Is the intention to adopt a child affected by legalized oocyte donation?

A comparative study of eight European countries

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Master thesis

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http://www.duo.uio.no/
Abstract

BACKGROUND: Oocyte donation is an effective treatment for females who experience the disability of infertility. The treatment is legal in most of the European countries, but is forbidden in Norway by binding laws. The Norwegian Biotechnology Advisory Board (NBAB) has recommended a change in the Norwegian legislation, but in their recommendation, they discuss how this might reduce the intention to adopt. Because the possible effect is characterized by uncertainty, this study compares eight European countries, five of them who legalize oocyte donation, and three who do not, and the possible effect on the intention to adopt.

METHODS: The methods applied in this thesis is multiple regression analyses and treatment effect analyses with nearest neighbor match. Because the infertile females are those affected by the fertility treatment, they are the main interest of this study. However, because fertile females are unaffected by legalized oocyte donation, they are used as a baseline, to avoid confounding from the included countries, created by country-specific preferences.

RESULTS: The main result in this study is that the intention to adopt is significantly greater in countries with legalized oocyte donation. Even with the baseline created by fertile females taken into consideration, infertile females’ intention to adopt seems to be about 2% higher in legalized countries. An increase in the intention to adopt, with enhanced supply of fertility treatments, is described theoretically to have several explanations. Most of all, it is expected that increased availability of fertility treatments, such as oocyte donation, also increase the number of females who fail to have a child with the approach. Hence, with their reinforced desire of a child, created by the new treatment, the infertile individuals opt for adoption instead of staying childless.

CONCLUSION: The tests indicate that infertile females do not seem to reduce their intention to adopt when oocyte donation is legal. Hence, it does not appear that a decrease in the intention to adopt is an effect the Norwegian Ministry of Health and Care Services need to provide concern, before they decide upon the legislation of oocyte donation.
Acknowledgements

The work of this thesis started in 2016, motivated by two years as a nurse at the maternity ward at Ullevål University Hospital. It has been an exciting and somehow long journey.

There are a number of people who are entitled an acknowledgement. First of all, my sincere gratitude goes to associate professor Hans Olav Melberg, at the institute of Health Management and Health Economics, who has patiently guided me through the process, with constructive comments and valuable feedback.

Further, I would like to thank my friends and fellow students at the institute, especially Tori, Astrid, and Margrethe. We did it! It has been a great experience that I will never forget.

Most of all, I would like to thank my near and dear family; especially my parents, Målfrid and Odd, for always believing in me, and for giving me their never-ending support, and Anne for proofreading my thesis, her kindness, and all her useful comments.

Finally, my heartfelt gratitude goes to Marius for cheering me up and bringing happiness to my life. I am lucky to have you by my side.

Marlene Kvåle

Oslo, May 2017
## Abbreviations and Acronyms

<table>
<thead>
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<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ESHRE</td>
<td>The European Society of Human Reproduction and Embryology</td>
</tr>
<tr>
<td>ART</td>
<td>Assisted Reproduction Technique</td>
</tr>
<tr>
<td>NBAB</td>
<td>The Norwegian Biotechnology Advisory Board</td>
</tr>
<tr>
<td>GGS</td>
<td>The Gender and Generation Survey</td>
</tr>
<tr>
<td>GGP</td>
<td>The Gender and Generation Programme</td>
</tr>
<tr>
<td>LOGG</td>
<td>The Life-course, Generation, and Gender Survey</td>
</tr>
<tr>
<td>FSH</td>
<td>Follicle-Stimulating Hormone</td>
</tr>
<tr>
<td>IVF</td>
<td>In Vitro Fertilization</td>
</tr>
<tr>
<td>POI</td>
<td>Primary Ovarian Insufficiency</td>
</tr>
<tr>
<td>RCT</td>
<td>Randomized Control Trial</td>
</tr>
<tr>
<td>IV</td>
<td>Instrumental Variable</td>
</tr>
<tr>
<td>MDM</td>
<td>The Mahalanobis Distance Measure</td>
</tr>
<tr>
<td>EDM</td>
<td>The Exact Distance Measure</td>
</tr>
<tr>
<td>ATE</td>
<td>Average Treatment Effect</td>
</tr>
<tr>
<td>ATET</td>
<td>Average Treatment Effect of The Treated</td>
</tr>
</tbody>
</table>
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1 Introduction

Oocyte donation is a fertility treatment for women who do not produce healthy eggs, have damaged eggs, or have reached the age when reproduction is no longer possible. It is described to be effective, with a low level of risk for the donor, the child, and the mother, both physical and psychological. The European society of human reproduction and embryology (ESHRE) claim that treatments, known to be as safe and effective as oocyte donation, should be available for all infertile patients, who should be given the opportunity to make informed reproductive choices on the basis of sound scientific evidence. The supply of oocyte donation is, however, not equally available for all countries in the EEA (ESHRE, 2017b).

1.1 Significance of the study

Infertility increases in extent in the western society, due to the postponement of parenthood derived by the change in the socioeconomic factors. In total, 1 out of 10 couples is challenged with the disability of infertility (Helsedirektoratet, 2015a). The widespread use of assisted reproduction techniques has advantaged involuntarily childless individuals since its origin in 1950 (Andersen & Erb, 2006). In 2013, 2132 children were born due to assisted reproduction technique (ART) conducted in Norway. This constitutes almost 4% of all children born in 2013. 10% of children conceived by ART in Norway, are born due to sperm donation (Helsedirektoratet, 2015a). It is estimated that the same amount applies women, if oocyte donation was legal. This constitutes four out of 1000 children (Helsedirektoratet, 2015b).

Among the Northern countries, Norway is the only one who forbids this treatment. In the EEA, only Germany, Austria, and Italy, in addition to Norway, have binding laws against it. In 2011, and 2015, the majority of the NBAB recommended a change in the Norwegian legislation of oocyte donation on behalf of the Norwegian Ministry of Health and Care Services. Despite of this, the treatment is still illegal (Bioteknologirådet 2015).

The NBAB describe that there are several possible effects with a legalized intervention. They explain how a change in the legislation might give incentives to postpone childbearing, and contribute to increased age of parenthood. Further, they claim that increased age of parenthood might enhance the number of infertile individuals (Bioteknologirådet, 2015).
The NBAB also describe a possible reduction in the demand for adoption, with legalized oocyte donation. This is to some extent mentioned in previous studies, but mainly as a possible effect of the intervention (Bioteknologirådet, 2015). Hence, to limit this study, the effect of legalized oocyte donation on the intention to adopt, is the effect investigated. In order to do so, eight European countries are examined, as a comparative study, to acknowledge if the possible described effect, actually occurs. If the demand for adoption is significantly different in countries where the intervention is legal, acquisition of awareness concerning this, could be an advantage before deciding to change the Norwegian legislation.

1.2 Investigated effect

The adoption rate in Europe has decreased recent years. In 2015, 194 children were adopted in Norway. This is a reduction of more than 50% compared to the number in 2003 (Statistics Norway, 2017). The decrease is mainly believed to be a cause of the small supply of children available for adoption, and not the demand for adoption (Bioteknologirådet, 2015; Högbacka, 2008). Oocyte donation and adoption are described as possible substitutes for one another. It is expected that increased availability of one, might affect the demand for the other (Bioteknologirådet, 2015).

While the number of children adopted depends on the supply of children available for adoption, the intention to adopt discloses the consumers’ preferences in a better way. Hence, instead of exploring the adoption rate, the intention to adopt a child, is investigated.

1.3 Research questions and hypothesis

With this information as contemplation, the research question for this thesis is:

*Will legalized oocyte donation reduce infertile females’ intention to adopt?*

My belief in the presence of the effect, is the background of the subject in this study. According to the principle of substitution, it seems reasonable to believe that enhanced availability of one treatment, affects the demand for the other. Hence, my hypothesis is that the effect is present, i.e. the intention to adopt is reduced with legalized oocyte donation.
1.4 Theory

The aim of the theoretical framework is to provide information about how individuals make decisions based on their preferences, and in order to maximize their net benefit. Decision theory is commonly applied in such frameworks, and is as much a theory of desires and behavior as it is a theory of choice. What matters is how these various attitudes, i.e. preferences, cohere together (Steele & Stefánsson, 2016). Further, the decision theory is used to explain how a decrease in the intention to adopt might occur, as described to be a possible effect by the NBAB.

1.5 Data and method

The data used in this thesis is from the Gender and Generation survey (GGS). GGS is an international study from 2008, developed by the Gender and Generation Program (GGP). Because the Norwegian data assigned from GGP was to be processed external and fairly time consuming, the identical data is collected from The Life-Course, Generation, and Gender Survey (LOGG) (NSD, 2017).

The GGS provides data on individual-level, and is described to be valuable for policy-related research on fertility changes in Europe and elsewhere in developed nations. In total, 19 countries participated in the survey (GGP, 2017a; GGP, 2017b). Due to omitted variables in some of the countries, this study compares the eight countries; Norway, Austria, and Germany, who have binding laws against oocyte donation, and France, Belgium, Sweden, Czech Republic, and Bulgaria, who legalize it (GGP, 2017a; GGP, 2017b).

The independent variables applied in this study, are based on the importance of characteristics described in fertility theory, and includes the fertility status, the age, the marital status, the immigration status, the number of children in household, being a student or not, unemployment, and education level. Because there is a high degree of omitted variables in the survey concerning income, the covariate “money left for savings” is used to reflect this. The dependent variable applied is the intention to adopt. Only females aged 20-44 years are included in the analyses, due to the age limit of fertility treatments.

The methodology applied is based on the theory of causality, and the analyses are performed in three steps. The first is multiple regression analyses, which explore the relationship
between the dependent and independent variables. Then, because the survey is not randomized, a nearest neighbor matching test is conducted, with oocyte donation as the treatment variable, and the intention to adopt as the outcome variable. Finally, a method where the variables are weighted, due to confounding created by the respondents’ country of residence, is performed.

1.6 Structure of the thesis

The second chapter provides information about the medical background and the indication of fertility treatments. This chapter also describes the legal aspects of oocyte donation in the countries included in this study. In chapter 3, the supply, demand, and cost of the fertility treatments in the eight countries are described. Chapter 4 comprises the theoretical framework of decision theory, in relation to the fertility treatments. The data, and the necessary adjustments of it, will be presented in chapter 5, and the applied methodology, in chapter 6. In chapter 7, the results are submitted. Finally, chapter 8 consists of concluding remarks.
2 Background

2.1 The female reproductive system

The female reproduction system consists of the ovaries, the fallopian tubes, the womb (uterus), the cervix, and the vagina. When a girl is born, each ovary contains 400,000 follicles, which is the shell of all the eggs she will ever process. When reaching puberty, approximately 20 eggs will ripen in the follicles every month, caused by the follicle-stimulating hormone (FSH). Most of the ripened eggs will die, and only those to be fertilized, in most cases one egg, will be released from the ovary (Peate, 2013).

Fig. 2.1. The female reproductive system

2.2 Female infertility

If clinical pregnancy is not achieved after 12 months or more of regular unprotected sexual intercourse, it is diagnosed as infertility. Infertility might be due to the inability to become pregnant, the inability to maintain pregnant, or the inability to carry the pregnancy to a live birth (WHO, 2017a; Helsedirektoratet, 2015c). The medical reason of the infertility, is equally distributed between the woman and the man, and ranks as the 5th highest serious disability among population under the age of 60 (WHO, 2017b). Due to the widespread use of legalized ART, infertility has begun to lose its historical stigma, and gained acceptance as a medical condition worthy of treatment (Glennon, 2016).
2.3 In Vitro Fertilization

In vitro fertilization (IVF) is the most effective treatment for infertility, with a success rate of almost 30% for each attempt, i.e. cycle. This rate drops rapidly after the female reaches the age of 30, and with females >40 years, only 20% of the cycles lead to a child. After five completed cycles, the probability of a child is estimated to be 75%. However, treatment with IVF is a physical and psychological strain for the female, and many opt out of the treatment before five cycles are accomplished. In total, less than 50% of the females who undergo this treatment, succeed to have a child (Wade et al, 2015).

The technique of IVF has been performed ever since the first IVF baby was born in England, in 1978. The procedure is performed after two to four weeks of hormone therapy. The ovaries are located with vaginal ultrasound guidance, and a needle is directed through the back wall of the vagina and into the ovarian follicles. Once the eggs are retrieved, they are placed in culture plates with nutrient media and stored to ripe. The oocytes could then be fertilized, or frozen for future occasions. The procedure is performed under a light anesthesia and generally takes less than 15 minutes to complete. The overall complication rate is < 1%. If the male does not have eligible sperm for fertilization, a donor sperm could be applied. After the fertilization, one or two fertilized oocytes (embryos), are replaced in the woman’s uterus (Bioteknologirådet, 2016; Wade et al, 2015).

Fig. 2.2 In Vitro Fertilization
2.4 Oocyte donation

In 1984, the first child after oocyte donation was born in California. The technology is now a widespread fertility treatment worldwide. It is assumed that more than 8,000 European children have been concepted by this method. The procedure for the donor is the same as with IVF, where eggs are collected and placed to ripe in an incubator. The oocyte is most commonly fertilized with sperm from the father, which gives the child one biological parent. With same sex couples, or in cases where the father is infertile in addition, one could either use a sperm donor, or a fertilized oocyte, donated by a couple who has undergone IVF (Dayal, 2013). The risk assigned for the donor, the recipient, and the child, regarding oocyte donation, is estimated to be the same as with IVF, and is not a reason itself to illegalize it. The success rate with oocyte donation is about 25% per cycle, but with a donor >35 years it decreases significantly (Wang et al, 2012).

2.5 Indications for oocyte donation

Approximately half of the women utilizing oocyte donation, are assigned with a diagnosis of diminished reserves of follicles. This is normally the point in time when the female reach her menopause at age 51. However, to some women it happens significantly earlier. Primary ovarian insufficiency (POI) is considered menopause in a woman before the age of 40. There are several reasons for a woman to develop POI. Turner’s syndrome is an innate chromosome abnormality in females, which causes accelerated loss of follicles over the first postnatal months or years. 90-95% of those diagnosed with the syndrome, develop POI and infertility. In addition, certain medical treatments, such as chemotherapy and radiation, increase the risk of POI (Foudila, 1999; Dayal, 2013).

Tubal-, uterine- and ovulatory dysfunction factors account for a total of 4% of the women who utilizes oocyte donation. In more than 30% of the cases, multiple factors are present. The remaining percentages are mainly women with poor quality of the oocytes, women affected by or carriers of significant genetic illness, and couples with multiple previous failed IVF-attempts (Dayal, 2013).
2.6 The donor

In general, oocyte donation is supposed to be altruistic, but donors can be compensated for travel costs, absence of work, etc. In a strict interpretation, compensation should be restricted to proven expenses. However, one could also argue for compensation for incidental effects of the procedure such as pain, missed opportunities, time, and so on. The European resolutions and directives do allow compensation limited to cover expenses and inconveniences related to the donation. The amount of this compensation is up to each country to decide. In France, only proven expenses can be reimbursed for oocyte donors. Other countries, such as Finland, Portugal, Spain, and the UK, offer a fixed amount (€250-€900). Nevertheless, with a few exceptions, most oocyte donors indicate that they mainly donate to help others (Pennings et al, 2016).

2.7 Legal aspects of oocyte donation

Oocyte donation has since its origin in the 80s become legal in most of the European countries. In the member states of EEA, only Germany, Italy, Austria, and Norway have binding laws against it (Bioteknologirådet, 2015).

2.7.1 Norway

Even though a change in the legislation of oocyte donation was recommended by the NBAB in 2011 and 2015, this is still illegal by Norwegian law. This is highlighted in the Act relating to the application of biotechnology in human medicine, etc, § 2-15, “Fertilized eggs cannot be deposit to a woman who is not the origin of the oocytes”. The NBAB recommends a change, based on several conditions (Bioteknologirådet, 2015):

- The donated oocytes should be given by women who are already undergoing IVF, with retrieved oocytes in spare.
- The oocytes should be fertilized with the partner’s sperm, to ensure a biological connection with the child.
- The childbearing woman should not be more than 45 years.
- The donation should be administered through an egg bank.
• The children should have legal rights to receive information about the donor’s identity when they reach mature age.

2.7.2 Germany

According to the German embryo protection act, oocyte donation is forbidden by penal law. A person who takes an unfertilized egg from a woman in order to transfer it to another woman shall likewise be guilty of assistance in criminal act (Busardò et al, 2014; Bioteknologirådet, 2015).

2.7.3 Austria

Austria has one of the strictest legislation concerning assisted reproduction. The Act on Reproductive Medicine, allows the use of ART only within marriage or a stable heterosexual civil partnership, and prohibits oocyte donation. Sperm donation can only be utilized by couples where the male partner is infertile, but not in combination with IVF, and is not available to single women or lesbian couples (Shalev & Werner-Felmayer, 2012).

2.7.4 Sweden

Oocyte donation has been legal by Swedish legislation since January 2003. Sweden was the first country to give children born as a result of donor insemination the legal right to receive information about the donor’s identity, when the child reaches mature age. About 35 treatments per million inhabitants, is conducted yearly (Bioteknologirådet, 2015; Svanberg, 2003).

2.7.5 France

After an extensive judicial and ethical deliberation, oocyte donation was legalized in 1994. Even though France has signed the UN convention on the rights of the child, which explains the importance of the child’s knowledge of its biological origin, it is only legal with anonymous donors (Bioteknologirådet, 2015; Letur-Könirsch, 2004).
2.7.6 Belgium

Oocyte donation was legalized in Belgium in 2007. The treatment is mainly anonymous, but could be non-anonymous if the donor and the recipient attend the clinic together and agrees on non-anonymity. Embryo donation however is anonymous. It is permitted to provide compensation to the donor, but no agreement has been reached concerning the acceptable amount (Lejeune, 2008).

2.7.7 Bulgaria

Oocyte donation was legalized in Bulgaria in 2004. This is stated in the Bulgaria Health Act of August 2004. The act especially expands the legal aspects of extraction of an ovum from one woman, and the implantation into the body of the same or another woman. Donation could be both anonymous or non-anonymous, and is also available for single females and homosexual couples (Busardò et al, 2014; Bioteknologirådet, 2015).

2.7.8 The Czech Republic

Oocyte donation has been legally practiced in the Czech Republic since 2006. The principle driving the donation of reproductive cells are regulated by binding law, conducted by the ministry of health. The donation is performed anonymous, and is not offered to homosexual couples or single females (Busardò et al, 2014; Health & Consumer Protection Directorate-General, 2006).

None of the countries included in this study allows surrogacy (Busardò et al, 2014).

2.8 Cross border intervention

Even though the countries are free to enact their own medical legislation, the patients in Europe have free movement for treatment. This involves that patients are free to travel abroad for treatment, even if their 'cross border reproductive care' violates domestic legislation (ESHRE, 2017b). Cross-border fertility care is a growing phenomenon. An unknown, but probably substantial number of couples travel to another country to obtain oocyte or embryo donation. A study performed in cooperation with 46 fertility clinics in six European countries, collected background characteristics of 1230 females who applied for fertility treatment. In
total, 20% of these females applied for oocyte donation, and their nationality varied. More than 40% of the females were German, 20% were French, 6% were Swedish, and only 1.5% were Norwegian. The main reason for the cross-border treatment for the German and Norwegian females, was the illegal aspects of oocyte donation in their country of residence (Shenfield et al., 2011).

Because the actual number of infertile females who opt for cross-border treatment is unknown, it is difficult to adapt for this in the analyses. However, due to the illegal aspects of the treatment, it is assumed that less people opt for cross-border treatment if it violates the domestic legislation. Many people believe that moving across borders for treatment is morally wrong, and should be limited as much as possible. This might be a reason for why the number of females who opted for cross-border treatment due to illegal aspects, as described in the study above, was not more comprehensive (Pennings et al., 2016; Shenfield et al., 2011).
3 Fertility treatments

Before the preferences of one fertility treatment over the other is presented through the decision theory, I find it expedient to present the treatments, and their availability first. Because IVF is assumed to be a substitute to adoption (Cohen & Chen, 2010), it seems reasonable to include this technique in the investigation.

The relevance of this description is to avoid biased results, due to unknown inequality in the investigated countries.

3.1 IVF

Performed cycles with IVF are monitored by the European monitor center of assisted reproduction techniques (ESHRE), and most fertility clinics report directly to them. The cycles of IVF performed in 2010, varied from 93 cycles/million in Bulgaria, to 611 cycles/million in Norway (Kupka et al, 2010).

Table 3.1 Cycles of reported IVF performed in 2010.

<table>
<thead>
<tr>
<th>Country</th>
<th>Clinics in the country</th>
<th>Clinics reporting</th>
<th>Performed cycles</th>
<th>Population (10⁶)</th>
<th>Cycles/10⁶</th>
<th>Summarized cycles/10⁶</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Legal oocyte donation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Belgium</td>
<td>18</td>
<td>18</td>
<td>4 526</td>
<td>11.2</td>
<td>404</td>
<td></td>
</tr>
<tr>
<td>Bulgaria</td>
<td>21</td>
<td>7</td>
<td>680</td>
<td>7.3</td>
<td>93</td>
<td></td>
</tr>
<tr>
<td>France</td>
<td>107</td>
<td>104</td>
<td>21 783</td>
<td>66</td>
<td>330</td>
<td></td>
</tr>
<tr>
<td>Sweden</td>
<td>16</td>
<td>16</td>
<td>5 754</td>
<td>9.6</td>
<td>599</td>
<td></td>
</tr>
<tr>
<td>Czech Republic</td>
<td>32</td>
<td>32</td>
<td>n.a.</td>
<td>10.5</td>
<td>n.a.</td>
<td></td>
</tr>
<tr>
<td>Norway</td>
<td>11</td>
<td>11</td>
<td>3 118</td>
<td>5.1</td>
<td>611</td>
<td></td>
</tr>
<tr>
<td>Gemany</td>
<td>124</td>
<td>114</td>
<td>9 545</td>
<td>80.6</td>
<td>119</td>
<td></td>
</tr>
<tr>
<td>Austria</td>
<td>29</td>
<td>29</td>
<td>1 014</td>
<td>8.5</td>
<td>119</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Illegal oocyte donation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The numbers should be interpreted with some cautiousness. In Bulgaria, only one out of three clinics reported their IVF-cycles to ESHRE, and actually performed cycles is likely to be at approximate 250-300. In Germany, 119 IVF cycles/million were conducted in 2010. This number is explained to be smaller than representative. In 2001, 396 IVF cycles/million were conducted in Germany, which by the monitor center is explained to be more current for the
country (Andersen & Erb, 2001; Kupka et al, 2010). The table highlights the diversity of performed IVF in the countries. A difference perceived as relatively small, both in the eight countries individually, and in the two groups with legal and illegal oocyte donation.

### 3.1.1 Costs

IVF is available in private clinics with self-payment for females under the age of 45, in all the investigated countries. The out-of-pocket price for one cycle with IVF, is 4,000-5,000 EUR. However, many of the European countries have rich reimbursement systems that cover the costs associated with IVF (Wade et al, 2015; ESHRE, 2017a).

<table>
<thead>
<tr>
<th>Country</th>
<th>Coverage level</th>
<th>Maximum cycles covered</th>
<th>Only medical indications</th>
<th>Age limit (years)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Legal oocyte donation</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Belgium</td>
<td>Full</td>
<td>6</td>
<td>Yes</td>
<td>40</td>
</tr>
<tr>
<td>Bulgaria</td>
<td>Partial</td>
<td>Varies</td>
<td>Yes</td>
<td>43</td>
</tr>
<tr>
<td>France</td>
<td>Full</td>
<td>4</td>
<td>Yes</td>
<td>43</td>
</tr>
<tr>
<td>Sweden</td>
<td>Full</td>
<td>Varies</td>
<td>Yes</td>
<td>44</td>
</tr>
<tr>
<td>Czech Republic</td>
<td>Partial</td>
<td>Varies</td>
<td>Yes</td>
<td>41</td>
</tr>
<tr>
<td><strong>Illegal oocyte donation</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Norway</td>
<td>Full</td>
<td>3</td>
<td>Yes</td>
<td>41</td>
</tr>
<tr>
<td>Germany</td>
<td>Partial</td>
<td>3</td>
<td>Yes</td>
<td>40</td>
</tr>
<tr>
<td>Austria</td>
<td>Partial</td>
<td>4</td>
<td>Yes</td>
<td>40</td>
</tr>
</tbody>
</table>

As showed in the table, the investigated countries are similar in many ways. Females below the age of 40-44 years with a medical condition are offered three to six cycles with IVF, that are mainly reimbursed. Bulgaria have the smallest reimbursement level of 40%, while France and Belgium have the richest one, and provides full coverage of the treatment. In addition to the monetary costs of IVF, the fertility treatment has a cost in accordance with the females’ physical strain of the treatment, and the psychological stress due to the uncertain aspects of it (Brigham, Cadier & Chevreul, 2013; Krastev & Mitev, 2013).
3.2 Adoption

Although adoption in its present form began after World War II, it did not become common until after 1960, most notably in the USA, Scandinavia, and the Netherlands. Adoption is mainly associated with the incidence of infertility, and the majority of adoptive parents are involuntarily childless (Högbacka, 2008).

The supply of adoptive children is more regulated in Europe than elsewhere, such as in the USA, where 40% of the adoptions are performed private. European individuals who apply for cross-national adoption must be approved in their country of residence, before the application is delivered to the country of the child. The countries in the western Europe, have strict requirements of their adoption seekers. Hence, by being approved for adoption in the country of residence, the probability of being approved in the country of the child, is described as high (Högbacka, 2008).

Adoption is offered to women under the age of 45, in most of the European countries. Single, or individuals in a homosexual couple could apply for adoption, but the approval of this is decided by the country of the child (Petersen et al, 2015; Högbacka, 2008). More than 20 000 children are adopted yearly from Russia and China, which entails more than 50% of all transnational adoptions. France and Sweden are the countries included in this study who receives the highest number of transnational children, with 4 000 adoptions in France and 1000 adoptions in Sweden yearly (Petersen et al, 2015). However, increasingly fewer children are adopted in the western society. In Norway, the number of adoptions is reduced with 50% from 2003. In 2015, 194 Norwegian parents adopted a foster child or a child from another country (Statistics Norway, 2017). Short supply of adoptable children, is believed to be the main reason for the decrease, and it is estimated that for each child available for adoption, there are six adoption seekers (Högbacka, 2008).
Adoption of a stepchild is not defined as a way of curing childlessness, due to the limited availability of it, thus, it is not included in this study (Högbacka, 2008).

### 3.2.1 Costs

An international adoption can currently cost about 20 000 EUR, where some of these charges will be reimbursed by the government. For the Norwegian residents, the government reimburses 8 000 EUR, i.e. 40% of the charges (Bufdir, 2017). In 2006, the cost of an international adoption was 12-15 000 EUR, with a reimbursement of 5 000 EUR (Familie- og kulturkomiteen, 2006). Hence, the decline in Norwegian adoptions, pictured in fig 3.2, does not seem to be an effect of increased cost for the adoption seekers.

Unlike IVF, there is no monetary uncertainty with adoption, as individuals typically end up with a child at the end of the process. In addition, most of the costs of an adoption are incurred at the end, when the actual adoption process has taken place (Gumus & Lee, 2012). However, the waiting time for a child can be comprehensive, and is described as a cost for the adoption seekers. This waiting time consists of two phases. First, there is a wait for approval given by the country of the adoption seekers. This is individual for each of the included countries, and is partly dependent on the supply of adoption seekers. In Norway, the turnaround for approval is estimated to be 6-12 months. The second phase, is an international waiting list, organized by the country of the adoptable child. The length of this differs in each
country, and normally varies from one to eight years. From the perspective of the childless individuals, the discrepancy between supply and demand results in a very long and exhausting waiting time (Högbacka, 2008; Freundlich 1998).

### 3.3 Oocyte donation

A third substitute for infertile females in Europe is the treatment with donated oocytes. It is unknown how many involuntarily childless Norwegian couples who would have utilized oocyte donation. In Finland, more than 500 females are treated yearly with donated oocytes. In Denmark, 200-300 females receive the treatment yearly (Malchau et al, 2013). The NBAB estimate that at least 200 Norwegian females would have wanted to treat their involuntarily childlessness with this approach every year (Bioteknologirådet, 2015).

Table 3.3 Cycles of reported oocyte donation performed in 2010

<table>
<thead>
<tr>
<th>Country</th>
<th>Clinics in the country</th>
<th>Clinics reporting</th>
<th>Performed cycles</th>
<th>Population (10^6)</th>
<th>Cycles/10^6</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Legal oocyte donation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Belgium</td>
<td>18</td>
<td>18</td>
<td>1 412</td>
<td>11.2</td>
<td>126</td>
</tr>
<tr>
<td>Bulgaria</td>
<td>21</td>
<td></td>
<td>7</td>
<td>7.3</td>
<td>10</td>
</tr>
<tr>
<td>France</td>
<td>107</td>
<td>104</td>
<td>979</td>
<td>66</td>
<td>15</td>
</tr>
<tr>
<td>Sweden</td>
<td>16</td>
<td>16</td>
<td>357</td>
<td>9.6</td>
<td>37</td>
</tr>
<tr>
<td>Czech Republic</td>
<td>32</td>
<td>32</td>
<td>2 365</td>
<td>10.5</td>
<td>225</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Illegal oocyte donation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Norway</td>
<td>11</td>
<td>11</td>
<td>0</td>
<td>5.1</td>
<td>0</td>
</tr>
<tr>
<td>Germany</td>
<td>124</td>
<td>114</td>
<td>0</td>
<td>80.6</td>
<td>0</td>
</tr>
<tr>
<td>Austria</td>
<td>29</td>
<td>29</td>
<td>0</td>
<td>8.5</td>
<td>0</td>
</tr>
</tbody>
</table>

The table describes cycles of performed oocyte donation in the applicants’ country of residence. Due to cross-border treatments, these numbers are not presumed as overall descriptive, but to illustrate an outline of the situation.

### 3.3.1 Costs

Oocyte donation is offered as a fully reimbursed fertility treatment in many of the European countries, given that the treatment is due to a medical condition. Hence, homosexual couples will not have their charges reimbursed. Sweden have a partly reimbursement system, that was recently increased from 3 000 SEK to 11 000 SEK (Johansson & Sahlin, 2013). France and
Belgium offer full reimbursement of oocyte donation, this also apply females who opt for cross-border treatment. (Gomez & De La Rochebrochard, 2013). On the contrary, Norwegian females who seek cross-border treatment, will not have any of their charges reimbursed. The price for one cycle with donated oocytes is approximately 8 000 EUR. In addition to the fee for the procedure, travel costs must be taken into consideration, as out-of-pocket-payment for the applier (Petersen et al, 2015).
4 Theoretical framework

4.1 Decision theory

Decision theory deals with situations where the actor must make choices among different given alternatives. The decision theory is based on assumptions concerning that each decision entails consequences i.e. outcomes, and that the actor who makes the decision has preferences for the different outcomes. There are different perspectives in decision theory: the normative mode explains what individuals should choose (in theory), while the descriptive mode explains how individuals actually behave (Steele & Stefánsson, 2016).

In a normative mode, one expects individuals to be perfectly rational. With perfectly rational lays the interpretation of a decision maker with individual preferences based on envisaged consequences. First, a rational decision maker is expected to make decisions based on maximized net benefit, derived by expected cost and utility, of the outcome (Rapoport, 1998).

The expected utility of a decision is given by:

\[ EU(D_i) = \sum_i x_i P_i, \quad (3.1) \]

where the decision \( D_i \), has outcome \( x_i \), with probability \( P_i \)

Further, the net benefit of a decision is given by:

\[ NB(D_i) = EU(D_i) - EC(D_i), \quad (3.2) \]

where \( EU(D_i) \) describes the individual’s expected utility of the fertility treatment, and \( EC(D_i) \) the costs of it (Brown, 2000; Steele & Stefánsson, 2016).

Secondly, it is expected that a rational actor is transitive, with consistent preferences. In economic terms, this gives:

If the actor chooses \( A \geq B \), and \( B \geq C \), then he also chooses \( A \geq C \).

Thus, if the actor originally prefers childlessness > adoption, and adoption > oocyte donation, then the actor should also prefer childlessness > oocyte donation. However, violations of transitivity of preferences are by no means uncommon, because individuals not always
behave rational (Rapoport, 1998). Therefore, one should be aware that the model presented here is based on how economists expect individuals to behave, and not a description of their actual behavior.

4.2 Expected utility of the fertility treatments

Theory explains how genetic children provide a greater utility in terms of a biological connection, than what an adoptive child provides. This is also described with oocyte donation, where the father in most cases is the biological father (Högbacka, 2008). Furthermore, one would expect that adoption provides more utility in terms of its altruistic action. Nevertheless, several studies explain that while the motivation for fertile adopters tend to be altruistic, the infertile individuals tend to focus on their need of a child (Van den Akker, 2001; Högbacka, 2008).

With oocyte donation, the probability of success/cycle is described initially to be $p = 0.25$, and the probability to fail is given by $1 - p = 0.75$. (Wang et al, 2012). The possible outcomes are to try oocyte donation and succeed, try oocyte donation and fail, or not try oocyte donation. The sum of the associated utilities of the outcomes, multiplied with the probability of these outcomes give the expected utility of the decision.

Fig. 4.1 Expected utility of oocyte donation

<table>
<thead>
<tr>
<th>Possible actions $(D_i)$</th>
<th>Success $(P_1) = 0.25$</th>
<th>No success $(P_2) = 0.75$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oocyte Donation $(D_1)$</td>
<td>The individual chooses oocyte donation, and succeeds to have a child $(X_1)$</td>
<td>The individual chooses oocyte donation, but fails in having a child $(X_2)$</td>
</tr>
<tr>
<td>No oocyte donation $(D_2)$</td>
<td>The individual does not choose oocyte donation and can neither fail nor succeed $(X_3)$</td>
<td></td>
</tr>
</tbody>
</table>

Hence, the $EU(D_1)$ is given by: $X_1P_1 + X_2P_2$, while the $EU(D_2)$ is given by: $X_3$. The same approach appeals IVF, with similar probability of success and failure.
This gives that a rational decision maker will choose oocyte donation or IVF if:

\[ X_1 P_1 + X_2 P_2 - EC(D_1) > X_3, \]  

(3.3)

where the expected monetary cost of oocyte donation is described to be approximate 8 000 EUR with a reimbursement level from full coverage in France and Belgium, to a small amount in Sweden (Petersen et al, 2015), and the monetary cost of IVF is described to be 4 000 EUR, with a reimbursement level from 40% in Bulgaria to full reimbursement in Belgium and France (Högbacka, 2008). In addition, the costs of physical and psychological strain related to the treatments, are described to affect the decision (Wade et al, 2015). Hence, for a rational decision maker to choose \( D_1 \) over \( D_2 \) the expected costs of \( D_1 \) should be less than the utility of a child, with a 25% probability of success.

Adoption is by scholars associated with no uncertainty to simplify the model (Gumus & Lee, 2012).

Fig. 4.2 Expected utility of adoption

<table>
<thead>
<tr>
<th>Possible actions ((D_i))</th>
<th>Success ((P_2) = 1)</th>
<th>No success ((P_4) = 0)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adoption ((D_3))</td>
<td>The individual chooses adoption, and succeeds to have a child ((X_4))</td>
<td>The individual chooses adoption, but fails in having a child ((X_5))</td>
</tr>
<tr>
<td>No adoption ((D_4))</td>
<td>The individual does not choose adoption and can neither fail nor succeed ((X_6))</td>
<td></td>
</tr>
</tbody>
</table>

This implies that the expected utility of adoption is given by: \(X_1\), i.e. the individual’s utility of adoption. Hence, the decision maker will choose adoption if:

\[ X_4 - EC(D_3) > X_6, \]  

(3.4)

where the expected monetary cost of an adoption is approximately 20 000 EUR with a reimbursement level of 40%, in addition to the comprehensive waiting time, from one to eight years (Högbacka, 2008; Bufdir, 2017)

Furthermore, the decision maker is not allowed to choose more than one of the fertility treatments at a time, and will rationally choose the alternative that provides the greatest net
This make the fertility treatments possible substitutes for one another (Petersen et al, 2015).

4.3 Fertility treatments as possible substitutes

A substitute is a product that is considered similar to another product. Hence, substitutes are known to replace the use of one another. The described effect by the NBAB is that oocyte donation, if legalized, might replace adoption. Substitution is normally explained in relation to price, where an increase in the price of one good, increases the demand for the other. However, it also explains other sources of shifts in the demand, such as a change in cultural attitudes, new information, and new availability of goods. Therefore, if oocyte donation and adoption appear as substitutes, the demand for adoption is expected to decrease, if oocyte donation becomes available (Stiglitz & Walsh, 2006).

Two goods can also be complementary goods. By this lays an expected increase in the demand for one of the goods, if the demand for the other increases. If adoption and oocyte donation appear as complements, it is expected that a legalized intervention increases the adoption rate (Stiglitz & Walsh, 2006).

A study performed in Denmark stated that after a year of unsuccessful attempts with IVF, 10-15% of the females opted for other alternatives, such as adoption or oocyte donation (Petersen et al, 2015). Another study, of young adult with fertility problems, performed in the USA, stated that infertile females considered IVF as the first option, followed by adoption and the third-party reproduction method, oocyte donation, as a second (Wilson & Cheung, 2004).

Thus, according to the decision theory, one would expect that individuals choose IVF first because this provides them the highest net benefit. Secondly, it seems reasonable, as described by the NBAB, to assume that the fertility treatments behave as substitutes for one another (Bioteknologirådet, 2015).

4.4 Paths of substitutive decisions

The infertile females’ treatment possibilities are described by Appelton & Pollak (2011), as paths of decisions. To simplify the model, all adoption seekers are assigned a child, even though a certain number of females are declined, by several reasons such as age, economic
uncertainty, and health (Gumus & Lee, 2012). If the female holds reproductive oocytes, her first decision will be to choose between adoption and IVF. The most common approach, as described, is to start with IVF. However, 50% of the females fail to have a child by IVF, which leads to the next path. This path also applies females without reproductive oocytes, and involves the decision between adoption and legal/illegal oocyte donation (Appleton & Pollak, 2011).

Fig. 4.3 Paths of fertility substitutes

| 1. IVF or Adoption → Child |
| 2. Failed IVF/Ineligible for IVF → Adoption or Oocyte donation → Child |
| 3. Failed IVF → Failed Oocyte donation → Adoption → Child |

If the female has reproductive oocytes, her first choice would be IVF, if the utility accomplished by genetic children is greater than the altruistic approach of adoption. Furthermore, the weight of this utility must be greater than the difference in the expected cost of IVF compared to adoption.

In economic terms, the female will choose IVF over adoption if:

\[ X_1P_1 + X_2P_2 - EC(D_1) > X_4 - EC(D_3), \]  
(3.5)

where, \( X_1P_1 + X_2P_2 \) is the expected utility of IVF, \( X_4 \) the expected utility of adoption, and \( EC(D_1) \) and \( EC(D_3) \), the decisions’ associated costs. Further, if the female fails to have a child with IVF, she can continue to choose between adoption and IVF three to six times, due to the countries’ reimbursement level (Brigham, Cadier & Chevreul, 2013), before the monetary cost of \( D_i \) increases.

If the female does not have reproductive oocytes/several failed cycles with IVF, her first choice would be oocyte donation, if the utility accomplished with a child that is partial genetic, is greater than the altruistic approach of adoption. Furthermore, the weight of this utility must be greater, than the difference in the expected cost of oocyte donation compared to adoption. This is given by the same function as above (3.5), but \( X_1P_1 + X_2P_2 \) are now the expected utility of oocyte donation, and \( EC(D_1) \), the associated costs.
4.5 Socioeconomic factors

Many researchers have tried to disclose which socioeconomic factors that state the decision of having a child. The effect that education and income have on fertility, is a central subject here. Females with higher education are more likely to be voluntary and involuntary childless, due to several mechanisms. Balancing the roles between being a student and having a child is time-consuming, and increases the female’s opportunity cost. No less important is the intersection of these costs when the female attend the working role (Balbo, 2015).

The large body of literature focuses on a negative relationship between higher education, income, and fertility. Females with higher education tend to have jobs with higher income. This implies that females with higher education have more to lose, and a higher opportunity cost for taking care of a child. It is estimated that the female’s income decreases with 7% per child, due to loss in work-experience, and the fact that females tend to seek lower paying jobs, that are thought to be more family friendly (Kravdal & Rindfuss, 2008). The interaction with higher education, income, and fertility, is also described by the certain need that children fulfill. People with high educational level and good jobs are expected to have more alternatives to achieve the needs of stimulation, adulthood, and power (Boschman, 2007). Parenthood as a rational decision, is explained to be strategical planned, based on the minimization of the opportunity costs of childbearing. Hence, more females with high education and income choose a life of childlessness, because they fulfill their certain needs with other achievements. Nevertheless, infertile females with higher education and income, are more likely to bear the costs of fertility treatment and adoption. Therefore, their relative cost of having a child is smaller than those with a budget constraint that is more restricted (Freundlich, 1998).

Changes in partnership dynamics, especially in the western society, has been linked to the absent of parenthood. The frequency of several partners before considering parenthood is increasing in most of the European countries. Having a suitable partner, which could be described through marital status, is found to influence the decision of a child (Högbacka, 2008).
Economic uncertainty diminishes the tendency of both marriages and parenthood. Hence, unemployment is described to affect the fertility rate both indirectly, i.e. through a decreased probability of marriage, and directly due to the uncertain aspects. Several studies link the economic uncertainty of unemployment with the absence of parenthood (Balbo, 2015).

A small extent of research is provided on the factors that urge females to decide between adoption and assisted reproduction. A study performed in the UK, disclosed that those opting for adoption tend to have higher ranked occupations than those opting for oocyte or embryo donation (MacCallum, 2009). A study performed on French applicants for oocyte donation stated that most of the females (70%) were childless. About 50% of the females were in the age group 38–42 years, and almost all the females were in heterosexual couples. Finally, 60% of the females had a low occupation level (Gomez & De La Rochebrochard, 2013).

### 4.6 Country-level factors

The infertile females’ decision between ART and adoption is explained to be affected by policy and welfare regimes provided in the different countries (Adamson, 2009). Like the socioeconomic factors, country-level factors are closely interrelated. The social security system in countries, have been discussed as determinants of infertility decisions (Balbo, 2015). A richer system, normally provides a higher level of reimbursement in fertility treatments. However, in richer countries with generous coverage level of health services, the necessity of a child to ensure security in old age is not as dominant as in countries with less generous security systems. Therefore, a generous security system is by many researcher claimed to have a possible countervailing effect on fertility decisions (Adamson, 2009). Nevertheless, there seems to be some fertility preferences that are created by the country of residence, and a reason for why country-specific preferences should be adjusted for in the upcoming analyze.
5 Data

The Gender and Generation Survey (GGS) is an international study, that is developed by the Gender and Generation Program (GGP), and conducted through questionnaires on individual level. The included countries in the survey are Russia, Georgia, Lithuania, Netherlands, Japan, Australia, Poland, Bulgaria, Romania, Italy, Czech Republic, Belgium, Austria, Germany, France, Sweden, and Norway. The study contains of two waves, one from 2008 and one from 2012. Norway conducted the first of these, like all the other countries included in the survey, and a minority of the countries also conducted the second wave. The survey provides data on micro- and macrolevel and is described to be valuable for policy-related research on population and family changes cross-national in Europe. The aim of the survey is to improve the knowledge of various factors, such as fertility, economic activity, and the individuals’ attitude towards this. Even though the data could be applied in research as both longitudinal and cross-sectional data, the main interest of these analyses is the expected effects in Norway. Since Norway, and most of the other countries included in this study only conducted the first wave from 2008, the data is applied as cross-sectional from this year, to ensure equality in the timeframe (GGP, 2017).

5.1 Validity of the data

The data from the GGS is mainly collected through telephone interviews. A questionnaire was developed in advance by an international group of scholars, and each interview lasted from 45 min to 1.5 hours. In addition to the telephone interviews, data were collected through a self-administered postal questionnaire (Brunborg & Lappegård, 2007). The overall response rate varied from 42% in Belgium to 84% in Bulgaria. On average the response rate was about 60%, which is highly comparable to the average response rates in other major cross-national studies that have been conducted. All the included countries conducted a pilot survey to test the questionnaire and fieldwork procedures, except Austria that skipped this pilot, as they used the same questionnaire that had already been tested in Germany (Fokkema et al, 2016).

5.2 Adjustment of the data

The data is disclosed as panel data, with information on micro-level for each of the respondents. Because the relevance of these analyses are women in fertile age and their
decision concerning fertility treatments, only females aged 20-44 are kept in the dataset. The countries’ response to all relevant covariates were investigated, to ensure that relevant information on national level is not omitted. Since there are only four countries in the dataset that illegalizes oocyte donation; Norway, Austria, Germany and Italy, data from these countries are especially important to preserve. However, the question concerning “the physical possibility to have a child”, is omitted for all Italian respondents. Because the fertility status is a key covariate in later analyses, Italy is excluded from the dataset used in the analyses. The same applies for countries where oocyte donation is legal; Russia, Georgia, Lithuania, Netherlands, Japan, Australia, Romania, and Poland, which either lack replies on the outcome variable, or on important independent variables. This gives eight countries left for the analysis; Norway, Germany, and Austria, who all illegalizes oocyte donation, and Sweden, France, Belgium, Czech Republic, and Bulgaria, who all legalizes it.

The covariate “urban/rural habitation” was originally planned to be included in the analyses, as an independent variable. However, the question that covers the type of habitation is not applied in the Swedish questionnaire. To avoid exclusion of all Swedish responders, a regression was performed to investigate the covariate’s influence on the intention to adopt. The test disclosed an influence that was not statistical significant, with an odds ratio close to one. Therefore, the “rural/urban” covariate was excluded, and the respondents from Sweden retained.

5.3 Outcome variable

The outcome variable has its origin from the survey’s question: Do you intend to adopt or take a foster child within the next three years? The question is manufactured as a categorical variable, with four possible replies: Definitely not, probably not, probably yes, and definitely yes. The replies are interpreted, and recoded as no (0), and yes (1) for these analyses. In total, 22 500 females aged 20-44 in the included countries replied to the question, where 2.2% (495) expressed this intention.
Table 4.1 Descriptive statistics: the intention to adopt

<table>
<thead>
<tr>
<th>Country</th>
<th>Fertile</th>
<th>Infertile</th>
<th>Difference</th>
<th>Summarized difference</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Legal oocyte donation</td>
<td></td>
</tr>
<tr>
<td>Sweden</td>
<td>3.5%</td>
<td>6.2%</td>
<td>2.7%</td>
<td>2.2%</td>
</tr>
<tr>
<td>France</td>
<td>3.5%</td>
<td>3.9%</td>
<td>0.4%</td>
<td></td>
</tr>
<tr>
<td>Belgium</td>
<td>2.7%</td>
<td>5.7%</td>
<td>3.0%</td>
<td></td>
</tr>
<tr>
<td>Czech Republic</td>
<td>0.9%</td>
<td>3.6%</td>
<td>2.7%</td>
<td></td>
</tr>
<tr>
<td>Bulgaria</td>
<td>1.6%</td>
<td>3.4%</td>
<td>1.8%</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Illegal oocyte donation</td>
<td></td>
</tr>
<tr>
<td>Norway</td>
<td>0.9%</td>
<td>2.2%</td>
<td>1.30%</td>
<td>0.9%</td>
</tr>
<tr>
<td>Germany</td>
<td>1.3%</td>
<td>1.1%</td>
<td>-0.20%</td>
<td></td>
</tr>
<tr>
<td>Austria</td>
<td>2.6%</td>
<td>4.1%</td>
<td>1.50%</td>
<td></td>
</tr>
</tbody>
</table>

The expected effect is that the difference between fertile and infertile females is higher in countries where oocyte donation is illegal, due to a shortage of fertility treatment. However, the statistics describe the opposite, with a summarized difference that is 1.3% higher in countries where oocyte donation is legal.

5.4 Independent variables

The independent variables included in the analyses are fertility status, marital status, higher education, being a student, being in the oldest age group (>35 years), money left for savings, unemployment, immigrant status, and children in household.

As explained initially, the dataset from the GGS is provided as categorical data. However, the answers are not categorized in a way that makes it possible to compare the different subgroups within each question with one another. For instance, the question: “What is your relationship status?”, is categorized into “Divorced”, “Widowed”, “Single”, “Partnered”, and “Married” with associated numerical values for each category. Because the purpose of the analyses is to match respondents, the independent variables are recoded to binary values yes (1) and no (0). Therefore, the question above concerning the relationship status, is now labeled as “are you married?”. 
Table 4.2 Descriptive statistics: independent variables

<table>
<thead>
<tr>
<th>Independent variable</th>
<th>N</th>
<th>Min.</th>
<th>Max.</th>
<th>Standard deviation</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infertile</td>
<td>22727</td>
<td>0</td>
<td>1</td>
<td>0.269</td>
<td>0.078</td>
</tr>
<tr>
<td>Married</td>
<td>25807</td>
<td>0</td>
<td>1</td>
<td>0.499</td>
<td>0.507</td>
</tr>
<tr>
<td>Student</td>
<td>25807</td>
<td>0</td>
<td>1</td>
<td>0.279</td>
<td>0.084</td>
</tr>
<tr>
<td>Money left for savings</td>
<td>25807</td>
<td>0</td>
<td>1</td>
<td>0.497</td>
<td>0.447</td>
</tr>
<tr>
<td>Higher education</td>
<td>25807</td>
<td>0</td>
<td>1</td>
<td>0.305</td>
<td>0.461</td>
</tr>
<tr>
<td>Children in household</td>
<td>25807</td>
<td>0</td>
<td>1</td>
<td>0.474</td>
<td>0.657</td>
</tr>
<tr>
<td>Immigrant</td>
<td>25807</td>
<td>0</td>
<td>1</td>
<td>0.280</td>
<td>0.086</td>
</tr>
<tr>
<td>Unemployed</td>
<td>25807</td>
<td>0</td>
<td>1</td>
<td>0.279</td>
<td>0.085</td>
</tr>
<tr>
<td>Old (&gt;35 years)</td>
<td>25807</td>
<td>0</td>
<td>1</td>
<td>0.497</td>
<td>0.447</td>
</tr>
</tbody>
</table>
6 Method

6.1 Causal inference

Causal inference analyses are commonly used in studies investigating health, society, and human behavior. In simplest terms, the causality model proposes that a causal effect is the difference between an outcome when a person is exposed or treated, and the hypothetical outcome of the very same person, had it not been exposed, i.e. the counterfactual. Since it is obviously impossible to observe the hypothetical outcomes, researchers seek the best observable comparison to substitute the unobservable counterfactuals (Varian, 2016; Pearl, 2009). In context with the thesis, the theory of causality is relevant due to the causal question: “What is the effect, $Y$, of a legalized intervention, $D$?”. Hence, the causal variable of primary interest is $D$, and the causal effect to be estimated, is the effect of $D$ on $Y$ (Pearl, 2009).

In order to use the basic causal model, no simultaneous interaction of $X_i$, on $D$ and $Y$, is allowed. The basic causal model is given by (Pearl, 2009):

\[ \begin{align*}
\text{Cause} & \quad \text{Effect} \\
(D) & \quad (Y) \\
& \quad (\epsilon_i)
\end{align*} \]

where $D$ is a dummy variable for whether the individual has received the “treatment” or not. $X$, defines the exogeneous covariates, and $\epsilon$ is the error term of the model (Pearl, 2009).

6.2 Logistic regression

In causal research with an outcome variable concerning failure (0) or success (1), i.e. a dichotomous, or binary outcome variable, the logistic regression method is a powerful analytical technique. The method discloses the included covariates’ impact on the outcome variable (Peng et al, 2002).
Logistic regressions are easily interpreted by presenting them as odds ratios. A value smaller than one for the covariate explains a decrease in the probability of $Y=1$. A value greater than one explains an increased probability of $Y=1$, and odds ratio = 1 explains that the covariate does not affect the probability of $Y=1$ (Szumilas, 2010).

The causal multiple logistic regression is given by:

$$Y = \ln \left( \frac{\pi}{1-\pi} \right) = \beta_0 + \beta_1 D_1 + \beta_2 X_2 + \beta_3 X_3 + \ldots + \beta_k X_k + \epsilon_i,$$  \hspace{1cm} (5.1)

where $\pi$ is defined as the probability that $Y=1$. $\beta_0$ is the $Y$ intercept, and $D$ explains whether the individual is treated or not. $X_k$ describe the independent variables; married, student, money left for savings, higher education, unemployment, children in household, immigration, old (>35 years), and infertile. $\beta_k$ is the coefficient of these independent variables, presented as odds ratio (Peng et al, 2002).

### 6.3 Matching

When investigating if causal inference is present, experimental data, i.e. randomized control trials (RCTs) are viewed as the golden standard. An RCT consists of people randomly allocated to either a group who receives the treatment, or a group who does not receive it. In this context, an RCT would serve to randomly allocate individuals into groups with legalized and illegal oocyte donation (Garcia-Huidobro & Oakes, 2017). Because RCTs allow the researcher to keep all other background variables constant, the relationship between cause and effect is disclosed independently of assumptions concerning this. Hence, randomization reduces selection bias (Stuart, 2010). However, because randomization is expensive, only evaluates one effect at a time, requires follow-ups and is impossible in many situations due to unethical issues, observational data are commonly applied in causal inference analyses. With observational data, as in this case, one sample of individuals that already receive the treatment, and one sample of individuals who do not, are compared. One limitation with observed data is selection bias, because the individuals are not identical in the two groups. (Garcia-Huidobro & Oakes, 2017).

To reduce selection bias in observational data, matching is described as a powerful technique. Matching is defined by Stuart (2010, p. 1) as “any method that aims to equate or "balance" the distribution of covariates in the treated and control groups”. When estimating the causal
effects using observational data, it is desirable to replicate a randomized experiment, by obtaining treated and control groups with as similar covariate distribution as possible. This goal can often be achieved by choosing matched samples from the treated and control groups, and thereby reduce bias due to the covariates, $X_i$. Some major preparations of the data are required before the matching is performed (Stuart, 2010; Garcia-Huidobro & Oakes, 2017).

The first step in matching involves determining which variables to include or not. It is important to include all covariates assumed to be relevant for $Y$, and there is little cost of including covariates, that are in fact not relevant. Excluding important covariates is however very costly in terms of selection bias (Stuart, 2010).

The distance measure of the covariates should then be defined, which explains the degree of closeness required to determine if individuals are eligible as matches for one another. There are several methods to define this closeness of the individuals. The Mahalanobis distance measure (MDM) is commonly used, but the method has certain limitations. The covariates should be continuous, normally distributed, and preferably no more than eight. If the covariates nevertheless are categorical, the distance measure can be applied by converting the categorical variables into binary indicators. The exact distance measure (EDM) requires a perfect match of individuals from the treated group and the untreated group, which makes the distance measurement ideal in many ways. However, by requiring an exact match of treated and untreated individuals, the chance of ineligible matches increases, which might cause a greater extent of bias, than by using the inexact measure, MDM (Stuart, 2010; Garcia-Huidobro & Oakes, 2017).

The Distance, $D_{ij}$ between individuals $X_i$ and $X_j$, is given by:

$$MDM: D_{ij} = (X_i - X_j)' \Sigma^{-1} (X_i - X_j)$$  \hspace{1cm} (5.2)

In the second step, a matching method is implemented. There are several methods available in matching. The nearest neighbor matching method is a commonly applied approach when the treatment effect with observational data is investigated. This method compares a treated individual with the closest untreated individual in the dataset. The individuals are matched based on k:1, i.e. several treated individuals could be matched to one untreated individual (Cerulli, 2015; Stuart, 2010).
The nearest neighbor match is most commonly used to estimate the average treatment effect (ATE) or the average treatment effect of the treated (ATET). The ATE explains the mean difference in the outcome $Y$, for treated individuals $Y_1$, and untreated individuals $Y_0$, and describes the estimate on the outcome variable if the whole population were to be treated (Cerulli, 2015). This is given by:

$$\hat{ATE} = \frac{1}{N} \sum_{i=1}^{N} (\hat{Y}_i - \hat{Y}_0)$$  \hspace{1cm} (5.3)

The ATET explains the observed treatment effect of those actually receiving the treatment, and is given by:

$$\hat{ATET} = \frac{1}{N_1} \sum_{i=1}^{N_1} (Y_i - \hat{Y}_0)$$  \hspace{1cm} (5.4)

### 6.4 Confounding

In order to use the basic causal model as above, no interaction with both $D$ and $Y$, for the independent variables, $X_i$, is allowed. If this interaction is present, the independent variable is a confounder variable ($Q$). Confounding, also described as systematic error, is a major concern in causal studies because it leads to biased estimations of the effect. Hence, the presence of a causal effect could be stated, where it in fact is none existent (McNamee, 2005).

In this context, the country of the respondent determines the legal aspects of oocyte donation. Hence, country affects $D$. However, as described initially, the country of residence is also assumed to affect the outcome variable, $Y$, and the independent variables $X_i$, due to country-specific preferences. This makes $Q$ a confounder variable, and creates “back-doors” of $(D, Q, Y)$ and $(Q, Y, X_i)$, which could result in misleading results in the analyses. Therefore, before stating final conclusions about causal inference, variables such as $Q$, should be adjusted for. (Morgan & Winship, 2014).
To adjust for confounder variables, such as $Q$, the method of conditioning on a variable is helpful. This involves eliminating the influence of $Q$, on $Y$ and $X_i$ (McNamee, 2005). Basically, conditioning refers to introducing information about the confounding variable into the analysis by some simple calculated means. It is explained that the method of conditioning on a variable, induces overcontrol bias. Hence, by conditioning on $Q$, it blocks the flow of association along the path (Elwert & Winship, 2014).

### 6.4.1 Blocking the backdoor between Q and Xi

In order to block the backdoor between the respondent’s country and the independent variables, the probability of possessing the characteristics is calculated for each country.
For the Norwegian females aged 20-44, this gives a 50.1% probability of having higher education, 12.9% probability of being a student, 1.6% probability of unemployment, 40.1% probability of being married, 69.4% probability of having money left for savings, 63.9% probability of having children in the household already, and a 12.5% probability of being an immigrant. The variation of the probabilities in the different countries states that there is an impact of $Q$ on $X_i$. To adapt for this country-specific influence, a new variable is created in the dataset for each of the included independent variables. Hence, each covariate in the eight countries are assigned the probability of holding the characteristic, as tabled above. A new variable is generated to explain the difference between the observed value and the expected value. This is given by:

$$X_i = O(X_i) - E(X_i) \quad \text{(5.5)}$$

For a married Norwegian respondent, this gives:

$$X_{married} = 1 - 0.401 = 0.599$$

And for a Norwegian respondent that is not married, this gives:

$$X_{notmarried} = 0 - 0.401 = - 0.401$$
6.4.2 Blocking the backdoor between Q and Y.

However, Q still affects both D and Y, which makes it a confounder variable, even after the first backdoor is blocked. As described previously, the fertile females create a baseline of the expected intention to adopt in each country, because the intervention does not affect them. Hence, a weighted mean of the expected outcome is calculated by using the values from the descriptive statistics of the fertile females.

Table 5.2 Country-specific preference to adopt given by fertile females

<table>
<thead>
<tr>
<th>Country</th>
<th>Baseline: Intention to adopt</th>
<th>Summarized baseline: Intention to adopt</th>
<th>Country-specific preferences</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sweden</td>
<td>3.5%</td>
<td>2.1%</td>
<td>1.4%</td>
</tr>
<tr>
<td>France</td>
<td>3.5%</td>
<td></td>
<td>1.4%</td>
</tr>
<tr>
<td>Belgium</td>
<td>2.7%</td>
<td></td>
<td>0.6%</td>
</tr>
<tr>
<td>Czech Republic</td>
<td>0.9%</td>
<td></td>
<td>-1.2%</td>
</tr>
<tr>
<td>Bulgaria</td>
<td>1.6%</td>
<td></td>
<td>-0.5%</td>
</tr>
<tr>
<td>Norway</td>
<td>0.9%</td>
<td></td>
<td>-1.2%</td>
</tr>
<tr>
<td>Germany</td>
<td>1.3%</td>
<td></td>
<td>-0.8%</td>
</tr>
<tr>
<td>Austria</td>
<td>2.6%</td>
<td></td>
<td>0.5%</td>
</tr>
</tbody>
</table>

As with the independent variables, the calculated mean of country-specific preferences, creates a new variable in the dataset. Each outcome variable in each country are assigned the expected outcome, as tabled above. A new variable is generated to explain the difference between the observed value and the expected value. This is given by:

\[ Y_i = O(Y_i) - E(Y_i) \]  

(5.6)

For a Norwegian respondent who intends to adopt, this gives:

\[ Y_{\text{adopt}} = 1 - (-0.012) = 1.012 \]

And for a Norwegian respondent who does not intend to adopt, this gives:

\[ Y_{\text{not adopt}} = 0 - (-0.012) = 0.012 \]
By assigning independent and dependent variables weighted means, their relationship with the confounding variable $Q$ is blocked. This gives a model equal to the basic causal model, where the assumption of no interaction is fulfilled.

Fig. 5.3 Blocked relationship between $Q$ and $X_i$, and $Q$ and $Y$
7 Results

7.1 Logistic regression

The first step in the examination of a present effect is to investigate the independent variables’ importance on the outcome, presented as odds ratios. Two logistic regression analyses are performed. The first test includes both fertile and infertile females, with the intention to adopt as outcome.

Table 6.1 Logistic regression of the intention to adopt

<table>
<thead>
<tr>
<th>Independent variables</th>
<th>Odds ratio</th>
<th>Standard error</th>
<th>Z</th>
<th>P-value</th>
<th>95% confidence interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infertile</td>
<td>2.100</td>
<td>0.341</td>
<td>5.04</td>
<td>0.000</td>
<td>1.525-2.885</td>
</tr>
<tr>
<td>Old (&gt;35 years)</td>
<td>0.859</td>
<td>0.100</td>
<td>-1.30</td>
<td>0.195</td>
<td>0.682-1.080</td>
</tr>
<tr>
<td>Unemployed</td>
<td>1.180</td>
<td>0.195</td>
<td>0.99</td>
<td>0.320</td>
<td>0.851-1.633</td>
</tr>
<tr>
<td>Money left for savings</td>
<td>1.000</td>
<td>0.107</td>
<td>0.00</td>
<td>0.997</td>
<td>0.809-1.234</td>
</tr>
<tr>
<td>Higher education</td>
<td>1.273</td>
<td>0.136</td>
<td>2.30</td>
<td>0.021</td>
<td>1.037-1.578</td>
</tr>
<tr>
<td>Immigrant</td>
<td>2.227</td>
<td>0.301</td>
<td>5.91</td>
<td>0.000</td>
<td>1.707-2.903</td>
</tr>
<tr>
<td>Married</td>
<td>0.900</td>
<td>0.111</td>
<td>-0.85</td>
<td>0.396</td>
<td>0.706-2.903</td>
</tr>
<tr>
<td>Children in household</td>
<td>0.430</td>
<td>0.053</td>
<td>-6.73</td>
<td>0.000</td>
<td>0.336-0.550</td>
</tr>
<tr>
<td>Student</td>
<td>0.529</td>
<td>0.107</td>
<td>-3.15</td>
<td>0.002</td>
<td>0.355-0.786</td>
</tr>
<tr>
<td>Oocyte donation</td>
<td>1.677</td>
<td>0.188</td>
<td>4.60</td>
<td>0.000</td>
<td>1.345-2.090</td>
</tr>
<tr>
<td>Constant</td>
<td>0.023</td>
<td>0.003</td>
<td>-26.52</td>
<td>0.000</td>
<td>0.017-0.030</td>
</tr>
</tbody>
</table>

In this regression, there are several covariates included that affects the outcome variable significantly. Being infertile seems to double the intention to adopt, with a significance level of 0.000. Having a higher education or being an immigrant increases the probability to intend adoption significantly, while having children in the household or being a student, decreases the probability significantly. Being in the oldest age group (35-44 years) versus the youngest group (20-34 years) does not affect the intention to adopt significantly (P > 0.05).

Respondents in countries with legalized oocyte donation have a 68% higher probability to intend adoption than respondents in countries where it is not legal, with a significance level of 0.000. The constant is significant (p < 0.05) and describes that 2.3% of the female intend to
adopt a child. Due to the interest in characteristics that affects the infertile females’ intention to adopt, the same logistic regression is performed, by only including infertile females.

Table 6.2 Logistic regression of the intention to adopt among infertile females

<table>
<thead>
<tr>
<th>Independent variables</th>
<th>Odds ratio</th>
<th>Standard error</th>
<th>Z</th>
<th>P-value</th>
<th>95% confidence interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>Old (&gt;35 years)</td>
<td>0.465</td>
<td>0.152</td>
<td>-2.34</td>
<td>0.019</td>
<td>0.246</td>
</tr>
<tr>
<td>Unemployed</td>
<td>2.515</td>
<td>1.093</td>
<td>2.12</td>
<td>0.034</td>
<td>1.073</td>
</tr>
<tr>
<td>Money left for savings</td>
<td>1.869</td>
<td>0.629</td>
<td>1.86</td>
<td>0.063</td>
<td>0.966</td>
</tr>
<tr>
<td>Higher education</td>
<td>3.492</td>
<td>1.086</td>
<td>4.02</td>
<td>0.000</td>
<td>1.899</td>
</tr>
<tr>
<td>Immigrant</td>
<td>1.785</td>
<td>0.792</td>
<td>1.31</td>
<td>0.000</td>
<td>1.707</td>
</tr>
<tr>
<td>Married</td>
<td>1.055</td>
<td>0.355</td>
<td>0.16</td>
<td>0.873</td>
<td>0.545</td>
</tr>
<tr>
<td>Children in household</td>
<td>0.192</td>
<td>0.063</td>
<td>-5.01</td>
<td>0.000</td>
<td>0.100</td>
</tr>
<tr>
<td>Student</td>
<td>0.305</td>
<td>0.782</td>
<td>-1.10</td>
<td>0.272</td>
<td>0.036</td>
</tr>
<tr>
<td>Oocyte donation</td>
<td>2.394</td>
<td>0.782</td>
<td>2.67</td>
<td>0.008</td>
<td>1.262</td>
</tr>
<tr>
<td>Constant</td>
<td>0.040</td>
<td>0.018</td>
<td>-6.98</td>
<td>0.000</td>
<td>0.016</td>
</tr>
</tbody>
</table>

As in the first regression, concerning both fertile and infertile females, high age (>35 years) reduces the intention to adopt with more than 50%. However, by restricting it to infertile females, this influence is now statistically significant. It appears as the economic characteristics; education, money and unemployment, are more important when only investigating infertile females. The most unexpected effect is that the intention to adopt is more than twice as high in countries where oocyte donation is legal, with a significance level of 0.008. The expected effect is a decrease, due to the additional supply of fertility treatments.

### 7.2 Nearest neighbor match

However, as explained in the methodical framework, selection bias is a possible explanation of the results in the logistic regression, because the data is not randomized. To disclose possible country-specific preferences, the test is performed two times. First with only infertile females included, and in the next test with only fertile females. The matching is performed based on the independent variables; Married, student, higher education, unemployment, children in household, money left for savings and immigration status. Because the aim of
these analyses is to estimate the effect in Norway with a legalized intervention, the most entreatingly approach is to find the average treatment effect if the treatment was provided to the whole population, i.e. ATE. The distance measure is the Mahalanobis distance, which as described, is suitable in a test like this with binary values, and no more than eight independent variables.

The tests have 1,475 observations of infertile females, and 17,393 of fertile females, and their intention to adopt a child or take a foster child within three years. The treatment variable is legal oocyte donation (1,0).

Table 6.3 Treatment effect of infertile vs fertile females’ intention to adopt

<table>
<thead>
<tr>
<th></th>
<th>Coefficient</th>
<th>Standard error</th>
<th>Z</th>
<th>P-value</th>
<th>95% confidence interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infertile</td>
<td>0.025</td>
<td>0.011</td>
<td>2.28</td>
<td>0.023</td>
<td>0.004–0.047</td>
</tr>
<tr>
<td>Fertile</td>
<td>0.010</td>
<td>0.002</td>
<td>4.58</td>
<td>0.000</td>
<td>0.006–0.014</td>
</tr>
</tbody>
</table>

The test describes that infertile females have a 2.5% higher intention to adopt in countries where oocyte donation is legal, than in countries where it is illegal, a difference that is statistical significant (p < 0.05). By performing the same test on the fertile females, a baseline of females unaffected by the intervention is predicted. In this test, the intention to adopt is 1% higher in countries where oocyte donation is legal, compared to in countries where it is illegal. Even with the baseline taken into consideration, the effect on the intention to adopt is opposite of the expected one.

7.3 Nearest neighbor match adjusted for confounding

Due to the confounding variable $Q$ in the previous analysis, the same test is performed after adjusting for the influence of $Q$, on $X_i$ and $Y$. The baseline, described separately in the previous test, will now be included in the results. By adjusting the independent covariates, the respondents from countries with more equal probabilities of holding characteristics will have a higher probability of being matched. All the same variables are included in this exploratory test. However, both $Y$ and $X_i$ are now adjusted for the country-specific probability of holding the characteristics.
When testing for the intention to adopt in countries with legal and illegal oocyte donation with this explorative method, the result is still considered as statistical significant (p = 0.054), and the probability to intend adoption is still greater in legal countries. However, the difference is 0.4% less now, with an expected difference of 2.1%, due to the adjustment of the variables.

### 7.4 Discussion of results

The background of why this effect is relevant, is the ongoing debate in Norway concerning a possible change in the Norwegian legislation of oocyte donation. The NBAB claim that a possible effect of legalized oocyte donation is a reduced intention to adopt (Bioteknologirådet, 2015). Several methods have been applied to test for this. The most interesting result is that all the tests claim the opposite of the effect described by the NBAB.

The first approach was a logistic regression of the intention to adopt with both infertile and fertile females included. The test describes that infertile females have a twice as high probability to intend adoption, given by the odds ratio of 2.10. Several of the other characteristics affected the outcome. Being a student, or having children reduced the intention to adopt significantly. This corresponds with the description in fertility theory (Balbo, 2015), and was an expected discovery. Higher education increased the intention to adopt. This is explained as bilateral in the theory. Higher education decreases the need of a child to fulfill needs such as adulthood and power, but also increases the possibility of infertility due to a postponement of parenthood (Balbo, 2015; Kravdal & Rindfuss, 2008). In addition, in the study performed on ART and adoption as substitutes by MacCallum (2009), the conclusion was that higher education increased the possibility of choosing adoption over oocyte donation, significantly. Hence, it seems reasonable that the intention to adopt increases with higher education. The mothers’ age reduced the probability of adoption, a reduction that was not statistical significant. Independent of the significance level, there are several explanations of why high age causes a reduction in this intention. Due to the high demand for adoption, age

### Table 6.4 The intention to adopt, adjusted for confounding.

<table>
<thead>
<tr>
<th></th>
<th>Coefficient</th>
<th>Standard error</th>
<th>Z</th>
<th>P-value</th>
<th>95% confidence interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infertile</td>
<td>0.021</td>
<td>0.011</td>
<td>1.93</td>
<td>0.054</td>
<td>0.000 - 0.043</td>
</tr>
</tbody>
</table>
limits are severe, and the expected waiting time of a child, comprehensive. In some of the countries, females above the age of 40 years are not even considered as adoptive parents, because the absolute age limit of receiving a child is 45 years (Petersen et al, 2015; Högbacka, 2008). Finally, legalized oocyte donation increased the possibility to intend adoption with 68%. This effect is not unexpected. It is described in fertility theory how cultural factors might affect this decision (Adamson, 2009), which is the reason of why the baseline conducted by fertile females where created. The increase does not explain the effect of the intervention, since the regression primarily is performed on those unaffected by it.

The second logistic regression was limited to infertile females, and those who are expected to consider oocyte donation and adoption as possible substitutes. In this regression, the age seems to be of greater relevance. However, it still goes in the same direction, and describes how increased age reduces the intention to adopt. Unemployment still increases the probability of intending adoption, and this affect is greater by only investigating the infertile females. Due to the severe requirements of adoption seekers, one might expect the opposite. The fertility theory describes how unemployment reduces the probability of marriage, and therefore, the likelihood of children, due to economic uncertainty. However, the theory also describes how high income and education fulfill needs of power and adulthood, which is not achieved to same extent with unemployment (Balbo, 2015). The most aggregating finding is that the intention to adopt increases even more significantly in countries where oocyte donation is legal, by only including the infertile females. The analysis explains how infertile females are 140% more likely to intend adoption in countries where oocyte donation is legal, than in countries where it is illegal. If the hypothesis of a decreased intention to adopt with legalized oocyte donation is true, the probability should have decreased instead of increased, as shown in this analysis.

In the second test, a matching approach was applied to adjust for the individuals’ characteristics, and the characteristics’ influence on the outcome. The main finding in this test was the same as in the logistic regression. Infertile females have a 2.5% higher probability of intending adoption in countries where oocyte donation is legal, compared to in countries where it is illegal. However, the baseline probability created by the fertile females was 1% higher in legalized countries than in illegal countries. Hence, the comprehensiveness of the difference in the intention to adopt, might be due to the confounding variable Q.
To adjust for possible confounding, an exploratory method was presented, where possible backdoors created by Q, were blocked. Similar to the other test, the result of this test, was an increased probability to intend adoption in countries with legalized oocyte donation. The significance level of this test was 0.054, hence fairly close of being statistically significant. Because the baseline was adjusted for in this test, the difference between the two groups of infertile females, was 0.4% less than in the previous test, with a result of a 2.1% higher probability to intend adoption in legalized countries.

### 7.5 Possible explanations of the increase

The possible, but unknown effect of legalized oocyte donation described by the NBAB, was a reduction in the intention to adopt. However, all the tests claim the opposite. Some scholars suggest that a high level of tolerance within assisted reproduction, reduces the stigma of infertility. Hence, respondents in countries where oocyte donation is legal could be more susceptible for other alternatives, such as adoption (Pennings et al., 2016; Shenfield et al., 2011). One variable in the dataset from GGS is “the decision of having a child depends on: Other people think much worse of me”. By performing the same tests, as performed above, the fear of stigma within infertile females, was not different in countries with legal and illegal oocyte donation, and did not appear as a reason for this increase. However, one should be aware of this as a possible cause.

The countries’ reimbursement system of IVF is described initially, and could be a reason for why more female intend to adopt in the countries with legalized oocyte donation, since IVF and adoption also are considered as substitutes. The RAND experiment confirmed the relationship between cost to the consumer and utilization of health care services by showing that the demand for it declined if cost sharing rose from 0 to 25% of the total cost (Collins, 2002). It is therefore reasonable to argue that if the cost of IVF services is lower in countries with legalized oocyte donation, increased utilization of IVF services might be expected, which could reduce the intention to adopt according to the principle of substitution (Appleton & Pollak, 2011; Collins, 2002).

Cohen & Chen (2010) have performed a comprehensive study on the reimbursement level of IVF and its impact on adoption in the US. The study discloses how an increased reimbursement level of ART, amplifies the exploitation of it. However, their main finding
was that increased reimbursement, i.e. availability of IVF, similarly increased the intention to adopt.

Table 6.5 Coverage level of IVF and US adoptions (Cohen & Chen, 2010).

<table>
<thead>
<tr>
<th>Coverage level</th>
<th>Cycles of IVF</th>
<th>Adoptions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full</td>
<td>1.537*</td>
<td>0.0798*</td>
</tr>
<tr>
<td>Partial</td>
<td>-0.553*</td>
<td>0.0240</td>
</tr>
<tr>
<td>Non</td>
<td>-0.379*</td>
<td>0.0008*</td>
</tr>
</tbody>
</table>

This coheres with the description of two goods as complements, where increased demand for one of the goods, also implies increased demand for the other good (Stiglitz & Walsch, 2006).

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1 Table 6.5 from Cohen & Chen (2010, p. 552). The outcome is measured per 1000 women, aged 20-44 years. * explains statistical significance (p < 0.05).
Further, Cohen & Chen (2010) performed an interrupted time design in the US, by investigating the effect of ART-coverage implementation in the health insurance, and its effect on adoption. The result was the same as in the table above. Increased availability of ART, also increased the adoption rate.

Fig 6.1 Adoption rates with full coverage vs no coverage of IVF (Cohen & Chen, 2010).

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2. Fig. 6.1 from Cohen & Chen (2010, p. 564).
The underlying cause of why the countries social security system in relation to IVF was so comprehensively investigated initially, was to disclose possible inequalities between the countries, and to avoid biased results due to IVFs impact on adoption. It is off course a possibility that the increase in the intention to adopt disclosed in the analyses, is a result of differences in the countries’ availability of IVF. However, the extent of state support of IVF in the countries included in this study, is not so different in many ways. Their support varies from full reimbursement in Belgium and France, to 40% in Bulgaria. In Germany, 50% of the costs of IVF are reimbursed, and Sweden have a public coverage level of 60% (ESHRE, 2017a). Because all the countries included in this study, require a medical condition for reimbursement (Brigham, Cadier & Chevreul, 2013), the infertile females are the interest here.

Table 6.6 Reimbursement level of IVF, and the intention to adopt.

<table>
<thead>
<tr>
<th>Country</th>
<th>Public coverage level (IVF)</th>
<th>Infertile (intention to adopt)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Legal oocyte donation</td>
<td></td>
</tr>
<tr>
<td>Sweden</td>
<td>Partial</td>
<td>6.2%</td>
</tr>
<tr>
<td>France</td>
<td>Full</td>
<td>3.9%</td>
</tr>
<tr>
<td>Belgium</td>
<td>Full</td>
<td>5.7%</td>
</tr>
<tr>
<td>Czech Republic</td>
<td>Partial</td>
<td>3.6%</td>
</tr>
<tr>
<td>Bulgaria</td>
<td>Partial</td>
<td>3.4%</td>
</tr>
<tr>
<td></td>
<td>Illegal oocyte donation</td>
<td></td>
</tr>
<tr>
<td>Norway</td>
<td>Partial</td>
<td>2.2%</td>
</tr>
<tr>
<td>Germany</td>
<td>Partial</td>
<td>1.1%</td>
</tr>
<tr>
<td>Austria</td>
<td>Partial</td>
<td>4.1%</td>
</tr>
</tbody>
</table>

By comparing the reimbursement level of IVF with the intention to adopt, there is no clear decrease in the intention to adopt with increased reimbursement level. For instant, Sweden and Germany are fairly equal in the reimbursement-level of IVF (ESHRE, 2017a). Nevertheless, the intention to adopt is 5% higher in Sweden than in Germany.

Cohen & Chen (2010), and Appleton & Pollak (2011) describe two main reasons of why adoption rates do not decrease, and may even expand, with amplified supply of fertility treatments.
1. The individual prefers oocyte donation, and do not want to adopt.

With legalized oocyte donation, it is expected that more females opt for treatment, but not surprisingly, it also increases failed cycles. Cohen & Chen (2010) explain the increase in adoption to be a result of the reinforced desire of a child, due to failed cycles with ART. Further, they describe how this leads infertile females who otherwise would have remained childless, to adoption.

According to the decision theory, this explains that the female’s original preferences were given by:

\[ NB(A) > NB(B), \text{ and } NB(C) > NB(A). \]  

(7.1)

where \( A = \) Childlessness, \( B = \) Adoption, and \( C = \) Oocyte donation. However, due to failed attempts with oocyte donation, her new preferences are given by:

\[ NB(A) < NB(B) \]  

(7.2)

According to the decision theory, a rational individual is expected to have consistent preferences. However, the theory, and the results from the tests, indicate that failing ART change individual’s preferences. As explained by Rapoport (1998), violations of consistent preferences are by no means uncommon, because individuals not always behave rational, as expected in normative decision theory.

2. The individual prefers oocyte donation, but wants to adopt if it fails

Furthermore, the monetary costs of failed ART cycles could be extensive for the females. A legalized intervention is expected to reduce the monetary costs, because the females are derogated from travel costs and time off from work (Cohen & Chen, 2010). Hence, if they fail with oocyte donation, they have more remaining money of their budget constraint to use on adoption (Cohen & Chen, 2010; Appleton & Pollak, 2011).

As explained initially, one out of two females opt out of ART (IVF and oocyte donation) before they accomplish to have a child (Wade et al, 2015). Hence, the two possible explanations described above, are expected to arise a rather wide-ranged number of infertile individuals. Thus, it is not unlikely to be the explanation of why the effect of the intention to adopt, is opposite of the expected one.
7.6 Limitations

As explained throughout this thesis, there are several limitations of this study. The available data does not cover any legal shifts, due to the cross-sectional aspects of it. Cross-sectional data differs from longitudinal data, in which longitudinal data traces the respondent’s intention to adopt through time (Anaby et al, 2014). With longitudinal measurements from before and after the intervention, the impact of the confounding variable $Q$, might have been of less importance on the outcome. However, because the data contains the variable infertile, I have tried to adjust for confounding in the best possible way, by creating a baseline of fertile females unaffected by the intervention. Further, the influence of IVF on the intention to adopt might impact the results, because the eight countries are expected to differ in their availability of it (Collins, 2002). I have taken this into account, by describing the availability of IVF thoroughly in the eight countries, and the result is a difference that seems to be smaller than first expected. However, if the data were available as longitudinal time-series, the influence of oocyte donation on adoption, could have been disclosed in a better way, without the same possible impact of IVF.

The result is not as I assumed initially, and it is the opposite of what the NBAB describe as a possible effect. Studies performed previously, have different explanations of why this result might in fact be the correct effect. Factors such as stigma, the availability and reimbursement-level of fertility treatments, and increased number of failed cycles with enhanced exploitation of ART, are mentioned as some of them. The latter argument appears as the most probable in this case, since the other factors are investigated, without any persuasive findings. Because the available data on performed cycles of oocyte donation is inadequate, I cannot state with certainty that failed cycles are correlated with an increased intention to adopt. Nevertheless, it seems like a credible argument, that should be investigated more thoroughly before final conclusions are drawn.

A final limitation is the lack of investigation on the influence of oocyte donation on adoption, which to the best of my knowledge, has not been investigated previously. This makes the unexpected result more difficult to explain. However, because IVF and oocyte donation is equal in many ways, and both appear as substitutes to adoption, I find it reasonable to support the findings, with the previous studies performed on IVF and adoption.
8 Concluding remarks

The aim of this study was not to encourage the Norwegian Ministry of Health and Care Services to change the legislation that forbids oocyte donation, but to increase awareness of the possible substitutive effect between adoption and oocyte donation, an effect characterized by uncertainty. By examining the data from the GGS from 2008, the effect seems to be opposite of the expected one. With the study performed by Cohen & Chen (2010), and Appleton & Pollak (2011) as support to the findings, it indicates that increased availability of ART, do not necessarily reduce the demand for adoption, and may even have the contrary effect.

Fertility treatments seem to have a substitutive effect as expected, where individual chooses one treatment over the other based on expected net benefit. However, the tests, and former studies indicate that they appear as complements, where a higher demand for ART increases the demand for adoption, due to the high rate of failed cycles and the change in the females’ preferences. Based on these findings, it does not appear that a decrease in the adoption rate is an effect the Norwegian Ministry of Health and Care Services need to provide concern, before they decide upon the legislation of oocyte donation.
References


GGP. (2017a). About the Gender & Generation Program. [updated 2017; cited 2017 01.02]; Available from: http://www.ggp-i.org/about

GGP. (2017b). About the Gender & Generation Program. [updated 2017; cited 2017 01.02]; Available from: http://www.ggp-i.org/data


Helsedirektoratet. (2015c). Nøkkeltall for helse- og omsorgssektoren. [updated 2016; cited 2017 01.02]; Available from: https://helsedirektoratet.no/Lists/Publikasjoner/Attachments/889/N%C3%B8kkeltall%20for%20helse-%20og%20omsorgssektoren.pdf


