This indecisiveness follows from the myriad of differential and sometimes even opposing effects that determine fertility at the individual level. As a result, studies that investigate the movement of fertility indicators over the business cycle provide evidence of their countercyclical as well as procyclical behavior.

This paper aims to examine how fertility responds to business cycle fluctuations and to quantify this effect using the unemployment rate as a proxy for economic conditions. For this purpose, a model is constructed and estimated employing panel data for 31 member states of the Organization for Economic Co-operation and Development (OECD) covering the period 2003 - 2010. This sample is advantageous in that it provides sufficient variation in both fertility and unemployment rates, as well as intriguing in that it encompasses the 2008 global economic slump, which differed from previous recessions in terms of its institutional and cultural context (Sobotka, 2011). Unprecedented female labor-force participation and widespread contraceptive use, continuous childbearing postponement, burdened welfare systems and extensive global media coverage may all be listed as characteristics of the recent crisis.

Prior to conveying the results of the empirical analysis, two points must be stressed in order to avoid potential confusion. One, this paper concerns itself with fertility in the industrialized countries. The value of children differs vastly between the developing and the developed world. In the former, children serve as production goods by providing pecuniary income to their parents (not only) in illness and old age (Becker, 1960). In the latter, where social security systems have taken over this role, children are more of a consumption good, providing their parents with non-pecuniary utility. As a result, these cases require separate consideration. Two, the subjects of investigation are short-run economic fluctuations and the corresponding fertility movements as opposed to long-run factors which determine fertility's course for decades. While long-term declining fertility is of perpetual concern with regard to the sustainability of social security systems, cyclical

fertility determinants also deserve attention on the ground that the birth rate affects aggregate demand (Simon, 1969).

The results indicate that fertility moves procyclically over the business cycle, with fewer children born during economic slowdowns. Ceteris paribus, a one percentage point increase in the unemployment rate lowers the crude birth rate by 0.054. The responsiveness of fertility to economic fluctuations results from individuals' preferences for the smoothing-out of consumption over the business cycle in the presence of imperfect capital markets. The analysis further identifies female employment as having a depressing effect on fertility, but assigns a positive influence to tertiary educational attainment, the marriage and divorce rates, the average wage and the female-to-male wage ratio.

The paper is structured as follows. Section 2 provides an overview of the existing literature and presents the theoretical foundations necessary for constructing the empirical model, which is described in Section 3. Results of its estimation are reported and discussed in Section 4. Section 5 concludes.

2. Theoretical Framework

The spread of contraceptive use has caused family formation to become a matter of decision-making and thus subject to environmental factors, allowing economists as well as other social scientists to formulate theories of how fertility decisions are made. Although their approaches vary and at times reach different conclusions, they all share the common notion that parenthood and employment are alternative activities competing for a limited time supply, and that an individual's resources are to be allocated between non-child consumption and child services.

2.1 Economic Theory of Fertility

Although some initial contemplation of the economic determinants of family size is to be found in the works of Thomas Robert Malthus as well as Adam Smith (Sobotka, 2011), the cornerstone of the economic theory of fertility has been put down by Gary Becker in 1960. Since then the body of fertility-related economic theory has expanded substantially. This section provides an overview of the key contributions to the matter, namely those of Becker, Easterlin, Debra Friedman and Happel.

Viewing children as durable consumption and production goods, in the sense that they may provide psychic satisfaction as well as pecuniary income, Becker (1960) linked the demand for children to standard economic theory. Families maximize their utility functions of the quantity of children, the resources spent on each child and the quantities of other commodities. The production of children takes place within the household, using as inputs market goods and services as well as parental time. Reasoning that the demand for children was similar to the demand for other durable goods, Becker concluded that fertility should behave procyclically, declining in times of economic slowdowns.

According to the updated version of Becker's (1991) theory, the demand for children depends on their relative price and on a family's real income. The relative price of children refers to the price of children compared to other goods; its increase leads to a fall in the number of children desired. A family’s real income should be positively related to the demand for children, assuming they are normal goods. Surprisingly, most longitudinal studies find a negative relationship between real income and the quantity of children. Becker (1991) resolves this apparent contradiction: the demand for children

comprises of their *quantity* as well as *quality* and as the latter rises, the former declines.[1] The interaction between them implies that the demand for children is responsive to price and income, even though no close substitutes for children exist.

Easterlin (1966) enriched the theory by introducing income aspirations as important determinants of fertility and declaring that relative, not absolute income matters for reproductive decision-making. Young adults form their income expectations based on the consumption levels they experienced as teenagers in their parents' households and are reluctant to start a family of their own unless their material aspirations have been met.

In a critical response to the rational-choice theories presented above Debra Friedman (1994) set forth her "uncertainty reduction theory of parenthood", at the center of which are actors who seek to reduce uncertainty. Friedman identifies three global uncertainty reduction strategies: stable careers, marriage and children. It follows that if, for instance, an economic downturn characterized by job instability blocks the actors' stable-career strategies, they may resort to childbearing as a means of reducing uncertainty[2].

The concepts presented up to this point may be referred to as *static* models of fertility in the sense that they are concerned with *completed* fertility (i.e. the number of children an individual will have had by the end of their reproductive life). However, taking into account the aim of this paper, which is to investigate the effect of cyclical fluctuations, *dynamic* fertility models are of greater relevance. In these models, individuals decide not only about completed fertility, but also about the *timing* of the individual childbirths. One such model is that of Happel, who views birth timing as a multi-period planning problem.

According to Happel (1984) individuals maximize life-cycle utility, a function of the time distribution of non-child consumption and child services, subject to the constraint that the present value of child and non-child expenditures equals the present value of income streams. In the hypothetical case of flawless capital markets, perfect consumption

[1] Quantity refers to the number of children whereas quality of children is determined by the resources spent on them. For example, children whose parents invest heavily into their education would be termed "high-quality children" (Becker, 1960). Child quality is more of a matter of social pressure than parental choice.

[2] In her paper Friedman (1994) refers to *biographical* uncertainty, which differs from *economic* uncertainty as understood by Becker both in definition and the consequences it carries for fertility behavior in response to changing economic conditions. Section 2.2.1 covers this issue in more detail.

smoothing is possible and the cost of childbearing determines how many children to have but not when to have them. However, real-life borrowing constraints coupled with preferences for smooth consumption give rise to parental attempts to place childbirth into a period when the man's earnings are relatively high (usually towards the end of his reproductive life). In addition, the mother will prefer a date of birth that maximizes her life-time earnings, which chiefly depends on her rate of skill depreciation during unemployment.[3] Therefore, not only the number of children, but also the timing of their births is a matter of economic choice.

2.2 Fertility Behavior over the Business Cycle

Does fertility behave procyclically, declining in times of economic downturns, or countercyclically, rising during recessions? Most studies on the topic conclude that a slowdown of economic activity depresses fertility levels (Macunovich 1996, d'Addio and d'Ercole 2005, Schaller 2012). By contrast, Butz and Ward (1979) found fertility to move countercyclically.

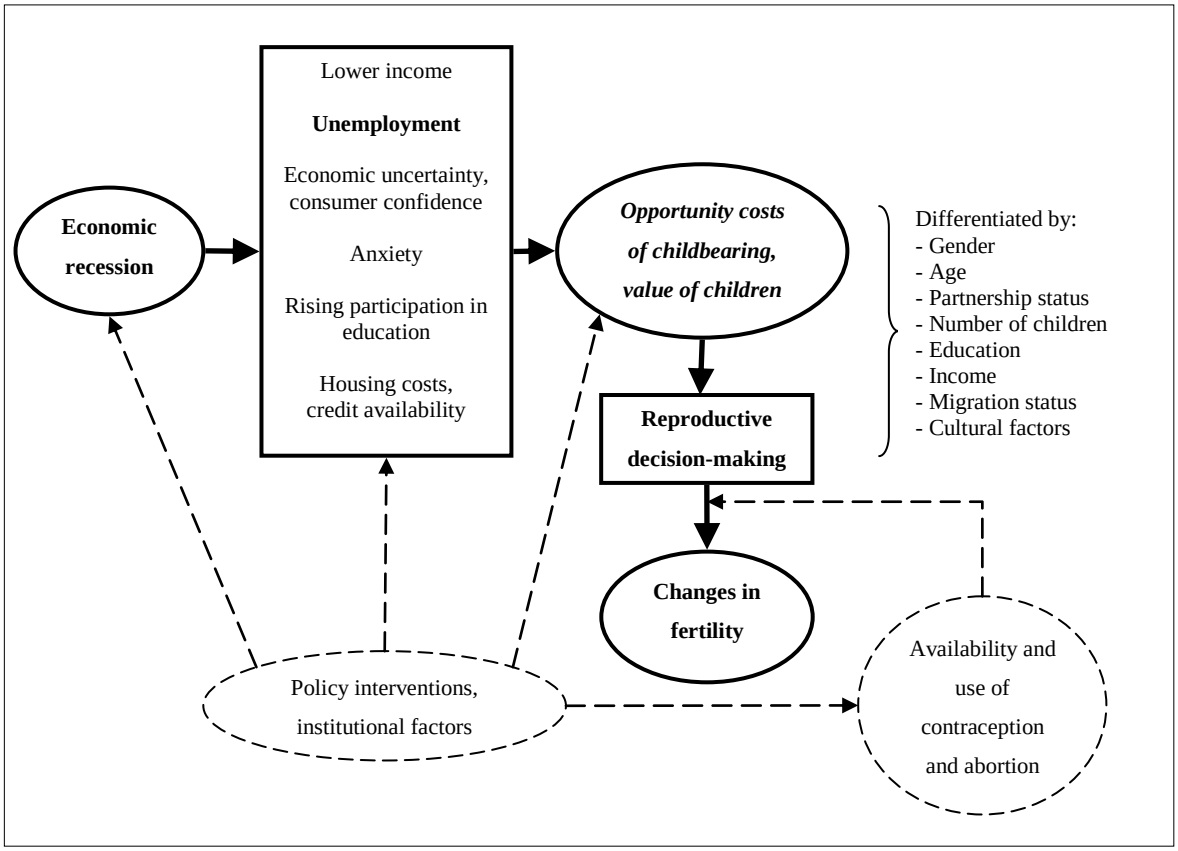
Figure 1 shows the channels through which an economic recession influences fertility, the bold parts being the focus of this thesis. A recession manifests itself in certain "symptoms" which consequently affect reproductive decision-making by altering the opportunity costs of childbearing or the value of children. Unemployment is one of such "symptoms" and its individual effects as well as aggregate impact on fertility are discussed in detail in section 2.2.1.

Yet Figure 1 provides an understanding of why fertility would move procyclically even without an in-depth analysis. A recession typically puts strain on households' budgets, either through wage cuts or unemployment, and thus discourages new additions to the family as these are financially demanding. Worsening economic situation and bleak outlooks trigger feelings uncertainty and anxiety, which are unconducive to taking on the long-term resource-intensive commitments children represent. And although falling housing prices may provide young couples with improved opportunities of residential independence, this is probably balanced if not outweighed by lower disposable incomes

[3] In his empirical analysis Happel (1984) discovered that women in high-skilled occupations tend to give birth later than women in low-skilled jobs.

and less accessible mortgages. Moreover, when faced with lacking employment opportunities particularly young people are likely to opt for gaining additional qualifications in hopes of boosting their chances in the labor market, at the same time putting away family formation as completed education is often considered its prerequisite.

Figure 1: From recession to fertility, channels of influence



Source: adapted from Sobotka (2011)

The magnitude and even the direction of a recession's influence on fertility are subject to demographic characteristics. The reproductive decision-making of young adults, males, immigrants and low-educated workers appears more responsive to economic circumstances in comparison with that of higher age groups, females, and native or high-educated workers (Sobotka, 2011). Institutional factors and policy interventions also mediate the recession–fertility link.

When investigating how the business cycle impacts fertility, one should keep in mind that common fertility indicators capture a *quantum* effect as well as a *tempo* effect.[4] Because

[4] A recession may cause an individual to reconsider the number of children they desire (a quantum effect) or it may simply induce them to postpone having children into a period of more favorable economic conditions (a tempo effect).

business cycle phases are of temporary duration, a recession-induced fertility decline should comprise of a tempo rather than a quantum effect (Sobotka, 2011). In other words, individuals consider long-term circumstances such as permanent income and rearing costs when deciding about completed fertility, but time the births of their children according to contemporary conditions, such as current disposable income (Butz and Ward, 1979).

2.2.1 Unemployment and Fertility

The unemployment rate, i.e. the number of the unemployed as a percentage of the labor force, is a commonly used business cycle indicator. According to Sobotka (2011) unemployment has a more tangible impact than the gross domestic product (GDP). This statement is also supported by Adsera and Menendez (2011) who find a positive relationship between GDP and fertility which disappears once they introduce unemployment into their model. The downside to the unemployment rate as a business cycle indicator is that it underestimates the true extent of an economic slump by excluding "discouraged" workers, who wish to work but are no longer actively searching for a job. Because the unemployment rate falls during booms and rises in recessions, a negative relationship between the unemployment rate and a fertility measure indicates procyclical fertility behavior, whereas a positive relationship implies that fertility moves countercyclically.

The unemployment – fertility relationship may be studied at the microeconomic or macroeconomic level. While the former is more frequently the case, this paper adopts the latter approach. However, since it would be difficult to see the macro-picture without the micro-pieces, a discussion of the mechanisms through which unemployment affects fertility at the individual level follows.

The **income effect** refers to the depressing effect unemployment exerts on fertility as a result of reduced income. Becoming unemployed reduces one's real as well as relative income and consequently lowers fertility levels by decreasing the quantity of children demanded (Becker, 1960) and postponing childbearing (Easterlin, 1966).

The **price effect** (also the **opportunity cost effect**) refers to the positive effect unemployment exerts on fertility as a result of reduced opportunity cost of having children. Because paid employment is generally considered the next best alternative

to childrearing, the market wage a parent must forego to stay at home with their children approximates the opportunity cost. Thus, when an individual becomes unemployed, their second best alternative vanishes, and having children becomes "cheaper".

Del Bono (2011) defines the **career effect**, which entails that jobless workers may fail to make human capital investments at the necessary pace. This would permanently lower their future earnings and cause them to adjust their desired number of children towards the lower end.

Some authors advocate the view that unemployment may encourage childbearing. According to Leibenstein (1975) becoming unemployed causes a drop in one's **social status**. Particularly in societies where children are valued as a societal contribution, unemployed individuals will be motivated to regain their social standing by forming a family. Seeing children as an uncertainty reduction strategy, Friedman (1994) also advocates the possibility of a positive influence.

Friedman's (1994) ***biographical*** **uncertainty**, however, starkly contrasts with Becker's (1960) ***economic*** **uncertainty**. According to Friedman, a recession brings around *biographical* uncertainty and motivates childbearing by blocking the alternative "stable career" uncertainty reduction strategy. In Becker's approach, a recession gives rise to *economic* uncertainty characterized by unemployment and fluctuating income, the rational response to which is to postpone childbearing in order to secure a stable position in the labor market.[5]

Synthesizing the above, the following inferences about unemployment and fertility may be drawn.

First, the resulting effect of unemployment on fertility will depend on the relative magnitudes of the individual effects described above. Nevertheless, most studies maintain that the negative income effect dominates the positive price effect. A major exception to this was Butz and Ward's (1979) paper, which claimed that fertility behavior

[5] In this context Bernardi (2008) stresses the role of cultural values and perceptions of unemployment. In her study she discovered that Becker's view applies to former West Germany, where financial security appears a necessary precondition to childbearing, but much less so to former East Germany, where family formation and job security are practiced as parallel rather than sequential investments.

in the United States has turned from procyclical into countercyclical as increasing female employment and rising female wages caused the price effect to outweigh the income effect.

Second, the effects of unemployment on fertility are gender-specific. Assuming traditional gender roles (men as breadwinners, women as child caretakers), male unemployment should depress fertility (income effect dominant), while female unemployment ought to raise it (price effect dominant). In comparison, more equal gender roles attenuate the female incentive to give birth during a spell of unemployment as women assume a smaller share of the household and caretaking chores; moreover, men in egalitarian societies also face the unemployment-induced opportunity cost reduction of having children. Kravdal (2002) and Schaller (2012) both find that female unemployment marginally increases fertility, while male unemployment substantially decreases it. Schmitt (2008) encounters a similar result, except that the positive effect of female unemployment is conditional upon the woman's bleak career prospects.

Third, the duration of the unemployment spell matters. Long-term unemployment exerts a stronger fertility-depressing influence than short-term unemployment (Kravdal, 2002) as it not only deprives individuals of current income, but also reduces their human capital, consequently increasing their probability of recurrent unemployment and creating expectations of lower future wages.

Fourth, institutional arrangements alter the individual effects of unemployment on fertility. While unemployment benefits soften the income effect from unemployment, maternity benefits reduce the opportunity cost of childbearing in that they partially compensate for the wage foregone (Bernhardt, 1993). Schmitt (2008) notes that the practice of reinstatement rights lessens the incentive to give birth during an unemployment spell, for it motivates women to go on maternity leave directly from employment in order to ensure their smooth return to the labor market.

Last, aggregate unemployment appears to be a more important fertility determinant than individual unemployment experience. Since unemployment not only directly affects those struck by it, but also captures crisis awareness among those who remain in their jobs, its influence extends beyond that of personal experience (Kravdal, 2002).

3. Empirical Analysis

This section describes the model used to estimate the unemployment – fertility relationship. Since it is defined on the macroeconomic level, its estimation will reveal merely the aggregate effect of changing economic conditions, not the magnitudes and directions of the individual effects laid out in Section 2.2.1.

3.1 Variables

With reference to the theoretical framework, I propose the following fertility function. The signs indicate the anticipated direction of effect. All the variables used are listed and defined in Table 1.

$$cbr = f(urate, educ, wavg, marriage, divorce, fempl, wratio, benefits, under14, repro)$$
$$\quad\; - \quad \pm \quad + \quad + \quad - \quad - \quad \pm \quad \pm \quad - \quad +$$

Table 1: Defining variables

Variable	Definition
cbr	The crude birth rate; the annual number of live births per 1000 population.
urate	The unemployment rate; the number of the unemployed as a percentage of the labor force.
educ	Tertiary education attainment; the percentage of the labor force with completed tertiary education.
wavg	The average wage; the average annual wage per full-time, full-year employee in 2010 USD purchasing power parities and 2010 constant prices; in thousands.
marriage	The crude marriage rate; the annual number of marriages per 1000 population.
divorce	The crude divorce rate; the annual number of divorces per 1000 population.
fempl	The employment rate of women; the percentage of female population aged 15 – 64 in employment.
wratio	The female-to-male wage ratio; the average female wage in manufacturing as a percentage of the average male wage in manufacturing.
benefits	The annual unemployment benefits to an unemployed married person with no children, whose partner earns 100 % of the average wage, in USD purchasing power parities; in thousands.
under14	The percentage of the population aged 14 and under.
repro	The percentage of the population in reproductive age (15 – 44).

The **dependent variable** is the crude birth rate (*cbr*). This indicator was chosen as a measure of fertility since its statistics are easy to calculate and consequently sooner available than those of other fertility indicators, such as the general or total fertility rates. Its downside is a limited analytical utility in the sense that it is influenced by factors such as the age-sex structure of the population. To moderate this limitation, demographic control variables are employed in the model.

The **independent variable** of interest is the general unemployment rate (*urate*) as defined by the International Labor Organization (ILO).[6] The use of the unemployment rate in econometric fertility models is common practice, yet not without complications. On the one hand, the measure proxies economic conditions well and is less likely endogenous to fertility than, for example, family income. On the other hand, as a result of capturing changes in labor supply (denominator) as well as labor demand (numerator), it is more likely to be correlated with changes in fertility-related unobserved variables (Schaller, 2012). Based on the theoretical considerations of the effects of unemployment on fertility presented in Chapter 2, I expect the coefficient on *urate* to turn out negative.

A pairwise correlation between the unemployment rate and the crude birth rate would undoubtedly suffer from the omitted-variable bias. Therefore, I introduce the following **control variables** into the model in hopes of avoiding biased coefficient estimates and large standard errors.

Tertiary educational attainment of the labor force (*educ*) relates to the unemployment rate as well as to the crude birth rate. A negative education-to-unemployment relationship at the aggregate level may be sustained in the following way. Assuming that education increases productivity, a more educated labor force would correspond to a more productive labor force, which would face a higher labor demand and thus display a lower unemployment rate.

The education-fertility relationship is complicated by the possibility of simultaneous causation. On the one hand, a high birth rate may render educational attainment unattractive by decreasing the returns to education due to less time spent in paid

[6] In order to be counted as unemployed according the ILO standards, one must be out of work and actively searching for a job. The measure fails to account for the presence of discouraged workers as well as of those working shorter hours than desired.

employment. On the other hand, high educational attainment discourages having children since individuals are reluctant to let their human capital depreciate due to childrearing; yet holding high qualifications may also support fertility by improving individuals' expectations of future income streams. Because of these opposing effects, a coefficient estimate on *educ* of either sign is plausible.

The **average wage** (*wavg*) has an ambiguous influence on both the unemployment rate and the crude birth rate. An exogenous increase in the average wage would decrease the unemployment rate if the number of individuals it lures into the labor force exceeds the number of workers losing their jobs due to the lower quantity of labor demanded; and increase it if the magnitudes of the effects are reversed. But the causation also goes in the opposite direction as an exogenous increase in the unemployment rate would lower the average wage in order to restore equilibrium in the labor market, conditional on its flexibility.

The relationship between the average wage and fertility is again one of simultaneous causation. Nonetheless, according to Becker (1991) significant causation goes from wages to fertility. Since a high birth rate indicates an on-average less experienced labor force, assuming that wages and work experience are positively correlated, a high-birth-rate society would tend to have lower average wages. Considering the opposite direction of effect, a higher wage induces a positive income effect and a negative price effect with respect to fertility. Under the assumption of traditional gender roles, the income effect should dominate the price effect as the latter concerns only one of the partners. Yet even when contemplating egalitarian couples, prospective parents might be more concerned about whether they possess the resources to sustain a child than what they are missing out on, assigning a greater weight to the income effect. As a result, I expect a positive coefficient estimate on *wavg*.

The **crude marriage rate** (*marriage*) should be positively correlated with the crude birth rate since marriage traditionally was – and to some extent remains – a precondition to childbearing, just as childbirth remains a reason for marriage.[7] This is why I expect to find a positive coefficient estimate on *marriage*. However, marriage may also function

[7] According to d'Addio and d'Ercole (2005) married women display higher fertility levels than unmarried, but this pattern is changing as the number of out-of-wedlock births grows. In the Nordic countries, the percentage of out-of-wedlock births has already exceeded 50 % of total births.

as a channel through which unemployment lowers fertility by delaying marriage entry (Sobotka, 2011).

The **crude divorce rate** (*divorce*) should depress the crude birth rate, partly because divorce signals troubled relationships that are not conducive to new family additions, and partly because awareness of a rising divorce rate may raise concerns about the stability of individuals' partnerships, thereby reducing their willingness to engage in joint long-term commitments such as children. For these reasons, I expect the coefficient estimate on *divorce* to be negative.

The **female employment rate** (*fempl*) shows the extent to which women participate in paid employment. Many authors attribute the 1960s fertility decline to the then rising female labor-market participation (Butz and Ward, 1979).[8] Since childbearing and paid employment compete for a limited time budget, I expect the coefficient estimate on *fempl* to be negative.

The **female-to-male wage ratio** (*wratio*) serves as a proxy for women's opportunity costs of interrupting their careers due to childbearing (d'Addio and d'Ercole, 2005) as well as for their economic independency. I consider its effect on the crude birth rate ambiguous. On the one hand, a higher wage ratio increases the opportunity cost of maternity, discouraging childbearing by making it more "expensive" in terms of the wage foregone. On the other hand, a higher wage ratio improves women's economic independency and financial security. The coefficient estimate on *wratio* will be positive if economic security matters to women more than the wage foregone; and negative if the opposite is true.

Unemployment benefits (*benefits*) are employed as a rough proxy for the institutional arrangements of the labor market. For the already unemployed, higher benefits soften the impact of unemployment, positively affecting fertility. Yet low unemployment benefits

[8] The causality direction between female employment and fertility is a disputed subject. While the view that rising female employment decreased fertility prevails, it could be that an exogenous change in preferences decreased fertility, thereby providing for female employment. In this context Stycos and Weller (1967) state: "*Where they* [the roles of mother and employed woman] *are incompatible, the relation* [between fertility and employment] *will depend on the availability of birth control. Thus, if efficient contraception is not readily available, fertility will influence employment, otherwise employment will influence fertility*." Cramer (1980) allows for simultaneous causation by distinguishing between the short run, when the dominant effects are from fertility to employment, and the long run, when the influence goes from female employment to fertility.

may also signal a labor market characterized by high uncertainty or a weak safety net. Therefore, either sign of the coefficient estimate on *benefits* is plausible.

Age-structure variables are also accounted for in the model. I expect the percentage of children in the population (*under14*) to be negatively, and the percentage of population in the reproductive age (*repro*) positively related to the birth rate.

3.2 Data

The data sample consists of 248 annual observations for 31 OECD member states[9] from 2003 to 2010. However, because of the model's specification (lagged independent variables) and estimation method (first differencing), only 186 observations were used to finally estimate it. Table 2 presents the descriptive statistics of the data sample.

Table 2: Descriptive statistics of the data sample

Variable	Mean	Median	Minimum	Maximum	Standard Deviation	
					Within	Between
cbr	11.74	11.20	8.20	20.60	0.50	2.59
urate	6.93	6.10	2.30	20.10	2.07	2.79
educ	27.00	29.30	10.50	43.00	2.13	7.75
wavg	32.02	33.22	6.67	52.72	1.27	12.02
marriage	5.12	5.00	2.90	9.20	0.34	1.05
divorce	2.14	2.30	0.60	3.80	0.20	0.68
fempl	59.27	60.45	22.30	81.70	1.76	11.12
wratio	82.43	82.95	58.6	100.60	5.34	9.81
benefits	15.77	14.88	3.07	22.86	15.17	11.90
under14	17.82	17.20	13.20	31.40	0.64	3.75
repro	42.54	42.30	29.40	53.30	1.01	2.89

Source: data from OECD, ILO, UN; own calculations

Data were collected from a number of sources. Statistics regarding demographic characteristics (the crude birth rates, the crude marriage and divorce rates and the age distributions) were gathered from the successive editions of the United Nations Demographic Yearbook. Economic variables were extracted from the statistical databases

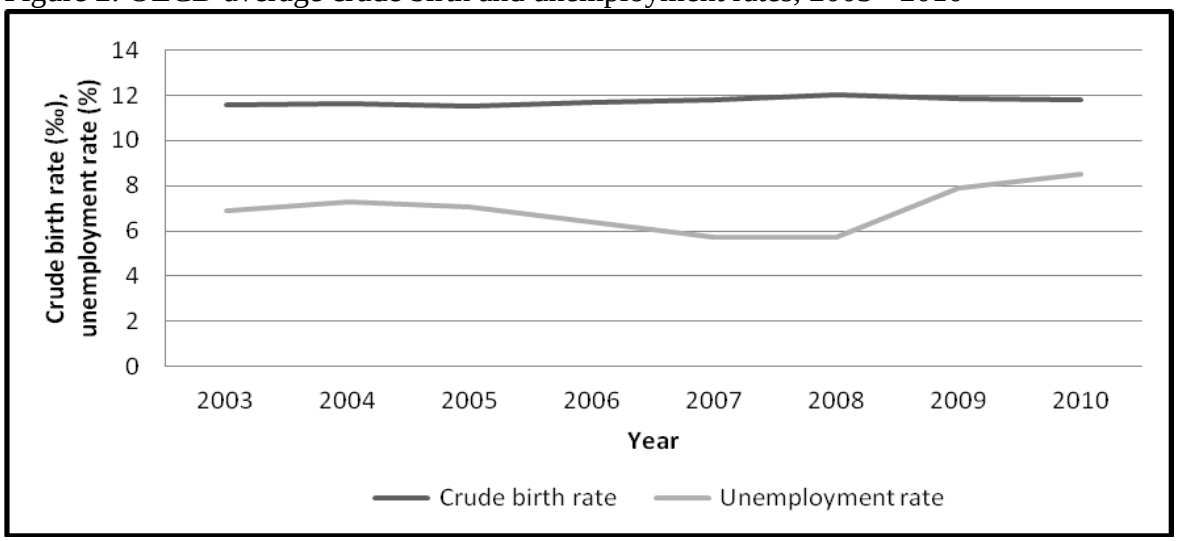
[9] The following countries are included in the sample: Australia, Austria, Belgium, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Japan, Korea, Luxembourg, Mexico, the Netherlands, New Zealand, Norway, Poland, Portugal, the Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Turkey, the United Kingdom of Great Britain and Northern Ireland, and the United States of America. Three of the member states, namely Canada, Chile and Israel, were excluded from the sample due to the lack of key data.

of the OECD (the female employment rate, the average annual wage, unemployment benefits) or of the ILO (the unemployment rate, the wage ratio, tertiary educational attainment). Observations missing in these international databases were acquired from the respective national statistical offices.

3.3 Model and Estimation Method

Figure 2 graphs the average OECD crude birth and unemployment rates from 2003 to 2010. Between 2005 and 2008 the unemployment rate was falling while the crude birth rate was rising, whereas the sharp increase in the unemployment rate between 2008 and 2010 was accompanied by a fall in the crude birth rate. These inverse movements hint at procyclical fertility behavior over the business cycle.

Figure 2: OECD average crude birth and unemployment rates, 2003 - 2010



Source: data from UN, ILO; own calculations

Admittedly, Figure 2 is somewhat misleading for the purposes of model construction. One could hardly expect the 2010 unemployment rate to influence the 2010 birth rate given that the corresponding reproductive decisions must have been made nine months earlier. Therefore, the following steps were taken to build a model suitable for estimating the unemployment – fertility relationship.

Firstly, all independent variables were lagged one year to account for the time difference between conception and birth. In other words, since children born in 2010 were conceived

in 2009,[10] it must have been the 2009 economic situation that influenced the 2009 reproductive decision and consequently the 2010 birth rate.[11]

Secondly, logarithms of the level variables (*wavg*, *benefits*) were taken to enable their interpretation in percentages. After deliberate contemplation whether to also take the logarithm of the remaining variables, including the unemployment rate, I decided not to since interpreting its impact in terms of percentage points as opposed to percentages appeared more sensible.[12]

The model to be estimated is a panel model. Its advantage lies not only in exploiting both international and inter-temporal variability, but also in making it possible to control for dynamic and country-specific effects. However, the price to pay in exchange for these benefits is that for some variables whose inclusion would be appropriate, no time-series data are available. The consequences this brings are discussed in Section 4.2.

Given that the 2003 crude birth rate values ranged from 8.6 in Germany to 20.6 in Mexico, the presence of unobserved factors such as preferences about desired family size (determined by culture and religion) is anticipated. Assuming these preferences are stable over the period under investigation, I utilize fixed effects to account for the differing fertility levels across countries. Since fixed effects within-estimation is inappropriate because of the model's dynamic specification, I exploit first differencing. Figure 3 shows the annual first differences of the OECD average crude birth and unemployment rates between 2004 and 2010.

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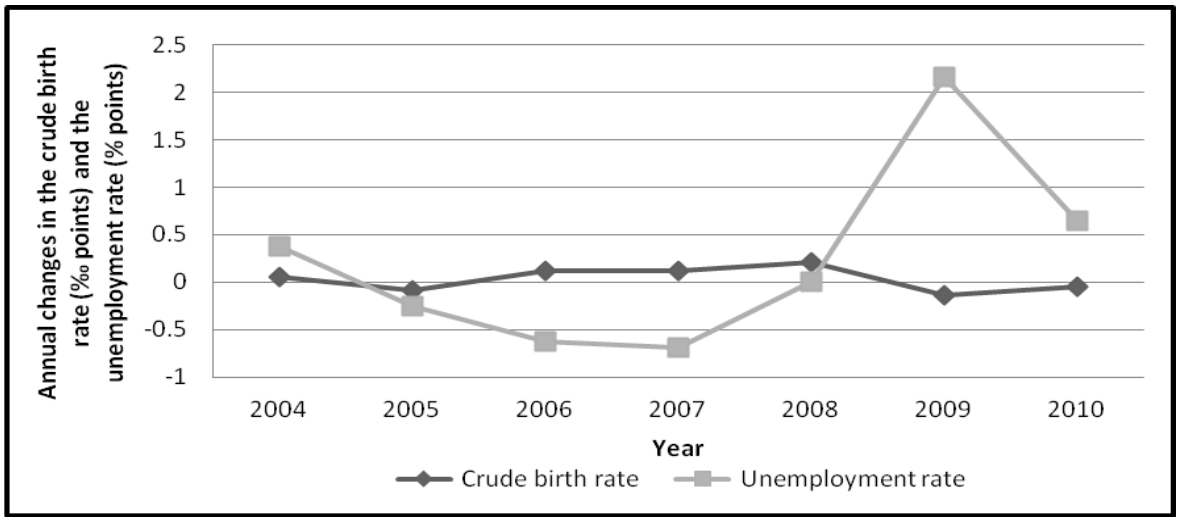
[10] A simplifying assumption as those born at the end of a given year would have been conceived in the beginning of the same year.

[11] The economic situation in any given year would influence the birth rate of the same year if actors (i.e. prospective parents) possessed perfect foresight, and thus could, say in 2009 perfectly forecast the economic situation of 2010. Because I consider this unlikely, I opt for lagging the independent variables. Naturally, the decision to conceive in 2009 is not influenced solely by current (2009) economic circumstances but also by expectations about the economic situation in the next year (2010) and the years to follow. I presume that these expectations are formed on the basis of the current (2009) economic situation.

[12] Not taking the logarithm of the unemployment rate is equivalent to saying that its increase from, say 2.5 % to 5 % (an increase of 2.5 percentage points) has half the impact on the crude birth rate than its increase from 5 % to 10 % (an increase of 5 percentage points). Taking the logarithm of the unemployment rate would imply that both the increases have the same impact. Supposing there is a labor force of 1000 workers, I believe that 50 of them becoming unemployed should depress fertility twice as much as 25 of them becoming unemployed.

Figure 3: First differences of the OECD average crude birth and unemployment rates, 2004 - 2010



Source: data from UN, ILO; own calculations

As Figure 3 illustrates, an annual decrease in the crude birth rate for any given year is associated with an increase in the unemployment rate in the previous year; the only exception being the 2009 birth rate, which was not preceded by any change in the unemployment rate.

Like Figure 2, Figure 3 also suggests procyclical fertility behavior over the business cycle. To confirm this negative relationship between the unemployment rate and the crude birth rate, I estimate the following model:[13]

$$(1)\quad \Delta cbr_{i,t} = \beta_0 + \beta_1 \Delta urate_{i,t-1} + \beta_2 \Delta educ_{i,t-1} + \beta_3 \ln(\Delta wavg_{i,t-1}) + \beta_4 \Delta marriage_{i,t-1} + \\ + \beta_5 \Delta divorce_{i,t-1} + \beta_6 \Delta empl_{i,t-1} + \beta_7 \Delta wratio_{i,t-1} + \beta_8 \ln(\Delta benefits_{i,t-1}) + \\ + \beta_9 \Delta under14_{i,t-1} + \beta_{10} \Delta repro_{i,t-1} + \varepsilon_{i,t}$$

[13] Originally I intended to estimate this model twice, once with the general unemployment rate and once with gender-specific unemployment rates. However, due to the unacceptably high correlation between the male and female unemployment rates, I had to discard the second model.

4. Results

Table 3 presents the results obtained by estimating model (1).

Table 3: Estimation results, model (1)

Dependent Variable: Δ*cbr*				
Variable	**Coefficient**	**Standard Error**	**P-value**	
const	-0.006	0.034	0.869	
Δ*urate*(t-1)	-0.054	0.017	0.002	***
Δ*educ*(t-1)	0.035	0.014	0.015	**
lnΔ*wavg*(t-1)	1.683	0.819	0.041	**
Δ*marriage*(t-1)	0.127	0.091	0.163	
Δ*divorce*(t-1)	0.160	0.111	0.152	
Δ*fempl*(t-1)	-0.002	0.001	0.001	***
Δ*wratio*(t-1)	0.005	0.001	$6*10^{-19}$	***
lnΔ*benefits*(t-1)	-0.070	0.056	0.207	
Δ*under14*(t-1)	-0.002	$9*10^{-5}$	$4*10^{-53}$	***
Δ*repro*(t-1)	0.015	0.017	0.388	
R^2= 0.187				

4.1 Econometric Verification

This section inspects whether the Gauss-Markov assumptions hold and the estimators are best, linear and unbiased.

Autocorrelation does not pose a problem as first differencing produced serially uncorrelated error terms. Although the Durbin-Watson statistic is inconclusive - its value of 1.69 falls within the lower (1.64) and higher (1.87) boundary values - regressing the residuals from period *t* on residuals from period *t-1* yields an insignificant correlation of 0.03 (p-value 0.280).

Because the distribution free Wald test indicated heteroskedasticity, robust standard errors were used to obtain unbiased variances estimators.

Perfect multicollinearity is obviously not present in the model. Bivariate correlation coefficients of the independent variables are displayed in Table 4.

Table 4: Correlation matrix

		1	2	3	4	5	6	7	8	9	10
1	**Δ*urate*(t-1)**	1.00									
2	**Δ*educ*(t-1)**	0.05	1.00								
3	**lnΔ*wavg*(t-1)**	-0.26	0.02	1.00							
4	**Δ*marriage*(t-1)**	-0.33	-0.11	0.20	1.00						
5	**Δ*divorce*(t-1)**	-0.14	-0.06	-0.07	0.02	1.00					
6	**Δ*fempl*(t-1)**	-0.15	0.01	0.05	0.12	0.07	1.00				
7	**Δ*wratio*(t-1)**	0.00	0.04	-0.07	-0.02	-0.01	-0.01	1.00			
8	**lnΔ*benefits*(t-1)**	0.00	0.06	0.06	0.05	-0.05	0.00	0.05	1.00		
9	**Δ*under14*(t-1)**	-0.07	0.00	-0.02	0.01	0.00	0.01	0.00	0.00	1.00	
10	**Δ*repro*(t-1)**	-0.03	0.02	0.03	0.01	0.03	-0.01	0.03	0.02	-0.01	1.00

The sample's highest bivariate correlation (-0.33) between the unemployment and marriage rates falls safely below the critical values of 0.8 to 0.9. The degree to which multicollinearity is present in the model proves acceptable even when examining multivariate correlations: none of the squared multiple correlations from the independent variables' subsidiary regressions exceeded 0.187. The highest subsidiary regression determination coefficient pertains to the unemployment rate (0.180).

The model as a whole is statistically significant (F-test p-value $1*10^{-4}$) and explains 18.7 % of the variability in the crude birth rate.

4.2 Economic Interpretation

The results show that the (lagged) **unemployment rate** has a negative effect[14] on the crude birth rate, significant at the 1% level. More specifically, a one percentage point rise in the unemployment rate in any given year decreases the next year's crude birth rate by 0.054.[15] To provide a better understanding of the magnitude of this effect, a numerical example follows.

[14] When interpreting the results of the model's estimation, the word "effect" refers to a partial effect, i.e. the effect of an independent variable on the dependent variable, holding all the remaining independent variables constant.

[15] At this point, I would like to refer to some of the estimates found in the literature. Schaller (2012), analyzing 1980-2006 U.S. data, concludes that a one percentage point increase in the unemployment rate decreases the birth rate by 0.8 %. D'Addio and d'Ercole (2005) analyze 16 OECD countries between 1980 and 1999 to find that a 1% increase in the unemployment rate decreases the total fertility rate by 0.018 or 0.032, depending on the estimation method employed.

In 2006 the mid-year population of the Czech Republic was 10 266 646 and the number of live births was 105 831, which corresponded to a crude birth rate of 10.308.[16] Suppose that between 2005 and 2006 the unemployment rate increased by one percentage point. This would have caused the next year's crude birth rate to decline to 10.254. Assuming an unchanged mid-year population, there would have been 105 274 live births in 2007. Thus, the one percentage point increase in the unemployment rate would have reduced the number of live births by 557, or roughly by 0.5 %.

Alternatively, the largest annual change in the unemployment rate found within the OECD sample occurred in Estonia between 2008 and 2009: an 8.3 percentage point rise from 5.5 % to 13.5 %. An unemployment increase of this magnitude should have depressed the crude birth rate by 0.448. Given that in 2009 the mid-year population of Estonia was 1 340 271, the number of live births was 15 763 and the crude birth rate amounted to 11.761,[17] the expected 2010 crude birth rate should have been 11.313, which corresponds to 15 162 live births. Hence, the crisis that struck Estonia in 2008 should have caused – based on the results of this paper – the number of live births to fall by 601, or by 3.8 %.[18]

As the numerical examples illustrate, the magnitude of the unemployment's effect on fertility is rather negligible. This is in line with Becker's child quantity vs. quality interaction: rising unemployment causes incomes to drop and the demand for children to decrease accordingly; however, the lower demand likely manifests itself through falling quality rather than quantity (Becker, 1991).[19] Yet the reported partial effect may underestimate the real-life effect; this is true if unemployment influences fertility through the marriage rate, which is held constant in the model. In any case, it is useful to be reminded that the influence comprises primarily of a tempo effect. Thus, a "fertility decline" as used throughout this paper simply means that some children are not born in a given year, not necessarily that they will never be born. In fact they may well be born in the course of the next economic expansion.

[16] Data from the Czech Statistical Office.

[17] Data from Statistics Estonia.

[18] According to Statistics Estonia, there was an increase of 62 live births between 2009 and 2010.

[19] The model provides evidence solely of falling child quantity. The drop in quality arises from theoretical considerations.

The negative relationship between the unemployment rate and the crude birth rate supports the notion of procyclical fertility. In other words, at the aggregate level the negative effects of unemployment on fertility (the income effect, the career effect) jointly dominate its positive effects (the price effect, the social status hypothesis), and Becker's economic uncertainty approach describes the OECD reality more appropriately than Friedman's concept of biographical uncertainty.

A frequent concern when estimating fertility models is the possibility of reverse causation between unemployment and fertility. The commonly considered fertility-to-unemployment channel suggests that a higher birth rate forces working mothers for at least some period out of the labor force, thereby increasing the measured unemployment rate (Schaller, 2012). I consider such an influence unlikely since the unemployment rate was lagged for the purposes of model estimation. In other words, could the 2010 birth rate somehow affect the 2009 unemployment rate? Del Bono (2011) offers one possible way: being pregnant or anticipating motherhood makes female workers less attractive to employers and increases their probability of being made redundant. While this may be true at the individual level, at the aggregate level a less "attractive" worker would be replaced by a more "attractive" one, so the effect should cancel out. Thus, I do not consider simultaneous causality between the unemployment rate and the crude birth rate problematic.

By contrast, I am concerned about the omitted-variable bias, the troublesome variable being institutionalized childcare. I expect its availability to be positively correlated with the crude birth rate (by lowering the opportunity cost of childbearing in that it decreases the time a parent must spent with their child) and negatively with the unemployment rate (by increasing its denominator as institutionalized childcare allows mothers to join the labor force). Availability of institutionalized childcare is not controlled for in the model because the relevant statistics were unavailable. Its omission biases the negative coefficient estimate on the unemployment rate away from zero.

The following lagged control variables also turned out significantly at the 1% level: the employment rate of women, the wage ratio and the percentage of children in the population.

The **female employment rate** is negatively associated with the crude birth rate. This confirms the view of children and employment as competing activities limited by a common time constraint. Yet the magnitude of the influence amounts to less than anticipated: a one percentage point increase in the female employment rate depresses the birth rate by 0.002. Returning to the 2006 numerical example, that is a decrease by 23 live births. I reason that the negligible magnitude may be due to egalitarian gender roles and widespread availability of institutionalized childcare in the OECD countries, which soften the tradeoff between female employment and motherhood.

The **female-to-male wage ratio** is positively related to the crude birth rate, which implies that improved economic independency of women outweighs the related increase in the opportunity cost.

The **percentage of children** in the population has a negative effect on the crude birth rate as expected.

Both tertiary educational attainment and the average wage are positively related to the crude birth rate, significant at the 5% level.

A one percentage point increase in **tertiary educational attainment** of the labor force is associated with an 0.035 increase in the crude birth rate. This positive relationship emerges when the effect of holding higher qualifications, which gives rise to optimistic expectations about one's future economic situation, dominates the parenthood-discouraging effect of human capital depreciation. If however, as discussed in Section 3.1, the crude birth rate negatively influences educational attainment by discouraging human capital investment, the 0.035 coefficient is an underestimate.

A one percentage increase in the **average wage** is associated with a 0.017 increase in the crude birth rate, suggesting that the income effect of a wage increase outweighs the price effect. Again, if the crude birth rate exerts a negative influence on the average wage through a less experienced labor force as discussed in Section 3.1, the coefficient estimate is biased towards zero.

The remaining independent variables, the crude marriage and divorce rates, unemployment benefits and the percentage of the population in the reproductive age are all insignificant at conventional levels.

4.3 Alternative Model Specifications

Model (1) was estimated twice more with some alternations to gain a better understanding of the relationships embodied therein.

First, I omitted the demographic control variables, thus estimating the following model.

$$(2)\quad \Delta cbr_{i,t} = \beta_0 + \beta_1 \Delta urate_{i,t-1} + \beta_2 \Delta educ_{i,t-1} + \beta_3 \ln(\Delta wavg_{i,t-1}) + \beta_4 \Delta marriage_{i,t-1} + \\ + \beta_5 \Delta divorce_{i,t-1} + \beta_6 \Delta fempl_{i,t-1} + \beta_7 \Delta wratio_{i,t-1} + \beta_8 \ln(\Delta benefits_{i,t-1}) + \varepsilon_{i,t}$$

Table 5 displays the results. The coefficient estimate on the unemployment rate increased slightly from -0.054 to -0.050, keeping its 1% significance. Returning to the 2006 numerical example from Section 4.2, this difference would amount to some 41 live births, an acceptable disparity at the national level. The control variables' coefficient estimates remained highly similar to those from model (1).

Table 5: Estimation results, model (2)

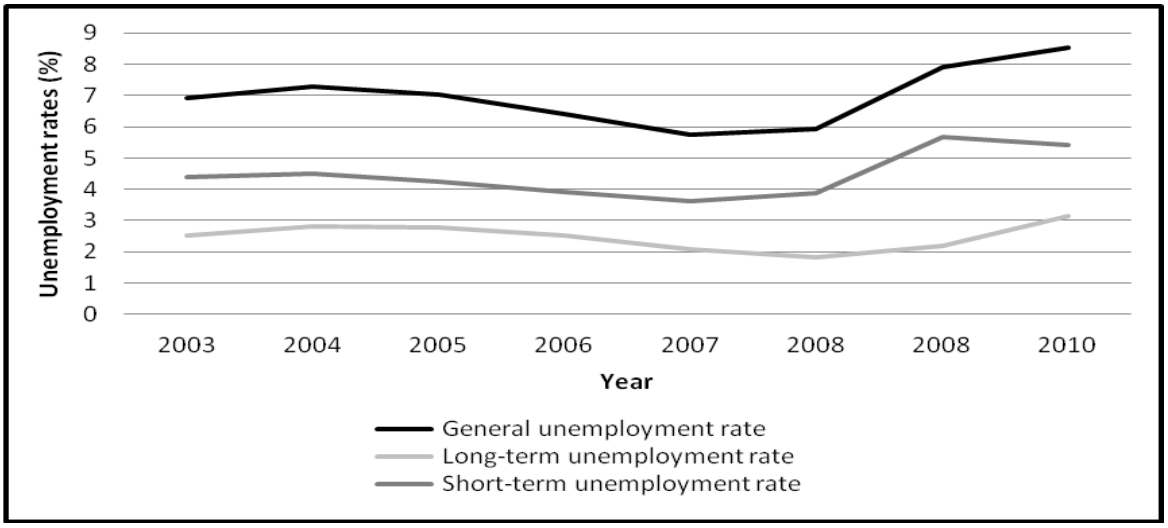
Dependent Variable: Δ*cbr*				
Variable	**Coefficient**	**Standard Error**	**P-value**	
const	-0.010	0.034	0.776	
Δ*urate*(t-1)	-0.050	0.017	0.003	***
Δ*educ*(t-1)	0.035	0.014	0.015	**
lnΔ*wavg*(t-1)	1.757	0.826	0.035	**
Δ*marriage*(t-1)	0.133	0.090	0.143	
Δ*divorce*(t-1)	0.169	0.116	0.145	
Δ*fempl*(t-1)	-0.002	0.001	0.001	***
Δ*wratio*(t-1)	0.005	$5*10^{-4}$	$3*10^{-20}$	***
lnΔ*benefits*(t-1)	-0.070	0.056	0.209	
R^2= 0.166				

Second, I substituted the general unemployment rate (*urate)* with the long-term unemployment rate (*LRurate*), which measures the number of those unemployed for a period of over twelve months as a percentage of the labor force.

$$(3)\quad \Delta cbr_{i,t} = \beta_0 + \beta_1 \Delta LRurate_{i,t-1} + \beta_2 \Delta educ_{i,t-1} + \beta_3 \ln(\Delta wavg_{i,t-1}) + \beta_4 \Delta marriage_{i,t-1} + \\ + \beta_5 \Delta divorce_{i,t-1} + \beta_6 \Delta fempl_{i,t-1} + \beta_7 \Delta wratio_{i,t-1} + \beta_8 \ln(\Delta benefits_{i,t-1}) + \\ + \beta_9 \Delta under14_{i,t-1} + \beta_{10} \Delta repro_{i,t-1} + \varepsilon_{i,t}$$

While long-term unemployment is a good proxy for the general unemployment rate in that it virtually copies the progression of the latter (see Figure 4), it should be a more influential fertility determinant than general unemployment as it is not "contaminated" by frictional unemployment. Unlike long-term unemployment spells, temporary unemployment that results from job transfers or job searches upon education completion probably does not worsen one's permanent career outlooks.

Figure 4: The OECD average long-term, short-term and general unemployment rates, 2003 - 2010



Source: ILO data; own calculations

Table 6 displays the results of model (3). The estimated coefficient on the long-term unemployment rate turned out negative, significant at the 1% level. The mild increase in the determination coefficient from the original 0.187 to 0.198 hints that long-term unemployment did slightly better in explaining birth rate variability than general unemployment. The control variables' coefficient estimates as well as their significance levels remained stable, with the exception of the marriage and divorce rates. These have kept their positive coefficient estimates, but have become significant at the 5% and 10% levels, respectively.[20]

[20] This is probably attributable to the now lower bivariate correlation coefficients: - 0.07 between long-term unemployment and marriage (compared to - 0.33 between general unemployment and marriage), - 0.01 between long-term unemployment and divorce (compared to - 0.14 between general unemployment and divorce).

Table 6: Estimation results, model (3)

Dependent Variable: Δ*cbr*				
Variable	**Coefficient**	**Standard Error**	**P-value**	
const	-0.023	0.032	0.474	
Δ*LRurate*(t-1)	-0.125	0.026	$4*10^{-6}$	***
Δ*educ*(t-1)	0.034	0.015	0.023	**
lnΔ*wavg*(t-1)	1.987	0.804	0.015	**
Δ*marriage*(t-1)	0.162	0.076	0.034	**
Δ*divorce*(t-1)	0.220	0.117	0.060	*
Δ*empl*(t-1)	-0.002	0.001	0.001	***
Δ*wratio*(t-1)	0.005	0.000	$7*10^{-21}$	***
lnΔ*benefits*(t-1)	-0.068	0.054	0.204	
Δ*under14*(t-1)	-0.002	$5*10^{-5}$	$5*10^{-82}$	***
Δ*repro*(t-1)	0.014	0.016	0.857	
R^2= 0.198				

The *divorce* coefficient estimate deserves some attention since its positive sign was not anticipated. One explanation may be the omission of a variable representing urbanization,[21] but it is also possible that divorce facilitates fertility by allowing multiple reproductive relationships.[22] Billari and Kohler (2004) provide evidence that the previously negative aggregate divorce – fertility relationship has turned into a positive one by the end of the 1990s, but unfortunately refrain from considering plausible explanations.

4.4 Suggestions for Improvement and Future Research

The results presented above need to be treated with caution for two main reasons. One, the coefficient estimate on the unemployment rate may be biased downward due to the omission of a variable capturing the availability of institutionalized childcare. Two, since the empirical analysis has been performed on the aggregate level, it fails to capture the differential unemployment-on-fertility impact with regard to separate population groups (by race, religion, income, education).

[21] Urbanization should be positively related to the divorce rate (Glick and Lin, 1986) as well as to the crude birth rate through out-of-wedlock births in that a higher urbanization rate likely correlates with a higher percentage of out-of-wedlock-births, which is positively related to fertility (d'Addio and d'Ercole, 2005).

[22] The positive relationship between the lagged divorce rate and the crude birth rate may arise if a considerable fraction of divorces are due to one of the partners engaging in a parallel reproductive relationship. For instance, a marriage that breaks down in 2008 because one of the partners is awaiting an offspring with someone else, would be followed by a birth in 2009.

Some obvious possibilities for improvement follow from the above. Accounting for childcare availability would prevent the biased coefficient estimate.[23] Plus the room for inclusion of other fertility-determining variables, both economic and demographic, remains close to boundless.[24] In addition, a more reliable estimate would have been obtained had age-specific fertility indicators been paired up with age-specific independent variables.

Finally, I would like to share two questions that emerged in the course of writing this paper. First of all, how come female employment has such a negligible effect on fertility? I hypothesize that it may a result of widely available childcare or equal division of labor between the sexes, which could be tested by introducing interaction terms into the model. Second, a naturally related topic is how child quality (proxied for example by private school enrollment) changes over the business cycle. The extent to which a society's child quality requirements (or tolerance towards low quality children) respond to unemployment fluctuations might carry implications for the linearity or non-linearity of the unemployment–fertility relationship.

[23] This might require limiting the sample to fewer units (comprehensive time-series data are available for the Nordic countries) or finding a suitable proxy (expenditure on pre-primary education or numbers of kindergarten personel are potential candidates).

[24] Suggestions include: the percentages of self-employment and public-sector employment, part-time employment availability for women, parenthood-related benefits, urbanization, migration, birth control usage.

5. Conclusion

This paper aimed to investigate how fertility responds to business cycle fluctuations and to quantify this effect using the unemployment rate as a proxy for economic conditions.

The results of a first differences regression analysis on a 2003-2010 data sample of 31 OECD member states confirmed that fertility moves procyclically over the business cycle, with fewer children born during economic slowdowns. Hence, it is appropriate to conclude that the income and career effects jointly dominate the price effect at the aggregate level; and that the concept of economic uncertainty applies to the OECD member states to a greater extent than that of biographical uncertainty.

Ceteris paribus, a one percentage point increase in the unemployment rate lowers the crude birth rate by 0.054; significant at the 1% level. However, the following should be kept in mind regarding this estimate. First, it may be biased away from zero since the model does not account for the availability of institutionalized childcare. Second, it captures both a quantum and a tempo effect, with the latter constituting its larger part. Third, since the estimate represents a partial effect, the real-life influence of unemployment on fertility would be more pronounced if it also influences the birth rate through the marriage rate, which is held constant in the model.

Thus, the results of this paper suggest that fertility's responsiveness to short-term economic fluctuations need not cause much concern with regard to economic planning. A recession-induced fertility decline is a mere consequence of individuals' preferences for the smoothing-out of consumption over the business cycle in the presence of imperfect capital markets and ought to be compensated for by an expansion-induced fertility rise.

The empirical analysis further indicated that female employment and the percentage of children in the population are negatively related to fertility, as opposed to tertiary educational attainment, the marriage and divorce rates, the average wage and the female-to-male wage ratio, all of which exert a fertility-enhancing effect.

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