Sibling Gender Effects on Voting Behavior and Attitudes

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Abstract

This paper examines how growing up with a brother versus a sister impacts voting behavior and attitudes. Research on sibling gender effects is marked by endogeneity concerns since the gender of firstborns influences the probability that parents with certain beliefs and preferences will continue to have children. Estimated effects of sibling gender from older siblings on life outcomes of younger siblings are therefore biased. To avoid self-selection of parents into those with female firstborns and those with male firstborns, the analysis is performed on a sample of Australian dizygotic twins. Because I expect gender role development to be an important driver of sibling gender effects, the estimations are also performed on a subsample which only includes twins with a religious family background. Though statistically significant effects were not established in the general sample, I find that men with religious family backgrounds who have brothers are less likely to vote for the Liberal party and more likely to vote for the National party than those who have sisters. Some contextual analysis presents the following facts. Religious women are shown to vote significantly more often for the Liberal party than men independent of their religiosity and the Liberal party has enacted some female-friendly policies at the time. The likelihood of men with sisters to vote for the Liberal party could therefore be driven by an improved understanding of the opposite sex. Finally, sibling gender effects are found for attitudes towards various topics in both the general and religious samples.

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1 Introduction

Social sciences and economics are strongly interested in the determinants of voting behavior such as rational choice, identity and ideology.¹ In addition to that, the family is a focal point of research on voting behavior since the formation of political beliefs is thought to result from social interactions, be it in the family, with peers, at school or in any other social context (Niemi & Sobieszek, 1977). Political socialization research has therefore focused extensively on the influence of parents on their children's voting behavior and a few studies have used family structure or composition as predictors for voting behavior (Charnock, 2006; McVeigh & Diaz, 2009; Washington, 2008).²

However, the potential influence of growing up with either a brother or a sister has received no attention at all. This is perhaps surprising, considering that siblings are a key component in childhood socialization and remain influential throughout adulthood. Growing up with a brother likely accounts for a completely different family dynamic than growing up with a sister. On top of that, the opinions of those who are closest to you greatly influence the formation of your own opinions. If women and men inherently have different political preferences due to distinct interests, the sex of one's sibling could have a direct influence on a person's own political beliefs.

While the effects of sibling gender have not been investigated for voting behavior, sibling gender effects have been found with regard to other outcomes (Rao & Chatterjee, 2018; Peter, Lundborg, Mikkelsen & Webbink, 2018; Cools & Patacchini, 2017; Brenøe, 2017). Peter et al. (2018) found that sibling gender composition had an effect on earnings, education and family formation. The authors observe that having a same sex sibling had positive effects on earnings for both men and women and they provide additional evidence about one of the responsible mechanisms. Namely, same sex siblings appear to make use of each other's labor market networks and thereby avoid unemployment. Rao and Chatterjee (2018, p.1739) present findings that confirm the existence of this mechanism.³ These studies are in line with observations of persistent sex segregation in the labor market (Singh & Peng, 2010). On top of that, sibling gender composition appears to be a driver for sex segregation. Brenøe (2017) found that having a younger opposite sex sibling increases the probability of enrolling in a gender-stereotypical field of education. For women, it appears that having a younger brother instead of sister makes them eleven percent less likely to complete an education in Science, Technology, Engineering and Mathematics (STEM). However, Cools and Patacchini (2017), who found that women with any brothers earn about 10 percent less than women with no brothers when they are in their late 20s and early 30s, showed that less than one percent of the total effect can be accounted for by differences in education and occupation. When women in STEM occupations were excluded from the analysis, the effect of having brothers instead of sisters remained close to unchanged. The role that sibling gender plays in the formation of gender identity is brought forward as the causal driver for differences in future economic outcomes in their research.

In recent decades, research has begun to explore the role of identity and gender in explaining economic outcomes and voting behavior (Akerlof & Kranton, 2000; Keely & Tan, 2008). According to Akerlof and Kranton (2000) 'identity is fundamental to behavior [and] choice of identity may be the most important "economic" decision people make' which, in turn, makes limitations on identity

¹Hindmoore (2010) extensively discusses the role of rational choice in political science. The work of Akerlof and Kranton (2000) illuminates the role of identity in economic and political decision making. Keely and Tan (2008) as well as Ben-Bassat and Dahan (2013) empirically investigate and confirm this role of identity with regards to political preferences. Finally, Adhia (2013) highlights the importance of nation-wide ideological change for voting behavior.

²Political socialization literature is often used as a framework for studies that investigate political involvement (Barnes & Hope, 2017; Clarke, 1973).

³In both papers, women's wages do not seem to be affected by the gender of their sibling. Instead, the increase in overall earnings found by Peter et al. (2018) for women pertains to their ability to avoid unemployment. Rao and Chatterjee (2018) provide evidence that while sisters are helpful for brothers in finding employment, brothers do not seem to be very helpful to sisters in this regard. Indeed, Peter et al. (2018) find that brothers do not increase each other's earnings as much through lowered rates of employment but seem to have better paying jobs. The authors propose the possibility that this is a symptom of rivalry between brothers. Contrarily, Rao and Chatterjee (2018) suggest that brothers boost each other's earnings by assisting each other in their job search for better paying jobs.

choice an important determinant of individual economic well-being. Formation of identity starts as early as limitations present themselves and the sex with which you are born can be considered one such limitation.⁴ As such, a women's preference for higher income redistribution such as was found by Keeler and Tan (2008), and Washington (2008) could reasonably be expected a direct consequence of the fact that women earn less than men (Singh & Peng, 2010; Whitehouse, 2003).

The gender of a sibling in relation to voting behavior might have received little attention up to now because the effect of gender on voting behavior has presented researchers with quite a puzzle. In many post-industrial western societies, women seem to have an interest in voting for left-wing parties which can be explained by their lower levels of income and lack of financial security. However, in most of these countries women used to vote more for right-wing parties than men did before the 1980's (Inglehart & Norris, 2000). The directions of gender gaps on a right to left-wing political spectrum differ over time and across countries. Gender equality in the labor market and at home, increased divorce rates, and decreased fertility rates have all been proposed drivers of this trend and country differences (Inglehart & Norris, 2000; Iversen & Rosenbluth, 2006; Emmenegger & Manow, 2014; Finseraas, Jakobsson & Kotsadam, 2010; Edlund & Pande, 2002). Though the development of gender roles evidently has a large role to play in the understanding of voting differences between men and women, individual gender development has not been an extensive subject of investigation in this matter. Traditional gender roles are likely learned at a very young age. Iversen and Rosenbluth (2006, p.18), therefore refer to childhood socialization as a promising field of inquiry.

Sibling gender can be hypothesized to affect attitudes in two ways. Firstly, having an opposite sex sibling could imply more differentiated or gendered parenting (which would imply having each of the parents spend most time with the child of their respective sex) and induce a stronger gender development. Gender development in childhood should cause opposite sex twins to assume or at least report attitudes that are gender stereotypical. Secondly, having an opposite sex sibling could induce a better understanding of the other gender, inspiring beliefs that are more in favor of the opposite sex. Having an opposite sex sibling could provide a person with new information about the world from the perspective of the other gender and consequently provide him or her with a different set of moral standards. Additionally, if that person has an interest in their sibling's well-being, they could potentially alter their voting behavior in favor of their sibling's interests.

Gender development is found to be influenced by sibling gender in recent studies. I will refer to this from now on as the 'gender role mechanism'. Rao and Chatterjee (2018) showed that a higher fraction of male siblings results in lower cognitive stimulation and less emotional support for girls in middle childhood and early adolescence. Additionally, their findings show that women with brothers have more traditional attitudes with regard to their role as a wife. Specifically, women who predominantly have brothers have a tendency to agree that women are happier in traditional roles and disagree with the idea that working wives are feeling more useful and that men should share housework. Brenøe (2017) has provided evidence for gender-specialized parenting among parents with mixed sex children. Mothers spend relatively more time with their daughters while fathers invest more time in their sons. This does not only explain how girls with an opposite sex sibling are relatively de-motivated to try and succeed in a STEM education, but also explains why these girls would identify more strongly with a traditionally female role pattern. More evidence for the gender role mechanism has been presented by Cools and Patacchini (2017), who have shown that brothers are most likely to affect women's wages in families that are religious, have higher socioeconomic status and contain two parents. When it comes to attitudes, they find that women with brothers have a greater focus on family-centered behavior including the importance of marriage, being in a committed relationship, and presence of and intention to have children. Their index of traditional gender roles accounts for more or less 20 percent of sibling gender effect on women's future earnings.⁵ Conclusively, the variations in the sex composition of siblings in

 $^{^{4}}$ Gender was one of the main identity markers that Akerlof and Kranton (2000) exploited in illustration of their model.

 $^{{}^{5}}$ To construct the index the authors asked questions about their behavior (for example about work, family, being married etc.) as well as attitudinal questions (for example how important it is to get married someday). The presence of children, family interruptions to work and family interference with work have the strongest explanatory

childhood provide some natural variation in family contexts and gender development. Because the future outcomes and beliefs of especially women appear to be significantly affected by the gender role mechanism, I also expect this mechanism to be an important driver for sibling gender effects on voting behavior.

The second channel through which opposite sex siblings could have an impact on voting behavior and attitudes relates to a potentially improved understanding of the other sex. Such an influence should cause opposite sex twins to adopt views that are more favorable towards the other gender. From now on, I will refer to this phenomenon with the term 'opposite-sex understanding'. Though I am not aware of any evidence for the existence of this type of effect from the gender of a sibling, the gender of a child has been observed to impact beliefs and voting behavior of parents. Warner and Steel (1999) found that US parents who parent only daughters have increased support for feminist policies. Similar conclusions were drawn with observations on Canadian parents (Warner, 1991). Washington (2008) found that (male) American legislators who father daughters vote more in favor of feminist causes than those who do not father daughters. Whether an improved opposite-sex understanding among siblings affects voting behavior has not yet been investigated. If siblings are similarly influenced by the gender of their sibling as that parents are influenced by the gender of their child, an effect on attitudes and perhaps even voting behavior could be expected.

In this research, other determinants of voting behavior are also investigated. This is mainly done to provide a contextual interpretation of potential sibling gender effects on voting behavior. For example, if I were to find that a woman who grows up with a sister has a higher likelihood to vote for a certain party, I would like to know what drives people to vote for that party in general and if it represents a gendered interest. Some valuable information can be obtained by looking into the campaigning that parties do. Another way of determining whether someone votes more in favor of a 'women's party' is by investigating whether women in general place votes to such a party. In an attempt to determine whether there are gendered interests in voting for specific parties, I investigate differences in the voting behavior of men and women. However, gender has been found to relate to political preferences in a complex manner. Understanding how gender relates to political choice therefore requires an in depth study of the country in question. Specifically, I will therefore elaborate on: the literature that concerns gendered voting behavior, the observed differences between voting behavior of the Australian men and women in the dataset used in this research, and how these findings relate to the societal and political context of Australia.

Research on sibling gender effects is marked by endogeneity concerns. The reason is that the gender of firstborns influences the probability that parents with certain beliefs and preferences will continue to have children. For example, parents with a preference for girls will be more inclined to continue with having kids if their firstborn is a boy. If preferences for boys or girls are also related to different parenting styles and other attitudes, this process will result in different family background characteristics for those who have older sisters than those who have older brothers. To identify the causal effect of sibling gender in this research, the estimations are performed on a sample of dizygotic twins. Since the gender of twins is determined concurrently, no self-selection of parents based on the gender composition of their children takes place and a participant with a twin brother does not come from a family with different background characteristics than a participant with a twin sister.

I obtained this sample from Australian survey data that was collected in the year 1990 on monozygotic and dizygotic twin pairs who were born between 1964 and 1970. The study contains questions on; family, marriage, relationships, occupation, health, personality, smoking, drinking, voting, religion and attitudes. For this research the variables of interest concern attitudes and voting preferences.

Besides estimation results of sibling gender effects on the full sample of Australian dizygotic twins, I will also present estimation results on a subsample of individuals, namely those who

power for the index. It seems that deeds speak louder than words. In fact, sex-typing appears to be the most evident in children's interests and activities while to a lesser extent visible in personality and attitudes (McHale et al., 1999). The presence of traditional role patterns are therefore most successfully captured by measuring out what activities men and women undertake.

have a religious family background. Cools and Patacchini (2017) found that the statistically significant impact of sibling gender on future earnings for women was driven by a subsample that was characterized by religious, two-parent families with mothers who obtained a college degree. A significant effect of having brothers was absent for a subsample of women who were not religious. Anticipating on the possibility that sibling gender effects on voting behavior are perhaps also driven by religious individuals I therefore presents results for a 'religious sample'.

I find statistically significant effects of sibling gender on the voting behavior of men with a religious family background. Also I find statistically significant effects of sibling gender on a range of attitudes towards specific topics for men and women.

The remaining of this thesis is structured as follows. Section 2 discusses the identification strategy and employed analytic methods. Section 3 provides more information about the origin of the data and construction of variables in the analysis. Section 4 and 5 present additional analyses on (gendered) attitudes and voting behavior with the aim of providing a context for the interpretation of sibling gender effects. The main results are presented in section 6 for sibling gender effects on voting behavior and attitudes. Section 7 provides a discussion and brings the paper to a conclusion.

2 Identification strategy

The influence of sibling gender is the effect of interest in this research. In line with previous research, the effect is investigated separately for men and women since sibling gender can be expected to affect the voting behavior or attitudes of men and women differently (Peter, Lundborg, Mikkelsen & Webbink, 2018; Cools & Patacchini, 2017; Brenøe, 2017).

To obtain a causal effect, it is not accurate to estimate the influence of having a brother or sister on the attitudes of just any kind of brother or sister. The reason is that the sex of younger siblings is not independent from the sex of older siblings since it is in all likelihood related to the parents' preference for having boys, girls, or a certain mix of the two. Parents can namely decide to stop having children when they happen to obtain the desired sex composition of their children and otherwise they can decide to continue having them until they obtain children of the desired sex. Emperically it has been found that parents with two boys or two girls are more likely to have additional children than parents who have a child of each sex (Angrist & Evans, 1998; Hank & Kohler, 2000; Angrist, Lavy & Schlosser, 2010; Black, Devereux, Salvanes & May, 2005). Since parents' preferences for a certain sex composition of their offspring is likely related to their attitudes, parenting styles, social class and other family background variables, an estimation of sibling gender effects might suffer from omitted variable bias. Therefore, in order to circumvent this bias and determine the causal effect of sibling gender on voting behavior and preferences; a sample of dizygotic twins is used. The gender of the first twin is determined independently from the gender of the second twin and vice versa in case of dizygotic twins. Twinning can therefore serve as a natural experiment when it comes to any effects that sibling gender might have.

Dizygosity entails that the genetic material of the twins are not more alike than the genetic material of normal siblings. Monozygotic twins, on the other hand, share almost all of their genetic material and are therefore close to identical in their appearance and characteristics. Monozygotic twins are excluded from the analysis because of the risk that not only the effects of growing up with a same sex sibling would be measured but also effects that might pertain to growing up with someone who is close to identical to yourself, also referred to as the 'zygosity bias'.⁶

The success of this identification strategy depends on the assumptions that the sex of a dizygotic twin is randomly assigned and that the gender of the co-twin does not cause attitudinal differences in utero. Insofar, I have only found evidence challenging the second assumption. Gielen, Holmes and Myers (2016) provide evidence strengthening the argument that biological differences between the behaviors of men and women could be drivers for the gender wage gap and that the hormones

 $^{^{6}}$ Controlling for monozygosity could solve that problem, but also unnecessarily complicates the comparison. After all, monozygotic twins are always of the same sex due to their shared genetic material which would cause the zygosity bias to be added to the measured effect of having a same sex sibling.

which are arguably responsible for these differences can be transferred to a twin (same sex or opposite sex) in utero.⁷ The proposed mechanism through which this would occur is the behavioral attitudinal difference that the hormones bring about which could bias the estimation results in this research. However, it must be noted that Gielen et al. (2016) employed a difference in difference strategy, comparing twins to closely spaced siblings. Justifying the use of closely spaced siblings as a good comparison, they perform the analysis with a set of control variables with which they account for birth order effects. Unfortunatly, this does not do away with the earlier described selection bias since the younger siblings are still being compared as if the sex of their older sibling is random while this is not the case.⁸ Other studies have made use of an identification strategy in which the effect of the gender of a younger sibling is estimated on the outcomes of an older sibling (Peter et al., 2018; Brenøe, 2017). This strategy should be free from bias because even if the younger sibling can still be considered randomly assigned wherefore the effect of the younger sibling is estimated on the older sibling, the gender of the younger sibling is estimated on the older sibling the younger sibling is estimated by the gender of the older sibling, the gender of the younger sibling is estimated on the older sibling.

Hence, from here we proceed with the assertions that the sex composition of a dizygotic twin pair is randomly assigned and that the gender of a twin does not affect the attitudes of the co-twin in utero. If these propositions hold, β_1 ought to capture the causal effect of growing up with a certain sibling gender on voting behavior and attitudes in the following equation.

$$A_{if} = \alpha + \beta_1 S S_{if} + \beta_2 X_{if} + U_{if}$$

Where A_{if} denotes the voting outcome or a score of an attitudinal variable from individual i from family f. Since sibling effects vary between families but might not vary within a family, the standard errors are clustered on the family level. SS_{if} is a dummy variable that takes on the value 1 if the person in question has a same sex co-twin. X_{if} denotes control variables comprising birth year fixed effects, one's social class, employment status, education level and religiousness of the parents.⁹

The estimations in my research call for the application of different types of statistical models that are widely used in regression analysis. For the estimation of sibling gender effects on voting behavior, I will make use of logistic regression analysis because I investigate the effect of having a same sex sibling on the probability of voting for a particular party. Logistic regression analysis is used when the dependent variable represents a binary outcome. In this case that outcome represents: to vote or not to vote for that party (and thus vote for another). The estimation of sibling gender effects on attitudes is done with either the general linear model or ordered logistic regressions. As will be explained in the next section, the attitudinal variables in the survey required answers that were limited to three options with which the participant could indicate whether he or she disagreed, agreed or felt indifferent about the topic. Because these answers are of a discrete nature but still represent an ordered degree of agreeableness with the topic, ordered logistic regression applies. From these opinions, some general attitudes have been constructed. Because the resulting measurement of these general attitudes is of a continuous nature, the general linear regression mode will be employed.

⁷Prenatal testosterone shared in utero by a twin brother, they propose, is responsible for an increase in hourly wages for men with 1-2 percent while the effect that was found for women was not statistically significant.

⁸The authors provided a sensitivity analysis with only first-born closely spaced siblings and the findings were not statistically significant.
⁹A confounding factor that was not taken into account involves the presence and gender of older siblings. Older

⁹A confounding factor that was not taken into account involves the presence and gender of older siblings. Older siblings might influence the behavior of the twins directly since the twins might copy the older sibling, and indirectly, through differential parenting related to birth order. On top of that, the gender of an older sibling cannot serve as a control for the gender of that older sibling might have influenced the decision of the parents to continue with having children or not and again create a selection effect as we described before. Though the presence of older siblings as well as missing sibling information can be controlled for alike to what Peter et al. (2018) have done, the amount of missing observations is so high (from 25% for women with same sex co-twins up to 78% for men who have opposite sex co-twins) that instead, perhaps only the diligence with which the participants have been filling out the survey would be controlled for. For this reason, older sibling information will not be controlled for in the analysis.

3 Data

In Australia, 1990, the Alcohol Cohort 2 questionnaire (also called the 'yellow' questionnaire) was sent to 4269 twin pairs who were born between 1964 and 1970. The study was conducted by the Genetic Epidemiology, Psychiatric Genetics, Asthma Genetics and Statistical Genetics Laboratories Studies. The study contained questions on; family, marriage, relationships, occupation, health, personality, smoking, drinking, voting, religion and attitudes. For this research the variables of interest concern attitudes or opinions (that were asked with regard to 50 topics) and voting preferences. All the questions that concerned attitudes were answered with either a 'Yes', '?' or 'No'.¹⁰ Voting preferences were surveyed with the possibility of picking the following responses:

- Liberal Party
- Labor Party
- National (Country) Party
- Australian Democrat
- Other
- "None of your business!"

In order to interpret the political inclination of the participants, observations in which the participant answered 'Other' or 'None of your business' are not included in the analysis. The listed parties can be considered right-wing, left-wing, centre-right and centrist respectively. It must be noted that the Liberal Party and National Party have had increasingly similar views which even led to a merger into the Liberal National Party in 2008 in the Australian state, Queensland.¹¹ Table 1 provides more information about the views of the parties on this voting spectrum.

Table 1: Voting spectrum

Party	Position on spectrum	Views
Liberal Party	(1) right-wing	Promotes free markets and small government
National (Country) Party	(2) centre-right	Very close to those of the Liberal Party though with a strong focus on the protection of the agricultural sector
Australian Democrat	(3) centrist	Support of a progressive tax system, environmental aware- ness, direct democracy and free education
Labor Party	(4) left-wing	Standing up for middle and working class people, promot- ing educational funding, universal health care and labor market policies that aid workers

Extrapolating on the data in its original state, exploratory factor analysis is used to identify and create scores for latent variables, also called 'factors'.¹² The resulting factors represent underlying attitudes of the twins which can be used as dependent variables. Thus, instead of solely using the observed measures of opinions on isolated topics, it then becomes possible to study the effects of sibling gender on more general preferences that can turn out to be more meaningful. For example, an opinion about the death penalty could be seen as part of a general attitude with regards to law enforcement and a preference for modern art could be a sign of that a general predisposition towards the arts and culture.

From fifteen of the fifty attitudinal variables, scores for four general variables have been distilled which describe a person's attitude towards 'Humanism', 'Christianity', 'Unnatural reproduction' and 'Inclusivity'. Appendix I describes the process through which these scores have been obtained

¹⁰The attitude variables can be found in table A.1 in Appendix II.

 $^{^{11}}$ "Senator McGauran quits Nationals". 2006-01-23. Retrieved from https://www.theage.com.au/news/national/senator-mcgauran-quits-nationals/2006/01/23/1137864841636.html.; Liberal National Party (LNP). Retrieved from https://www.lnp.org.au/

 $^{^{12}}$ Factors are distilled with statistical techniques that are based on the relatedness between the original variables. The statistical method is put to use for variable reduction, the extraction of latent variables, theory confirmation and to further insight in the data.

in detail. The factor analysis that is used in this research to construct general attitudes considers all fifty attitudinal topics for simplification but eventually uses only a subset (fifteen) of them due to a lack of communality between the variables (see table A.14). Principal-Factor is used as the method of analysis in which four factors have been retained and to which an oblique Oblimin rotation has been applied. At this point, the factors can be interpreted and named based on their pattern of loadings. To facilitate interpretation, table 2 only displays the factor loadings higher than ± 0.30 . Factor loadings essentially inform about the strength with which the original variables relate to the newly constructed factors. The pattern is very clear and allows for a straightforward interpretation.¹³ For a more in depth explanation of the construction of these variables through factor analysis I refer the reader to the appendix.

Lable 2. Loadings and Obinini rotation	Table 2:	Loadings	after	Oblimin	rotation
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	Humanism	Christianity	Unnatural reproduction	Inclusivity
Legalised abortion	0.52			
Condom machines	0.38			
Legalised prostitution	0.46			
Voluntary euthanasia	0.48			
Evolution theory	0.44			
Bible truth		0.68		
Divine Law		0.55		
Church authority		0.62		
Test-tube babies			0.55	
Surrogate mothers			0.54	
Asian immigration				0.62
Death penalty				-0.49
Multiculturalism				0.55
Gay rights				0.45
Divorce				

Factor loadings smaller than ± 0.30 are surpressed

Most of the variables that load on the first factor emphasize individual freedom and because the positive loading of 'Evolution theory' on the factor indicates a naturalist approach to life, the combination of variables seems to match the following definition: "Humanism is an approach to life based on reason and our common humanity, recognizing that moral values are properly founded on human nature and experience alone." The first factor will therefore be named 'Humanism'.¹⁴ The second factor can be interpreted very easily and is called 'Christianity'. Also the third factor, though an odd subject, clearly describes someone's attitude towards 'Unnatural reproduction'. Finally, the fourth factor is more difficult to interpret. Nonetheless, the variables' loadings have one thing in common; namely that they seem to favor something that could be called 'Inclusivity'. In other words, someone scoring high on that factor believes that no matter how different you are, you always deserve a place around the table. To improve the interpretation, we would like to know how strongly these factors correlate. The factor correlation matrix (table A.18, appendix) exhibits these relationships between the factors and confirms that attitudes 'Humanism' and 'Christianity' correlate negatively. Besides that, humanists are generally positive about unnatural reproduction while Christians are more likely not to be. Finally, humanist views seem to coincide slightly with positive attitudes towards 'Inclusivity'. The factors were constructed with Thomson's regression method. Due to questionable normality of the data, replicability of the findings is not ensured (see figure 2).

 $^{^{13}}$ It appears that the variable 'Divorce' does not have a loading higher than 0.30 on any of the obtained factors but it does have loadings on the first three factors that are higher in magnitude than 0.133 which are thus statistically different from zero. It relates positively with 'Humanism', negatively with 'Christianity' and positively with 'Unnatural birth'.

 $^{^{14}}$ A quote by the Bristol Humanist group found on the page of the American Humanist Association.

Table 3 shows the summary statistics of the main dependent variables in the regression analyses. Since the regressions occur separately according to sex, voting behavior and the general attitudes are divided into four groups; males with opposite sex co-twins, males with same sex co-twins, females with opposite sex co-twins and females with same sex co-twins.

We are interested in the effect of sibling gender on the dependent variables described above. Since the estimations are done separately for men and women, the gender of the sibling is denoted in terms of whether it is the same sex as that of the twin who's voting behavior or attitude is investigated. Monozygotic twins are excluded from all the analysis. To this end, I have utilized the variable 'zygosity' which contains information on the twins' zygosity status and was constructed in a second survey which was held amongst the same survey participants in 1999 and 2000, the so called "OZ Twin89 interview". Values 1 and 2 of the measure represent monozygotic female and male twins respectively and these have been excluded from the analysis. Values 3 and 4 represent dizygotic twins from female and male twin pairs while values 5 and 6 represent dizygotic twin pairs of opposite sex.¹⁵ The validity of the zygosity variable is confirmed by seeking out twin pairs in the dataset and determining whether their reported genders match or not.¹⁶

The control variables that are included in the regressions include birth year effects, religiousness of the parents, employment status, education level and social class. Almost all of the respondents were born between 1964 and 1971. Only one was born in 1955, another in 1962 and two others in 1974. Since the number of observations for these birth years are so small, birth year fixed effects are not included as controls for these particular years. 1964 is considered the base year. The employment status the participants could indicate they currently had was limited to either being a student, being unemployed, working part-time, being a homemaker, working full-time and an 'other' category. For their education respondents could indicate what their highest level of completed education was. The survey gave them the choice between primary school (0-7 years), high school (8-12 years), high school (11-12 years), whether they obtained a diploma or were an apprentice, whether they went to college, obtained a university degree and finally whether they obtained a university postgraduate degree. I control for education with a dummy variable that takes value 0 when the highest level of completed education is either primary school, high school or having obtained a diploma/ being an apprentice. The dummy takes value 1 when someone is more highly educated, meaning they went to college, obtained an university degree or have a postgraduate degree. As for social class, survey respondents were able to report belonging either to the 'working class', 'middle class' or 'upper class'. Though the participants could have indicated that they do not know what class they belong to, this has not happened in practice. Also included is the religiousness of the mother and father. Religiousness is determined based on church attendance. Respondents that answered their mom or dad were attending church more than once a week, once a week or every month or so, are said to have religious parents. Mothers and fathers that attend church from rarely to once or twice a year are considered not religious.

 $^{^{15}}$ Values 5 and 6 are providing information about the birth order of the twin pair. A twin with zygosity value 5 is born from a dizygotic twin opposite-sex pair where the female is born first. A twin with zygosity value 6 is born from a dizygotic twin opposite-sex pair where the male is born first.

¹⁶Zygosity of twins is often determined based on questions such as the following question in the survey in this dataset: "Non-identical twins are no more alike than ordinary brothers and sisters. Identical twins, on the other hand, have such a strong resemblance to each other in stature, colouring, facial features, etc., that people often mistake one for the other, or say they are 'as alike as two peas in a pod'.. Having read the above statement, do you think you are: (1) Identical, (2) Non-identical." This method of zygosity determination has proven to be correct for over 95% of the twins in Sweden and Finland (Cederlof, Friberg, Jonsson & Kaij, 1961; Crumpacker, Cederlof, Friberg et al., 1979; Sarna, Kaprio, Sistonen & Koskenvuo, 1978). However, basing the zygosity of the twins only on this question would leave me only few observations. Since these twins have been interviewed repeatedly and many additional questions have been asked that aid in the determination of zygosity, more information has been incorporated in the measure of zygosity from the Twin89 dataset.

	OS co-twin	%	SS co-twin	%
Women				
Liberal	148	(48%)	204	(44%)
National (Country)	14	(5%)	32	(7%)
Democrats	29	(9%)	57	(12%)
Labor	119	(38%)	172	(37%)
Working class	112	(28%)	206	(33%)
Middle class	286	(71%)	409	(65%)
Upper class	7	(2%)	10	(2%)
Student	61	(14%)	103	(16%)
Unemployed	20	(5%)	23	(4%)
Part-time	27	(6%)	59	(9%)
Homemaker	44	(10%)	69	(10%)
Full-time	264	(61%)	388	(59%)
Other	13	(3%)	17	(3%)
Low education	375	(69%)	551	(67%)
High education	170	(31%)	272	(33%)
Religious mother	160	(38%)	247	(39%)
Religious father	114	(29%)	172	(28%)
Men		. ,		. ,
Liberal	110	(44%)	114	(40%)
National (Country)	13	(5%)	22	(8%)
Democrats	26	(10%)	22	(8%)
Labor	100	(40%)	131	(45%)
Working class	109	(33%)	149	(39%)
Middle class	210	(64%)	229	(60%)
Upper class	11	(3%)	5	(1%)
Student	46	(13%)	58	(15%)
Unemployed	21	(6%)	22	(6%)
Part-time	11	(3%)	16	(4%)
Homemaker	0	(0%)	1	(0%)
Full-time	254	(74%)	290	(74%)
Other	10	(3%)	5	(1%)
Low education	327	(70%)	407	(70%)
High education	143	(30%)	176	(30%)
			4 A -	
Religious mother	129	(39%)	129	(34%)
Religious father	93	(30%)	110	(30%)

 Table 3: Summary statistics

Note: Percentages are rounded to whole numbers and therefore do not always add up to a 100%. OS stands for opposite sex and SS stands for same sex (only dizogotic twins are included). The total of observations for female participants are 821 with OS co-twins and 1158 with SS co-twins. The total observations for male participations equal 721 with OS co-twins and 970 with SS co-twins.

4 Gendered attitudes

When it comes to sibling gender and the development of attitudes, indirect effects (through differential parenting) and direct effects (immediate peer influence) are expected to take place. However, it is not clear in which direction sibling gender affects attitudes. On the one hand, if having a daughter could induce more feminist beliefs in a parent, the same might count for brothers and sisters. A better opposite-sex understanding would then translate into different beliefs. On the other hand, growing up with an opposite sex sibling can induce a stronger gender role development. A brother with a sister might feel inclined to form beliefs that are opposite of that of his sibling to establish his manhood.

This section provides information about the differences in opinions between men and women in this particular dataset. The provision of information on gendered attitudes contributes to a better understanding of sibling gender effects because it provides a context based on which we can hypothesize the nature of the effect. For example, when a man with a brother agrees more strongly with a certain topic than a man with a sister, it does not become immediately evident whether the influence of the sister is such that the opinion of the man has become more similar to that of women or if a sister actually drives the man's opinion away from those of women. In the first case, we might be looking at a case of opposite-sex understanding In the second case, the gender role mechanism is the driver of the effect. Having a sister could exacerbate the tendency of men to agree on masculine topics and disagree on feminine topics because they have been exposed to stronger traditional gender role development in childhood. In order to give a meaningful interpretation of sibling gender effects, it is therefore important to confirm the existence of gendered beliefs.

Table A.2 shows for each attitude the mean difference between that of men and women. Also included, is the size of the difference as a percentage of the standard deviation of that attitude. Though women have more positive views towards women judges, working mothers, birth control, and arguably also towards test-tube babies, their opinions do not differ from those of the men when it comes to legalized abortion. Washington (2008) compared the attitudes of American men and women using the 1992-2000 National Election Studies and found that women are slightly more likely to believe abortion should be legally available at a 10% significance level (44% of women versus 42% of men). The effect becomes more substantial and statistically significant at a 1%significance level when only the top third of the income distribution is considered. This possibility however, cannot be investigated in this research due to a lack of observations on participants who report their social class to be of the 'upper class'. Another explanation of this considerable lack of positivity from the women towards such a feminist issue could be sought in the fact that female participants are less in favor of the evolution theory and have a more positive outlook on bible truth, church authority and Christianity, though this is not the case for divine law. This finding is in line with the frequency with which women attend church. I conducted a one-sided statistical test and found that the degree with which the mean frequency of women's church attendance exceeds that of men (12%) of a standard deviation) is statistically significant at a 1% level.

Another puzzling outcome presents itself. Women namely report relatively positive attitudes towards gay rights and multiculturalism but also seem to be more in favor of Apartheid.¹⁷ Taking a closer look, it appears that women do not agree more with Apartheid by saying 'yes', but more often express uncertainty by ticking the box with a question mark while women, compared to men, do more often say 'yes' as opposed to 'no' when it comes to gay rights and multiculturalism.¹⁸ When it comes to the topic of socialism, the difference in attitudes does appear consistent. Women share more positive attitudes towards socialism, government welfare, Medicare, trade unions and

¹⁷Because the attitude towards Apartheid did not co-vary sufficiently with the other attitudes, this attitude was excluded from the factor analysis and therefore the score of inclusivity is not influenced by the attitude towards Apartheid. As such, according to the score that was made of inclusivity, women have a much more inclusive attitude than men do.

 $^{^{18}}$ The possibility exists that not all participants could readily infer what Apartheid was referring to at the time. If it were the case that women tend to answer questions with more uncertainty in general, then the topic for which the answers are most skewed towards 'yes' or 'no', will respectively make women seem less and more in favor of the topic. Reviewing histograms however, this does not generally appear to be the case. Concerning the topic of women judges for example, 96% of women and 87% of men said 'yes'

licensing laws while they have less positive attitudes towards privatization. Both the American women studied by Washinton (2008) and the women studied in this research, showcase a higher support for homosexuals, a negative outlook on defense spending and positive attitudes towards socialist topics.

5 Gendered voting behavior

This section provides an analysis of gendered voting behavior. Though I include regression analyses to establish the effects of gender on voting behavior, the goal of this section is not to prove that men and women inherently have different voting preferences. Instead, the focus lies on gaining an understanding of what men and woman vote for and why, as to provide a context for the interpretation of sibling gender effects. Specifically, I will therefore elaborate on; the literature that concerns gendered voting behavior, the observed differences between voting behavior of the Australian men and women in the dataset used in this research, and how these findings relate to the societal and political context of Australia.

5.1 Related literature

In the aggregate, men and women consistently vote differently from one another, but the way in which their votes differ is strongly dependent on the societal context and can be explained by determinants such as labor market participation, religion and divorce (Inglehart & Norris, 2000; Iversen & Rosenbluth, 2006; Emmenegger & Manow, 2014; Finseraas, Jakobsson & Kotsadam, 2010; Edlund & Pande, 2002). A country in which women generally vote more conservatively is said to have a 'traditional gender gap' in voting preferences, while a country in which women vote more left-wing than men has a so-called 'modern gender gap'. In many post-industrial countries since the 1980's, the voting behavior of women has become more left-wing oriented than before, such that the gender gap has progressively become less traditional and more modern (Inglehart & Norris, 2000).

From the moment that Inglehart & Norris (2000) showed that the modern gender gap diminishes after a range of societal and cultural factors are controlled for, many studies have attempted to pinpoint the exact reasons for why the gender gap in voting preferences differs between countries and over time. Iversen and Rosenbluth (2006) make a strong case by reasoning from the woman's perspective in a marital setting. Women, they argue, will vote more distinctly from their husbands when they obtain a stronger economic position in society. Their findings show that labor market participation for women and national divorce rates are associated strongly with a more equal gender division of household labor and a modern gender gap in political preferences.¹⁹ Once divorce is a likely event and women participate in paid work, their argument goes, we can expect their voting behavior to change due to the following reason. Women who balance their work and family life have a harder time doing so in a society where family duties severely limit their opportunities on the labor market. Voting for left-wing parties can alleviate this burden in two ways. Firstly,

¹⁹Iversen and Rosenbluth (2006) base the explanation of their findings on an adaptation of Becker's efficiency model (Becker, 1985) that views the family as a household utility maximizing structure and predicts a complete gender division of labor between the sexes. In this model, the division of labor in a household is a natural consequence of the fact that members of the household are advantaged through gains of trade by specializing in either marketable or household skills as long as there are increasing returns in these domains and the care of children cannot be subcontracted without a loss (of wellbeing). Because women have a comparative biological advantage for child care in the first months, the increasing returns to human capital investment in this domain quickly magnifies the labor role division over time. Besides this, socialization effects are proposed by Becker as a mechanism which magnifies the labor role division. Parents might instill preferences in children in order to prepare them for responsibilities that they believe them to fulfill later in life. Iversen and Rosenbluth (2006) then provide the additional argument that preferences within a marriage are not always aligned, marriage contracts are usually incomplete and that in modern, western societies divorce seems to become the norm rather than the exception. In case of a likely divorce, it is crucial for spouses to secure and defend successful outside options to their marriage by participating in paid work at the expense of total household welfare. Even in the event a divorce would not take place, it can be considered advantageous to increase one's own bargaining power inside the relationship.



Figure 1: The gender gap in support for public employment and left parties.

Notes: The bars show the predicted difference between men and women in their support for public employment policies and left parties, where a positive gap means greater support among women. The gap in support for public employment is measured in standard deviations of the dependent variable. The gap in support for the left is measured in differences in the probability of voting for a left party. These results are based on data from the 1996 International Social Survey Program on the role of government from the following advanced democracies; Australia, Britain, Canada, France, Germany, Ireland, Norway, New Zealand, Sweden, and United States. Source: Iversen & Rosenbluth, 2006, p.17.

through the provision of public jobs women are granted more job opportunities because government jobs require general skills in which a woman is more likely to be educated. Secondly, the provision of public services often include care for the elderly, the young and the sick. Women are traditionally burdened with these tasks and therefore benefit the most from these types of public services. On top of that, women are also likely to provide these services professionally. Public provision of health and elderly care therefore caters to the employment of women. The effects of divorce on voting behavior is confirmed by Edlun and Pande (2002) who found that women in the U.S. are more likely to support the Democrat party after a divorce. In figure 1 the results of Iversen and Rosenbluth (2006) are summarized. Women from different societal backgrounds have different degrees of work opportunity and distinct voting preferences that likely indicate different pretexts for gender development and socialization in childhood.²⁰

With the aim of providing an empirical test to the findings of Iversen and Rosenbluth (2006), Finseraas, Jakobsson and Kotsadam (2010) have shown that the likelihood of a divorce on an individual level does not influence the likelihood that a woman or man votes for a right or left wing party in Norway. They argue that the findings of Iversen and Rosenbluth (2006) might be invalidated by spurious correlations to omitted country characteristics. Average divorce rates, they argue, are likely related to the level of gender equality and the earning possibilities for women

²⁰The result that women who already participate in the labor market vote more for left-wing parties, seems quite paradoxical. After all, women who are married and not working run a greater risk in the event of a divorce. The authors argue however, that a selection effect might be taking place. Women who namely feel that they run a greater risk of divorce might choose to insure themselves in every which way possible. While a woman who expects to remain a housewife does not need to insure herself against this risk and rather focuses on maximizing her husband's income. Additionally, the argument can be made that women who get married are in fact insuring themselves against poverty and that unmarried, working women are simply more inclined to vote for left-wing parties than men do because their expected future income is lower than that of men.

in a country. The authors do find evidence that women who work are more likely to vote for left-wing parties. In particular, whether these women work in the public sector and have parents in need of care seem to be drivers of this effect. Women that are unmarried also tend to vote more for left-wing parties. Though Finseraar, Jakobsson and Kotsadam (2010) find that a gender gap in voting is clearly present in Norway, their findings are very far from explaining the entirety of the gender gap. Research by Emmenegger and Manow (2014) shows that religiosity appears to be a much more important predictor of voting behavior for both men and women than labor force participation. On top of that, religiosity appears to be responsible for a large part of the traditional gender gap that occurred at different times in different countries. In fact, religiosity continued to be responsible for inhibiting the modern gender gap from the moment it emerged. Not only religiosity of the electorate, but polarization of the parties in terms of religiousness explains much of the variation in the gender gap between countries. Religiousness severely inhibits the possibility for a left-wing party to win womens' votes with attractive labor market policies geared at female workforce participation. After all, right-wing parties often represent the interests of a religious voter. Especially since surveys tend to show a higher level of religiosity among women than men, religion can be expected to have a strong impact on the political choice of women. A country like Italy, where the electorate is quite religious and where the party system is divided in terms of pro-clerical and anti-clerical policies, is therefore one of the least likely countries to see a modern gender gap arise. But most importantly, Emmenegger and Manow (2014) show that parties can change their programmatic commitments to women's rights and that women respond to these changes. As a matter of fact, left-wing policies do not always align with the interests of women. For example, because women have a higher probability of career interruption as a result of motherhood, high employment protection could actually discriminate against women. When it comes to voting behavior, it is therefore important to have a closer look at the actual campaigning that parties do on women's issues instead of readily assuming that women have an interest in voting for the left-wing party.

5.2 Analysis of gendered voting

This section provides insights in the voting behavior of men and women that have participated in the survey that my analysis is based on. 5.2.1 starts with a full sample exploration of voting behavior and 5.2.2 then moves on to explore the voting behavior that is specific to voters from a religious family background. The sample is constructed by including only those participants whose mother is religious and it will be referred to as the 'religious sample'. As described in section 3, a mother is said to be religious when she attends church every month or more often. Religion was found to have strong effects on the occurrence and size of a traditional gender gap. Therefore I expect to see different results when I study the effects of gender in a religious sample.

5.2.1 General sample

In table A.3, the effects that gender, social class, education and employment status have on the probability of voting for the Liberal, National, Democrat and Labor parties are estimated. The first model specifications (1-4) investigate the effects of social class and gender on the voting behavior per party. Though the coefficients do suggest that women are somewhat less likely to vote for the Labor party and more likely to vote for the Democrat party and the Liberal party, the effects of gender are not statistically significant. In contrast, social class appears to have a statistically significant and substantial effect on voting for the Labor or Liberal party. A man from the middle class has a 53% probability of vote for the Liberal party while a man from the working class only has a 36% probability to vote for the Liberal party which amounts to a difference of 17 percentage points. The statistical significance of the effects from social class are absent for the National party and only significant at a 10% significance level for the Democrat party. This is not surprising, considering that the relatively low amount of voters for these parties increases the standard errors of these estimations. For the Democrat and National parties, the magnitudes of the effects are half the size of those from the Labor and Liberal parties and the

directions of the effects are contrary to what could be expected. Even though the National party is described as center-right and often mirrors the ideas of the Liberal party, the results from this estimation suggest that people who vote for the National party generally belong to the working class. And the Democrat party, while it favors a progressive tax system, attracts voters with a higher social status. This could be explained by the fact that the National party strongly defends the agricultural sector in Australia, which likely constitutes many working class voters. The Democrat party advocates free education, which attracts votes from students who are more likely to belong to middle or upper class families.

The next model specifications (5-8) include variables that control for the person's employment status and education level on top of the variables that were included in model specifications (1-4). It appears that being a student indeed strongly influences the probability of voting for the Democrat party at a 1% level of statistical significance. In particular, the decision to vote for the Democrat party is 20% for a middle class highly educated male student while a highly educated male full-time worker of the middle class votes for the Democrat party with a 9% probability. The only other employment status that significantly impacts voting behavior is that of unemployment. An unemployed person is less likely to vote for the Liberal party and more likely to vote for the Labor party at a 5% level of significance. Particularly, a lowly educated man from the working class who has full-time employment is 17 percentage points less likely to support the Labor party than someone with a low education from the working class that is unemployed.

Interestingly, after employment status and education are controlled for, women appear to vote less often for the Labor party compared to men with a statistical significance of 10%. The prediction says that a lowly educated woman from the working class who works full-time is 6% less likely to vote for the Labor party than a lowly educated man from the working class in full-time employment (45% versus 51%).

Because the labor participation of women is found to predict the direction of the gender voting gap, the last model specifications (9-12) include an interaction term of gender and full-time employment.²¹ Though the effect from the interaction term is not statistically significant, the coefficients suggest that women in full-time employment vote more frequently for the Labor party than women who are not in full-time employment. Now the prediction shows that a lowly educated, full-time working woman from the working class is only 3 percentage points less likely to vote for the labor party (47% versus 50%).

In addition to gender and the controls for social class, education and employment status, the effects of attitudes on voting behavior have been estimated.²² In order to explore how attitudes influence people's voting behavior over the whole voting spectrum from right to left, as is specified in table 1, ordered logistic regressions are employed that include attitudes of the twins. Because the effects of the attitudes might differ between parties, logistic regressions are performed as well for every party separately.²³

Table A.4 lists eight models portraying effects on the voting behavior of twins with the inclusion of attitudinal variables that are expected to influence one's voting behavior such as 'Privatization', 'Medicare', 'Trade unions' and 'Socialism' and the four general variables obtained through factor analysis: 'Humanism', 'Christianity', 'Unnatural birth' and 'Inclusivity'. From model (1) it appears that someone's social class and their attitudes towards socialism, Medicare, privatization and trade unions relate with expected signs and at a 1 % significance level to the voting behavior of the participants. More specifically, a person who answered that he or she belongs to the working class and agrees with Medicare, trade unions and socialism but disagrees with privatization votes with 81% probability for the Labor party while someone that has opposite opinions on these topics and belongs to the upper class votes for the Labor party with only a 3% probability. A control for

²¹See the earlier discussion in section 4 which refers to the findings of several papers (Inglehart & Norris, 2000; Iversen & Rosenbluth, 2006; Emmenegger & Manow, 2014; Finseraas, Jakobsson & Kotsadam, 2010).

 $^{^{22}}$ In association with voting behavior, attitudes appear to have a meaningful and large impact even if the prediction of behavior with attitudes generally has proven quite unsuccessful (Schuman & Johnson, 1976, p.169-170; Chaiklin, 2011).

 $^{^{23}}$ In fact, after testing it appeared that the parallel regression assumption does not hold for all the included variables.

gender is accompanied by controls for these attitudes towards socialist topics in model (2) and the traditional gender gap becomes quite substantial and statistically significant at a 1% significance level. Women and men who are from the same social class and who think similarly about privatization, Medicare, trade unions and socialism, apparently vote quite differently from one another. This could also be viewed from a different perspective, namely that women vote similarly to men from the same social class but nonetheless have more positive views towards socialist topics.

The general attitudes of the twins towards Christianity and inclusivity appear to relate significantly to voting behavior as model (3) shows. Particularly, focusing on someone from the middle class and assuming indifference on the topics of humanism and unnatural birth, a person who is very positive towards Christianity and negative about inclusivity, has a 87% probability of voting for the Liberal party, while someone with opposite opinions with regard to Christianity and inclusivity, only has a 24% probability of voting for the Liberal party.²⁴ With the inclusion of gender in model (4) we see no statistically significant voting differentiation between the sexes. Hence, a woman who thinks similarly to a man about humanism, Christianity, unnatural birth and how inclusive the society ought to be is not voting more or less in favor of left-wing parties than he would.

Models 5 and 6 provide estimation results with the inclusion of controls for education and employment status. It appears from model (5) that gender still significantly impacts voting behavior over the whole voting spectrum. We already know that this is mostly due to the smaller likelihood of voting for the Labor party for women. In model (6), when general attitudes are included, the gender gap seems to becomes somewhat smaller and the statistical significance of the traditional gender gap disappears. In the logistic regressions it will be investigated whether the relatively positive attitudes of women towards Christianity are drivers for the tendency of women to vote for more right-wing parties. Another interesting change is that, for some unknown reason, someone who is a homemaker is now more likely to vote for a left-wing party. In The final model, (7), from table A.4 all variables are included. Most of the effects earlier discussed remain close to unchanged. We only observe a diminished effect of someone's attitude towards inclusivity which is likely due to the fact that the attitudes towards socialist topics are closely related to that attitude.

Logistic regressions (1-8) show the effects of attitudes on voting behavior per party in table A.5. Because women are shown to have more favorable attitudes towards Christianity in section 4, this attitude is added as a control to the models from table A.3. Indeed, the magnitude of the gender effect on voting for the Labor party diminishes and becomes statistically insignificant when the attitude towards Christianity is taken into account. Religiosity is an important driver for the observed traditional gender gap in the voting behavior of these twins.

Controlling for all the attitudes in models 5-8, the effect of a person's attitude towards inclusivity appears to be absent with regards to voting for the labor party. Contrastingly, it appears that a positive attitude towards inclusivity does very substantially increase the probability of voting for the Democrat party. Noticeably, only attitudes towards trade unions and inclusivity have a statistically significant influence on whether one votes for the National (Country) party or for the Australian Democrat party. Considering the views that are outlined in table 1 this is not surprising. After all, even though the National party focuses on the protection of the agricultural sector, they believe this is something that should be incorporated in government and take a right-wing stance in every other regard, usually strongly opposing to trade unions. The Democrat party on the other hand advocates direct democracy and a progressive tax system. Part of the reason that the other attitudes are less pronounced could be because these parties represent more centered views on these topics. However, some of the effects like that of a person's attitude towards Christianity are not trivial in magnitude and could very well not be statistically significant because there are only few participants that vote for these parties which leads to increased standard errors. The effects of attitudes towards humanism or unnatural birth are not statistically significant in any of the model specifications.

 $^{^{24}}$ Since the factor variables have a mean of zero and differing maximum and minimum values, values close to the maximum and minimum of the factor in question were adopted for these calculations. In case of Christianity, I used a value of 2 for someone very positive and a value of -1.5 for a person very negative towards the religion. A value of 1.5 for inclusivity represents a very positive attitude and a value of -1.6 a very negative attitude.

5.2.2 Religious sample

Since we can expect religiosity to affect the gender gap in voting, I investigate whether a different pattern of gendered voting can be observed in a more religious sample. Besides that, religious denomination has conventionally been a determinant for voting behavior in Australia. Catholics are historically voting in favor of the Labor party while Anglicans (protestants) voted for the Liberal party (Bean, 1999). Therefore I will not only include birth year fixed effects, social class, education and employment status but also religious denomination. On top of that I will include the frequency with which the person attends church because independent of religious denomination, the strength of a person's religiosity is found to increase the probability that a person votes for right-wing parties in Australia (Bean, 1999).

A.6 shows the results of the estimations in a religious sample. It appears that gender significantly impacts the probability of voting for the Liberal and Labor parties. Specifically, a man with a religious family background from the working class votes with a 34% probability for the Liberal party while a woman with a religious family background votes for the Liberal party with a 42% probability. A working class man would vote for the Labor party with a 54% probability and a working class woman would vote for the Labor party with a 42% probability.

Estimations (5-8) show how gender and a range of additional variables relate to the voting probability on the Liberal, National, Democrat and Labor parties. As expected, church attendance has a positive effect on the probability of voting on the Liberal party. Being a protestant increases the likelihood of voting for the Liberal party. The effects of gender remain similar in size after the other variables are added to the regression.²⁵

5.3 Australian societal context

In this section, gendered voting behavior in Australia is discussed based on the results of the previous analyses and additional research on the position of women and gendered policies of political parties in Australia.

The gender differences in political preferences that arise in this dataset represent either an absent and if anything 'traditional' gender gap for the general sample. When we focus only on the gender gap in political preferences in the religious sample, we clearly see the presence of a traditional gender gap. The absent or slightly traditionalist nature of this political gender gap in Australia in the 1990s is confirmed by the findings of Inglehart and Norris (1999, pp. 449-457). Yet, the division of household labor in 1994 has been found to be comparatively egalitarian by Iversen and Rosenbluth (2006, p.11) and a more equal division of labor is typically found in more modern societies where women participate in paid labor. According to the estimations of Iversen and Rosenbluth (2006), the absence of a modern gender gap in voting behavior in Australia can be explained by the fact that the Australian labor market does not require much skill specificity. Women are then relatively ensured of a job in case their marriage breaks up. Another driver for the traditional gender gap observed in 1990 is the relative religiosity of women. Bean (1999) showed that in Australia, independent of religious denomination, stronger religiosity in terms of church attendance, which we observed among women in our dataset, translates into a higher probability of voting for the Liberal and National parties from 1984 to 1988.

More reasons for the absence of a modern gender gap can still be found in the economic position of women Australia today. Firstly, the flexibility and the presence of high job turnover rates and low tenure amongst employees gives women in Australia a comparative advantage (OECD, 2017). A woman's more likely absence from the labor market as a result of childrearing does not severely influence the possibility of her finding a job when re-entering the labor market again. This is related to the low skill-specificity that was found in the Australian labor market in the 1990s by Iversen and Rosenbluth (2006) and it should likewise dismantle the interest of women in voting

 $^{^{25}}$ A man full-time working man from the working class who visits church more than once a week has a 37% probability of voting for the Liberal party while a woman with the same characteristics votes for the Liberal party with a 49% probability. The man would vote with a 46% probability for the Labor party and the woman with a 32% probability.

for left-wing parties. Secondly, the relatively low labor participation of Australian women, in particular that of mothers, might be inhibiting the occurrence of a modern gender gap.

Though Australian women face a relatively favorable position in the labor market in the initial phase of their lives and resulting bargaining power in their relationships with regard to household chores, but they appear to be responsible for the care of their children in a later phase of their lives, stimulating their specialization in parenting skills.²⁶ The OECD has performed a series of country studies, Connecting People with Jobs, in which assessments are provided of the extent to which activation policies help everyone in society to participate in the labor market. In a report on Australia that was released in march 2017, Connecting People with Jobs: Key Issues for Raising Labour Market Participation in Australia, they investigate the untapped potential in female labor participation of women between the ages of 25 and 54. Though Australian employment falls well above the OECD average, female employment ranked in the lower third of the OECD countries in 2015. A large proportion of these rather scarce employed women work part-time. Only the shares of women working part-time in Switzerland, Netherlands, Austria and Germany surpass that of Australia. It appears that motherhood strongly impacts the labor participation of women in Australia in comparison to countries with higher female labor participation in this age group. On top of that, part-time employed Australian mothers with a partner, work less than 20 hours a week. In the majority of OECD countries, women in similar positions work 20-25 hours a week. In fact, Mexico is the only other OECD country in which part-time employed mothers with a partner work fewer hours than those in Australia. The effects of motherhood on female labor force participation is even more striking for women between the ages of 15 and 29 years old. In this age group across the OECD, the rates for women that are not in employment, education or training (NEET) are 36% higher than the rates for men. In Australia however, the rate of women in NEET is 51% higher than that of men and half of these women have a child under the age of 5. Relatively high childcare costs are one of the suggested drivers (OECD, 2017). Not mentioned in the report is that women are even more likely to specialize in parenting skills as a result of the paid parental leave system in Australia. Birth mothers are namely eligible to receive paid parental leave in the firsts 18 weeks after giving birth as opposed to the meager 2 weeks of paid parental leave that birth fathers are allowed to receive.²⁷

The situation could of course not have been more favorable to woman in the 1990's than it was in 2017. In fact, there was no paid parental at all in 1990. The only family friendly policy at the disposal of parents was a 12 month unpaid maternity leave (Rush, 2013). All in all, childcare is expensive and taking care of one's own offspring can increase the overall well-being of the household. In 1990, women were clearly assigned the role of staying at home with the children because of their biological and government induced comparative advantages. On average, women might therefore not have expected their personal benefits through investments in their own outside options to outweigh the costs of these investments in a marital setting with children. As a result, we can expect women to have dedicated themselves to their families and the maximization of household income which aligns their voting behavior with that of their husbands. However, these findings do suggest that women should have an incentive to vote for parties promising the implementation of policies that bring relief to their parenting responsibilities. When a closer look is granted at the current policies from the parties, support for women and mothers is scattered across the political spectrum.

While the National party does not appear to pay any attention in their policymaking to women's issues, the Liberal party proudly presents the policies they introduced over the years that have been in favor of women. Before 1990, the year in which the twins filled out the survey, these included policies that concerned child endowment, protection of deserted wives and equal pay legislation (introduced between 1966 and 1972). Between 1975 and 1983, they signed the Convention on the Elimination of Discrimination against Women. In the 2000's a child care benefit and child care tax rebate were introduced. The party is currently very dedicated to increasing the

 $^{^{26}}$ The measure for the division of household labor which was utilized by Iversen and Rosenbluth (2006) did not include any questions on child care. Had they been included, it might have become clear that Australian women are in fact carrying a large share of parenting responsibilities at home.

²⁷Retrieved from: https://www.fairwork.gov.au/leave/maternity-and-parental-leave/paid-parental-leave

labor participation of women by policies such as the Jobs for Families Child Care Package, which is aiming to make childcare more affordable and accessible.²⁸

Concurrently, the Labor party shows a deliberate intent to make sure that women obtain an equal position in the labor market, education and decision making on their website. In their 2018 National Policy Platform consultation draft, they promise this intent will be translated into action by maintaining a government-sponsored paid parental leave scheme, improving accessibility and affordability of childcare, and making sure that anyone who works in part-time or casual work (usually women) receives compulsory superannuation contributions. One policy that they are actively campaigning on could benefit mothers indirectly. This involves the preservation of preschool funding.²⁹

The Democrat party encourages a variety of flexible working structure to accommodate the diversity of individual employees' personal, family and community obligations. They are also in favor of reducing the standard working week (in number of hours) through the promotion of incentives that foster greater employment. The Democrat party also supports and formally legislates paid parenting leave funded by the state. They oppose all forms of discrimination in employment and aim to develop institutional arrangements to protect the interests of workers who are not represented by unions. All these proclaimed views favor the position of women in the labor market. On top of that, the Democrat party offers a wide range of services that concern reproductive choice such as available and affordable contraception, access to free pregnancy termination services, publicly funded midwifery services and postnatal care (including advocacy and support groups). Women who are (prospective) mothers would therefore have an incentive to vote for the Democrat party.³⁰

In sum, in 1990 the aggregate gender gap in political preferences was rather traditional in Australia. Though we observe that women had positive attitudes towards socialist topics, their voting behavior did not align. It could be that women matched their voting behavior with that of their husbands due to the fact that motherhood limited their expectation to benefit from labor market participation. Higher religiosity among women provides an additional explanation for the traditional gender gap. On top of that, the low skill specificity and increasing flexibility of the labor market insured women against the risk of going through a divorce which lessened the need for women to defend their outside options and vote for left-wing parties. But perhaps the most important reason for the absence of a modern gender gap is that the left-wing parties do not take the lead in defending the interests of women. In fact, the Liberal party is the only one to portray their achievements with regard to defending the rights of women from before the year 1990. Because I do not have information on the campaigning done by the other parties before 1990, I cannot conclude whether the Liberal party has been representing the interests of women most strongly at the time but I do not find evidence that the left was campaigning on women's issues in 1990.

 $^{^{28}\}mbox{Retrieved}$ on 31-07-2018 from: https://www.liberal.org.au/liberal-women and https://nationals.org.au/ourpolicies/

²⁹Retrieved on 31-07-2018 from: https://www.alp.org.au/campaigns

³⁰Retrieved on 31-07-2018 from: https://www.australian-democrats.org.au/policies/

6 Main results

6.1 Sibling gender effects on voting behavior

The effect of sibling gender on voting behavior has not yet been investigated, let alone the mechanisms through which sibling gender could possibly affect voting behavior. However, earlier research has identified heterogeneity in sibling gender effects. Cools and Patacchini (2017) found that the statistically significant impact of sibling gender on future earnings for women was driven by a subsample that was characterized by religious, two-parent families with mothers who obtained a college degree. A significant effect of having brothers was absent for a subsample of women who were not religious. On top of that, religion was found to have strong effects on the occurrence and size of a traditional gender gap. I will therefore also include an analysis based on a religious subsample in my main results.³¹ It appears that statistically significant effects are found in the religious subsample whereas they are absent in the general sample.

6.1.1 General sample

Sibling gender effects have been shown to impact employment and future earnings. In the meanwhile employment is an important determinant for voting behavior. Controlling for employment status might therefore alter or conceal the potential findings of sibling gender effects. From the analyses performed in section 5.2, it became evident that next to employment status, religiosity, and social class are also determinants of voting behavior. Because it is not clear whether sibling gender might affect voting behavior through any of these channels, the effects of sibling gender on voting behavior are initially estimated with only birth year fixed effects as controls. In a second range of estimations religiousness of the parents, social class, education level and employment status are included as controls. For the estimation of sibling gender effects, religiousness of the parents is used as a control instead of the twins' own attitudes towards Christianity because it is more informative about the childhood circumstances in which the siblings grew up and influenced each other.³²

In table 4 the results are presented for women. No statistically significant effect of sibling gender on the voting probability for a particular party can be found though the magnitudes and signs of the coefficients suggest that women with sisters are more likely to vote for the National or Democrat parties and are somewhat less likely to vote for the Liberal party than women with brothers. The inclusion of additional controls does not alter the statistical significance of the findings though it does seem to alter the magnitudes of the effects. Having a sister increases the probability that a woman votes for the National party with a bit less than 2 percentage points. This effect seems small but the probability of voting for the National party is already low. 4.8% of women with sisters versus 3% of women with brothers vote for the National party. The probability that a woman with a brother votes for the Liberal party is 4.5 percentage points larger compared that of a woman with a sister. After the addition of controls, women with sisters are not anymore less likely to vote for the Liberal party and the increased likelihood of voting for the National party diminishes.³³ Women with sisters do not vote more or less often for the Labor party but when controls are added to the model it seems that full-time working women with sisters is more likely to vote

 $^{^{31}}$ Perhaps different effects of sibling gender on voting behavior can be expected in different subsamples. After all, Cools and Patacchini (2017) also found that the effects of sibling gender are more likely to occur in two-parent families in which the mother obtained a college education. Research might therefore gain further insights by not only investigating the effects of sibling gender on individuals with religious family backgrounds, but also those from two-parent families with more highly educated mothers.

 $^{^{32}}$ Nonetheless, there exists a possibility that gender composition of the children might have an impact on the parents' religiosity of today which means that controlling for the religiousness of parents might control for potential sibling gender effects.

 $^{^{33}}$ We can infer from the summary statistics in table 3 that the women who have sisters in our dataset are more likely to belong to the working class than women with brothers. Indeed, when the effect of sibling gender is estimated with all the controls except that of social class, the magnitude of the effect increases somewhat.

General sample								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Liberal	National	Democrat	Labor	Liberal	National	Democrat	Labor
SS co-twin	-0.180	0.469	0.279	-0.0296	-0.0150	0.278	0.286	-0.203
	(0.158)	(0.342)	(0.243)	(0.162)	(0.175)	(0.361)	(0.259)	(0.184)
Add controls	No	No	No	No	Ves	Ves	Ves	Ves
Observations	775	775	775	775	660	660	660	660
0050174010115	110	110	110	110	000	000	000	000
Religious sample								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Liberal	National	Democrat	Labor	Liberal	National	Democrat	Labor
SS co-twin	-0.211	0.514	0.215	0.0159	-0.147	0.353	0.333	-0.143
	(0.258)	(0.575)	(0.383)	(0.277)	(0.277)	(0.642)	(0.397)	(0.307)
A J J J J J J J J J J	N.	N.	N -	N.	V	$\mathbf{V}_{}$	V	V
Add. controls	INO	INO	INO	INO	res	res	res	res
Observations	290	277	290	290	267	249	267	267

Table 4: Women: Sibling gender effects on voting behavior

Note: SS co-twin stands for same sex co-twin. All the regressions control for birth year fixed effects. Additional controls include social class, education and employment status in both the general sample and the religious sample. The controls of the general sample also include religiousness of the parents. The effects are estimated with logistic regression analysis. Standard errors in parentheses are robust and clustered by twin pair. *** p < 0.01, ** p < 0.05, * p < 0.1

for the National and Democrat parties. And a full-time working sister is equally likely to vote for the Libearl party as a full-time working woman with a brother.

Table 5 shows the results for men. Again, no statistically significant effects can be found in both the estimations without or with controls. Men with brothers in this dataset are predicted to vote more frequently for the National and Labor parties and less often for the Liberal and Democrat parties than men with sisters in either specification. Men with sisters are predicted to vote for the Democrat party with a 2 additional percentage points probability (8% instead of 6%) and they vote less for the National party (3.1% instead of 4.5%). A man with a sister votes with a 50% probability for the Liberal party while a man with a brother only votes with a 45% probability for the Liberal party.

6.1.2 Religious sample

This section investigates whether sibling gender effects are present when only participants who grew up in religious families are sampled. The sample is constructed by including only those participants whose mother is religious. As described in section 3, a mother is said to be religious when she attends church every month or more often.³⁴ Like in the general sample, estimations are run first only controlling for birth year effects. In the second range of estimations additional controls are included.

Table 4 presents the results for women. It appears that there are no statistically significant effects of sibling gender on the voting behavior of women with religious mothers. The results of this subsample are comparable to those of the general sample and show that women with sisters tend to vote for the National and Democrat parties. Again, full-time working women with sisters are more likely to vote for the Liberal party than women who do not work full-time (though still less likely than full-time working women with brothers). Like in the general sample, full-time working women with sisters are less likely to vote for the Labor party than full-time working women with

³⁴This determination of religiousness is directly carried over from the definition of Cools and Patacchini (2018).

General sample								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Liberal	National	Democrat	Labor	Liberal	National	Democrat	Labor
SS co-twin	-0.189	0.385	-0.326	0.203	-0.219	0.610	-0.407	0.212
	(0.190)	(0.359)	(0.321)	(0.191)	(0.208)	(0.399)	(0.342)	(0.210)
Add controls	No	No	No	No	Ves	Ves	Ves	Ves
Observations	E 20	E 20	E 20	E 20	469	105	460	469
Observations	538	538	538	538	402	440	402	402
Religious sample								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Liberal	National	Democrat	Labor	Liberal	National	Democrat	Labor
SS co-twin	-0 689**	1 137*	0 303	0.290	-0 660*	1 117*	0.519	0 191
55 co-twill	(0.343)	(0.689)	(0.594)	(0.347)	(0.359)	(0.678)	(0.610)	(0.359)
	. /	. /	. /	. ,	. /	. /	. ,	. /
Add. controls	No	No	No	No	Yes	Yes	Yes	Yes
Observations	186	154	179	186	181	140	161	181

Table 5: Men: Sibling gender effects on voting behavior

Note: SS co-twin stands for same sex co-twin. All the regressions control for birth year fixed effects. Additional controls include social class, education and employment status in both the general sample and the religious sample. The controls of the general sample also include religiousness of the parents. The effects are estimated with logistic regression analysis. Standard errors in parentheses are robust and clustered by twin pair. *** p < 0.01, ** p < 0.05, * p < 0.1

brothers.

The results for men in table 5 are very different from those of the general sample. Men who have religious mothers vote less for the Liberal party and more for the National party when they have brothers and these effects are robust to the inclusion of control variables and statistically significant at a 10% significance level. Specifically, a man with a sister has a 42% probability of voting for the Liberal party while a man with a brother only has a 27% probability of voting for the Liberal party. After inclusion of controls the difference remains almost unchanged. A full-time working, working class man with a sister has a 14 percentage point larger probability of voting for the Liberal party than a man with a brother who belongs to the working class (38% versus 24%). A man with a brother votes with 11% probability for the National party while a man with a sister only votes with a 4% probability for the National party. A full-time working man with a brother belonging to the working class is even more likely to vote for the National party. He votes for the National party with a 17% probability while a full-time working, working class man with a sister only votes with a 6% probability.³⁵ The Liberal party lose votes from men with brothers not just to the National party but also to the Democrat party and the Labor party. A man with a sister votes Labor with a 47% probability while a man with a brother votes Labor with a 54%probability. A full-time working man from the working class with a sister votes Labor with a 53%probability while a full-time working man from the working class with a brother votes Labor with a 59% probability. Men with brothers vote for the Democrat party with a 9% probability. Men with sisters vote Democrat with a 6% probability. Full-time working, working class men with brothers vote for the Democrat party with a 6% probability. Full-time working, working class men with sisters vote Democrat with a 4% probability.

Bean (1999) showed that a higher religiosity increased the probability of voting for the Liberal and National parties between 1984 and 1988. I was interested to know if men with sisters perhaps voted more conservatively because of increased religiosity. Therefore, another series of estimations

 $^{^{35}}$ It must be noted that the sample is very small. Particularly, 13 people in this sample actually vote for the National party. Only 4 men with sisters vote National and 9 men with brothers vote National.

was performed which included the church attendance of the individual. Inclusion of this variable did not change the results but the variable added explanatory power to the models and increased the statistical significance of the found effects. It informs us that the sibling gender effects of men with religious backgrounds do not seem to be driven by a higher religiosity of men with sisters in terms of church attendance.

6.2 Sibling gender effects on attitudes

Sibling gender can hypothetically affect attitudes in two ways. Firstly, growing up with an opposite-sex twin could induce a larger sense of sympathy for the other sex. Secondly, having an opposite-sex twin could lead to the adoption of more traditional role patterns. I will investigate the effect of growing up with a same sex sibling on the general variables that have been constructed with factor analysis and on all the original attitudes in the survey. Then I will discuss the findings based on the gender differences in attitudes that were found in section 4. Again, the effects of sibling gender are estimated for the general sample and additionally estimates are provided for a 'religious' sample that only includes participants with mothers who visit church every month or more often.

First I investigate the effects of sibling gender on the general attitudes. In table A.7 and A.8 the results for men and women from both samples are presented. A striking absence of effects can be observed. Both in magnitude and statistical significance, the gender of a sibling does not affect general attitudes towards humanism, Christianity, unnatural birth or inclusivity.³⁶ Growing up with a brother or sister apparently has no impact on these holistic attitudes for these Australian twins. Now we move on to see whether attitudes differ on a more granular level.

Table 6 shows the summarized results of the effects of sibling gender on attitudes towards all the topics in our dataset for both samples. Control variables for these regressions solely include birth year effects (for the reasons that were described in section 6.1). In tables A.9 and A.11 in the appendix the regression output for the general sample that presenting the statistically significant estimated effects is shown for women and men respectively. In tables A.10 and A.12 the regression output for the religious sample is shown. In both samples, the effects of sibling gender are reasonably substantial.³⁷

To interpret the effects of sibling gender, it is helpful to either see the effects from the perspective of traditional role patterns or from the perspective of a better understanding of the other sex. When having an opposite sex sibling induces a more in depth understanding of the other sex, it is expected that the attitudes of men and women converge. In section 4, women were found to have favorable attitudes towards women judges, charity work, modern art, socialism, royalty, birth control, conservationist and chastity (compared to men). Men favored legalized prostitution, nuclear power, caning, the evolution theory, the death penalty and defense spending.

In the general sample, the attitudes of women were found to become more similar to those of men when they had a brother with regards to legalized prostitution, the death penalty, caning and the evolution theory. It is conceivable that the reason behind this increased agreement of a sister's opinion on these topics with that of men is driven by a better understanding of her brother and that they are influenced by their opinions. Women from the religious sample who have brothers appear to have less favorable attitudes towards women judges. However, we can expect that this effect of sibling gender is likely not only driven by a better understanding of their brothers and their opinions but that it is rather a product of differentiated parenting and gender development

 $^{^{36}}$ In order to realize how small the magnitudes are, it helps to consider that the standard deviations of these general attitudes are respectively 0.84, 0.81, 0.77 and 0.79, the estimated effects of sibling gender generally do not exceed ore even come close to 10% of a standard deviation. The only exception is the effect of having a brother for men in the religious sample on their attitude towards inclusivity which amounts to 12% of the standard deviation of that attitude.

 $^{^{37}}$ For example, in the general sample a woman with a sister has a 56% probability of agreeing with the death penalty while a woman with a brother has a 62% probability of agreement. A woman with a sister has a 61% probability of agreeing with patriotism while a woman with a brother has a 68% probability. A woman from the religious sample with a sister has a 95% probability of agreeing with women judges while a woman from the religious sample with a brother has only a 90% probability of agreeing with women judges.

	SS co-	twin		SS co-1	twin
	women	men		women	men
Death penalty	-		Multiculturalism		
Casual sex			Chastity	-	\oplus
Privatisation			Fluoridation		
Medicare			Royalty		-
Stiffer jail terms			Women judges	\oplus	
Trade unions			Strict rules		-
Patriotism	-	⊖ -	Test-tube babies		
Voluntary euthanasia			Apartheid		
Nuclear power		-	Asian immigration		
Working mothers			Church authority		
Bible truth			Disarmament		
Gay rights			Censorship		
Inborn conscience			White lies		
Government welfare			Caning	-	
Divine law			Teenage dole		
Socialism	\oplus	\oplus +	Private schools		-
White superiority			Chiropractors		
Herbal remedies			defense spending		-
Charity work	-		Divorce		\oplus
Suicide			Foreign ownership		
Conservationists	⊖ -		Surrogate mothers		
Licensing laws			Legalised abortion		
Birth control		+	Modern art		\oplus
Evolution theory	-	•	Condom machines		
Sabbath observance			Legalised prostitution	-	

Table 6: Summarized effects of having a same sex sibling on attitudes

Note: This table summarizes the results from 200 ordered logistic regression analyses which estimate the effect of having a same sex sibling separately for men and women as well as for a general and religious sample on the 50 attitudinal topics in the survey. Specifically, the directions of these effects are summarized for statistically significant results with p-values below 0.10. '+' and '-' refer to statistically significant sibling gender effects in the general sample while ' \oplus ' and ' \ominus ' refer to those effects from the religious sample. A '+' and ' \oplus ' indicate that having a same sex sibling makes someone's attitude more positive towards that particular topic on average. A '-' and ' \ominus ' indicate that this person's attitude is more negative towards that topic when he or she has a same sex sibling. All regressions control for birth year fixed effects.

in childhood. Women with brothers (from the religious sample) are less favorable to socialism than women with sisters. Though it is true that men are less positive towards socialism, it is unclear if a better understanding of their brother lies at the heart of why women with brothers from religious families are less positive towards socialism. Apparently men who have a sister only adopt a more similar attitude to that of women with regards to Royalty.

For the next topics, having an opposite sex sibling creates even larger differences in opinion between the sexes. Men with sisters appear to be even more in favor of defense spending and nuclear power than men with brothers. Men with sisters from the religious sample have even less positive attitudes towards chastity and modern art. Women with brothers are more in favor of chastity and charity work. Women with brothers from both samples have more positive views on conservationists. Perhaps these are subjects that people associate with masculinity and femininity. Men and women gender differentiate their opinions further on these topics when they have an opposite sex sibling which could explain these findings. However, for some of the sibling gender effects it is hard to argue that this would be the case. Men from both samples who have sisters are less in support of socialism. When it comes to someone's attitude to socialism it is not clear what gender development does to impact it. Notably, men with sisters are apparently less in favor of birth control.

There are also some effects of sibling gender on attitudes towards topics for which no gender differences were found in section 4. These topics include patriotism, strict rules and divorce. Men with brothers are less in favor of strict rules and more in favor of divorce. Men and women from mixed sex pairs are more likely to have a positive attitude towards patriotism.

6.3 Religious denomination and robustness of the effects

I have conducted the previous analyses on voting behavior and attitudes on a general sample and a sample that considered only participants who grew up with religious mothers in terms of church attendance. However, in a later phase of my research I realized that religious denomination has traditionally also been an important driver for voting preferences for the Liberal and Labor parties (Bean, 1999). The Liberal party has a history of representing the protestant voter while catholics usually vote for the Labor party. Because religious denomination was not considered in the main analysis, I have conducted a robustness check with the inclusion of a dummy variable that controls for whether the mother of the participant is protestant or not. I especially expected to find different results from the estimations that were done based on the religious sample because the sample size was smaller and the average religious denomination differed between those that had a brother and those that had a sister. For example, men with religious mothers who had a brother were more likely to be Roman catholic. It then becomes possible that not sibling gender but Catholicism is the reason why men in this dataset with a religious family background vote less for the Liberal party.

Indeed, from these regressions it appears that having a protestant mother affects the probability of voting for the Liberal party positively and voting for the Labor party negatively. However, the direction, magnitude and statistical significance of the sibling gender effects on voting behavior barely changed through the inclusion of this variable. The effects of sibling gender therefore take effect independent of whether the person in question is catholic or protestant.

Similarly, sibling gender effects on attitudes have remained largely unchanged after the inclusion of a control for protestant religiousness of the mother. Very few effects that were close to significant become significant after controlling for this characteristic. For example, not only men from the general sample but also religious men who have brothers now appear to favor birth control with a 5% level of statistical significance.³⁸

 $^{^{38}}$ Apparently being a protestant has a large, positive and statistically significant effect on the opinion of a man from a religious family background towards birth control.

7 Discussion and conclusion

This research presents an analysis of sibling gender effects on voting behavior and attitudes. For a meaningful explanation of these effects, the contextual analysis proved to be as important if not more than the analysis on voting behavior itself. Ultimately, the contextual analysis has provided some directions for the interpretation of sibling gender effects though more evidence for the proposed mechanisms is warranted. Nevertheless, the outcomes of this research have shown that the impact of a sibling's gender is not confined to a person's economic outcomes or attitudes as was found in earlier research, but also extends to his or her voting behavior.

The estimations on a general sample do not yield significant results though the magnitudes of the effects are non-negligible. They suggest that women with sisters are more likely to vote for the National and Democrat parties and are less likely to vote for the Liberal party. However, after inclusion of controls I find that a full-time working woman votes less often for the Labor party when she has a sister (while other women apparently vote more for the Labor party when they have a sister). Men with brothers vote more frequently for the National and Labor parties and less frequently for the Liberal and Democrat parties. This effect does not change when controls are included.³⁹

Inspired by findings of Cools and Patacchini (2017), I have estimated the effects of sibling gender on voting behavior in a religious sample. The results for women are similar to that of the general sample but a different picture arises for men. Men with religious mothers are less likely to vote for the Liberal party and more likely to vote for all the other parties when they have a brother. Notably, the estimations for the Liberal party and the National party were statistically significant with and without controls for employment status, birth year, social class and education. This result raises the question why we found these effects for men with religious family backgrounds.

The Liberal party introduced female friendly policies before the year 1990 (the year in which the twins filled out the survey data used in this research). These policies concerned child endowment, protection of deserted wives and equal pay legislation and do not seem to challenge or counter traditional or religious ideas about a mother's position in the family. In fact, I find that women (compared to men) with religious mothers vote significantly less often for the Labor party and more often for the Liberal party independent of their social class, level of education, employment status, religious denomination and the frequency of their own church attendance. A potential explanation for the sibling gender effect that was found to impact the voting behavior of men with a religious family background is therefore that having a sister increases the understanding of the other gender. By growing up with a sister and emphasizing with the situation these sisters are in, they might favor policies that aid them. Next to opposite-sex understanding, the gender role mechanism might also play a role if men with sisters adopt more traditional role patterns and therefore vote more conservatively.

Another topic of investigation was whether the gender of a sibling would affect the opinions of men and women and how. To provide a context based on which the nature of the sibling gender effects could be understood, I looked into gendered attitudes of the twins.

Men and women in this dataset have differing attitudes with regards to Christianity, inclusivity and a wide range of specific topics. Women appear to be more religious and more inclusive than men. However, growing up with a brother or sister does not make a difference in the strength of these general attitudes for both men and women. Sibling gender effects do turn out to be present for a range of opinions on specific topics. I have attempted to interpret the effects of sibling gender in two frameworks. The first is a framework of traditional role patterns and gender identity alike to that described in the model of Akerlof and Kranton (2000). The second framework is one of an improved understanding of the other sex.⁴⁰

Notably, the opinions of women that have brothers often become more like those of men. In the general sample, having a brother likens the opinion of a woman more to that of a men for attitudes

 $^{^{39} \}rm{Due}$ to the low amount of voters for the Democrat and National parties, the magnitude of the effects are more significant for the Liberal and Labor parties.

 $^{^{40}}$ For the existence of such a mechanism, I found some suggestive evidence in the results of Washington (2008), Warner (1991), and Warner and Steel (1999).

towards; legalized prostitution, the death penalty, caning, and the evolution theory. Men on the other hand, do not bring their opinions closer towards that of women when they have sisters. The only topic for which this was the case concerned royalty. Rather, men seem to generally diverge with their opinions from those of women when they have a sister. Having a sister makes them think more positively about defense spending and nuclear power. Perhaps this confirms stereotypes of women being more understanding and men feeling a stronger need to establish their manhood. Men might then exaggerate those opinions that they can fit in their masculine identity. For women this seems to be the case only with regards to the topic of chastity. Women with brothers could feel more inclined to confirm their feminine identity by showing their agreement with virtuous sexual conduct (Akerlof & Kranton, 2000).

In the religious sample, men with brothers seem to have different ideas about topics that concern women. Men with brothers think more positively about birth control and divorce and they also think more positively about chastity. Women with a religious family background also think differently when they have a brother. Those who have a brother are less likely to agree with women judges than those with sisters. A likely explanation involves childhood socialization with regards to traditional role patterns. Rao and Chatterjee (2018) found that women with brothers were much more likely to adopt traditional ways of thinking about their own role as a wife. Perhaps men with sisters from religious family backgrounds also adopt more traditional views which could explain their more negative stance on birth control and divorce when they have a sister.

The nature of this research was rather exploratory and much about the effects of sibling gender on attitudes remains unexplained or unclear. For example, I cannot provide an explanation for why men from the general and religious sample and women from the religious sample with same sex siblings have a more positive attitude towards socialism. Or why women and men with opposite sex siblings have more positive attitudes towards patriotism. Also the earlier described effects of sibling gender on attitudes are only explained through the lens with which I chose to look, namely that of traditional gender role development and a better opposite-sex understanding. In other words, I might have missed out on other valuable frameworks that can explain sibling gender effects.

This research is also limited in its ability to create an understanding of the context in which to interpret the effects of sibling gender on voting behavior. Only for the Liberal party I was able to find information with regards to female friendly policies that they proposed and implemented before 1990. As such, it becomes difficult to reason through some of the observed effects. Because of that I cannot be completely sure whether men from the religious sample with sisters are more likely to vote for the Liberal party because they offer female-friendly policies or because of other policies about which I could not find information.

Other limitations concern the lack of observations and time constraints. For example, I have not been able to investigate why having a sister has a different impact on the voting behavior of women who work full-time compared to the voting behavior of women in general. This heterogeneity in sibling gender effects across women's employment status might be an interesting topic for further research.

Corroborating the findings of Cools and Patacchini (2017) I only found statistically significant effects of sibling gender on voting behavior in religious families. However, besides influence of the gender role mechanism, I propose a second driver of sibling gender effects. Not only are men with sisters inclined to adopt stronger gender roles, they could also have an improved awareness and understanding of the other sex. A continuation of sibling gender research with a focus on religious households and further exploration of the proposed mechanisms is warranted to test the validity of these arguments.

8 Appendix I: Factor Analysis

While a short summary of what is done is provided in this first paragraph, a more detailed description and justification of the steps and decisions made, follows in the consecutive sections.⁴¹ The factor analysis that is used in this research to construct general attitudes considers all fifty attitudinal topics for simplification but ends up being used on only a subset (fifteen) of them due to a lack communality between the variables (see table A.14). Principal-Factor is used as the method of analysis in which four factors have been retained and to which an oblique Oblimin rotation has been applied. Finally, the factors constructed with Thomson's regression method can be interpreted as measures of attitudes towards 'Humanism', 'Christianity', 'Unnatural birth' and 'Inclusivity'. Due to questionable normality of the data, replicability of the findings is not ensured (see figure 2). In the following paragraphs I will present arguments for adequacy and use of the data, choice of analysis type, amount of factors retained and type of rotation used. I will conclude with an elaboration on the interpretation of underlying attitudes and justify the applied method for the construction of factor scores.

8.1 Data adequacy

8.1.1 Normality

Since factor analysis is based on a correlation matrix, the data should be measured at least at an interval level (Rietveld & van Hout, 1993 p. 252). Seeing that all the attitudinal questions are answered with a choice between three degrees of agreement, this requirement is being met (see table A.1). However, the discrete nature of the questions does provide problems for testing the normality of our data which is of importance because approximately normally distributed data can ensure generalization of results beyond the sample (Field, 2009). Additionally, the normality of the variables will be essential when a choice has to be made between factor extraction methods (Costello & Osborne, 2005, p.2). Firstly I conducted the Shapiro-Francia normality test for all the attitudinal variables. On the basis of this test there seems to be much variability in how similar the distributions of the variables are to that of a lognormal distribution. For 29 of the 50 variables the zero hypothesis of normality was rejected. This is not a very surprising outcome considering that the data is of a discrete nature. The available answers were limited to 'Yes', '?' or 'No', implying that when attitudes towards a certain topic are generally not very pronounced, the distribution will show a lot more similarity to a normal distribution than when all people generally agree or disagree with a topic or when the attitudes are polarized, in which case people only agree or only disagree. This can be seen by plotting histograms for the distributions of the attitudes (see figure 2). You can see that the attitudes are indeed polarized or skewed, not only for attitudes on topics like the death penalty for which the Shapiro-Francia test rejected the zero hypothesis of normality, but even for attitudes towards topics like 'Church authority' for which the Shapiro-Francia test did not reject the zero hypothesis of normality. When you overlay the histogram with a normal density (that has the same mean and standard deviation as the data) it appears that the data does not match it very well.

Based on the outcome of the Shapiro-Francia test and the histograms, I will conclude that the data is not normally distributed and approach possible generalization of the results with caution.

8.1.2 Variables for analysis

Several methods have been employed to evaluate whether all the variables ought to be included in the analysis. The first method is to inspect the squared multiple correlations (SMC) of variables with all other variables. They give an indication of the common variance and also help to identify variables that are not related to the other variables, which should not be included in the analysis.

⁴¹The analysis is carried out loosely based on the overview of steps that Rietveld and van Hout put forward in their book Statistical Techniques for the Study of Language and Language Behaviour (1993, p. 291) complemented by the article "Best Practices in Exploratory Factor Analysis: Four Recommendations for Getting the Most From Your Analysis" by Costello and Osborne (2005).



Figure 2: Densities of four variables of which the normalities of 'Death penalty' and 'Divorce' were rejected by the Shapiro-Francia test $\$

Similarly, communalities after factor extraction tell us how strongly variables relate to all the factors and Costello and Osborne (2005, p.4) advise that when the communality of a variable is less than 0.40, researchers should consider removing the variable from the analysis. On top of that the anti-image correlation matrix can tell us something more about how the variables relate to each other. It displays the negative of the partial correlations between variables. A partial correlation is what is left of the correlation after the influences of all the other variables have been removed or 'partialed out'. We can establish which variables do not correlate at all with the other variables by looking at the diagonal values of that matrix. If they turn out lower than 0.5, they should be removed (Field, 2000, p.446). Additionally, if we see that the correlations between some of the variables are high in magnitude and that there is not much left in common with the other variables, we know that we can expect to need more dimensions or factors to describe our data. A high correlation can even be an indication that the variables correlate over and beyond the factors in which case perhaps one of the two variables should be eliminated. The Kaiser-Meyer-Olkin measure (KMO) enables choice on the previous matter since it compares between the magnitudes of the correlations and the partial correlations. When the partial correlations are relatively high compared to the correlations, the KMO measure is small and the possible degree of data-reduction is limited because a low-dimensional representation of the data is not feasible. Kaiser (1974, p.35) suggests that the level of factorial simplicity measured by the KMO can be interpreted as the following.

- In the .90's, marvelous
- In the .80's, meritorious
- In the .70's, middling
- In the .60's, mediocre
- In the .50's, miserable
- Below .50's, unacceptable

Hence, if a KMO is measured for variables with a value below 0.5, they should be eliminated from the analysis.

First of all the findings were analyzed in which all the fifty available variables were included and some of the measures showed promising results for data reduction.⁴² Be that as it may, the common variance in the data is quite low. This can be understood from observation of the communalities after factor extraction has been completed as well as from the pre-estimated squared multiple correlations of the variables. With a highest SMC of 0.43 and a lowest SMC of 0.08, the variables show they are not that strongly explained by one another. On top of that the SMC values can be inflated due to the sheer amount of variables that are included in the analysis. Altogether, an SMC value of 0.08 is too low to justify the use of the corresponding variable for analysis and as such it will not be included.⁴³

The earlier mentioned rule that Costello and Osborne put forward (2005, p.4), leads me to consider removing the variables with communalities lower than 0.40. However, only 6 variables (Bible truth, Gay rights, Multiculturalism, Asian immigration, Church Authority, Legalized abortion) appear to have communalities higher than 0.40. Moreover, for the same reason that SMC values decrease after variables are withdrawn from the analysis, the communalities decrease significantly after factor extraction employs less variables.⁴⁴ It seems that whichever combination of variables is included in the analysis, the obtained factors do not explain the variables well enough to fully adhere to the 0.40 communalities rule.

 $^{^{42}}$ None of the correlations on the diagonal axis of the anti-image matrix turned out lower than 0.5, indicating that all of the variables correlate to the others. Partial correlation between the variables appears very low, implying there is opportunity for the dimensionality of the data to be reduced. This is confirmed by the values found of the Kaiser-Meyer-Olkin measure.

 $^{^{43}}$ The variable in question is attitude variable number 42, the opinion of 'Chiropractors'. Likewise, the communality of attitude variable 42 is only 0.14.

 $^{^{44}}$ When the remaining variables are used for analysis, the variable 'Legalized abortion' does not have a communality of 0.40 anymore. The same happens to the attitudinal variable 'Gay rights' if factor extraction takes place again without inclusion of the attitude towards 'Legalized abortion'.

Fortunately, Costello and Osborne (2005, p.4) also mention that a relatively high sample size adds validity to the factors when they are created out of a set of variables that have lower communality values. They propose the subject to variable ratio as a comparable measure for sample size adequacy and created a summary of the measure based on two years' worth of PsychINFO articles (N = 303). Their summary can be seen in table A.13 in the appendix and shows that from the offset, our subject to variable ratio of 32.5:1 is reasonably large in comparison to that of most studies (falling in the top 18.4% of studies), indicating that the presence of lower communalities in our case can be offset by a larger sample size (Costello & Osborne, 2005, p.4).

For the purpose of retaining enough variables to conduct a meaningful analysis, I looked to exclude variables with a value of communalities lower than or equal to 0.25. When the factor extraction was run again after exclusion of a variable, the resulting communalities of the variables were inevitably lower. Therefore I continued this process iteratively, excluding the variable with the lowest communality from the analysis and conducting new factor estimations until the communalities of all the remaining variables exceeded 0.25.⁴⁵ The fifteen variables that are left after this process is completed are listed in table A.14 with their resulting squared multiple correlations, communalities and KMO values

This time I analyzed the anti-image matrix with the newly confined set of variables and found, as expected, that none of the correlations on the diagonal axis was lower than 0.5. No alarmingly high partial correlations between the variables were observed. Similarly, KMO values of the variables in this analysis range from 'mediocre' to 'marvelous'. The overall KMO value equals 0.81 which indicates that the combination of these variables is a meritorious candidate for simplification and suggests that the relatedness of the variables can be attributed to a presence of latent variables.

The question that remains is whether communality values of 0.25 or higher are really sufficient. Since the subject to variable ratio has increased even further to 114.5:1 (only the top 3% of studies has a ratio higher than 100:1), it can be argued that the sample size makes the occurrence of lower common variance quite acceptable. Objection to the previous reasoning lies in the fact that the observations were made on twin pairs. If the attitudes of these twins co-vary, an increased sample size does not provide as much information to credibly establish the communalities' independence of idiosyncratic error. For this reason, correlations were estimated between the answers of twins within a twin pair (N=637).⁴⁶ Averaged over the correlations of variables that are included in the analysis, the mean correlation between answers within a twin pair appears to be 0.27. Even though twins do share some of their opinions, there is definitely much variation in the answering of those questions that is apparently very personal and not influenced by their twin or shared upbringing. This finding strengthens the statement that the size of this sample redeems the fact that the communalities are rather low. Nonetheless, adequacy of the eventual factor structure will remain to be evaluated on the basis of the resulting factor loadings which will be described in the following paragraphs.

8.2 Type of Analysis

Before moving on to the analysis, let me briefly motivate the choice of factor extraction method. There are four options to choose from in my statistical package STATA namely principal-factor, principal-component, iterated principal-factor or maximum-likelihood factor methods. Based on the overview of steps from Rietveld and van Hout (1993, p.291), the relevant choices that ought to be made are between factor analysis (FA) and principal component analysis (PCA) and subsequently, in case of FA, between the ways in which the communalities can be estimated. This approach is shared by Costello and Osborne (2005), who first elaborate on the choice between PCA and FA, and then discuss the different factor extraction methods. However, Rietveld and

 $^{^{45}}$ Even of the variables that had communalities that were initially high enough to include in the analysis, many had to be removed later in the process since certain factors disappeared from the outcomes and therefore decreased their communalities.

 $^{^{46} \}mathrm{Since}$ there are 637 twin pairs in the sample, the remaining 443 'solitary' twins contribute to truly idiosyncratic error.

van Hout (1993) give limited information and guidance regarding the availability of and choice between factor extraction methods (p. 282-284). Likewise, Costello and Osborne (2005) observed that "information on relative strengths and weaknesses of these techniques is scarce, often only available in obscure references" and that there is no agreement on the exact names of the methods which makes it hard to figure out which method is being described and whether it is available in your statistical package (p.2). In line with the previous approach, I will first make a case for choosing FA over PCA and afterwards consider the choice between the factor extraction methods that are still available.⁴⁷ Although the method is very similar to FA, PCA proves inadequate for my data. PCA serves merely as a method for data reduction as it assumes that all the variation in the observed variables relates to the latent variables whereas factor analysis analyzes only the shared variance of the variables, thereby truly discerning an underlying structure (Costello & Osborne, 2005, p.2). For example, opinions on bible truth, divine law, Sabbath observance and church authority would be expected to fall into an attitudinal category called 'Christianity'. However, it is very likely that not all of the variability found in those variables can be attributed to their general attitude towards Christianity. Some of the observations could for example represent someone who is religious but not a Christian. They would appear to have a positive attitude towards divine law but not that positive towards the other variables that concern Christianity, resulting in a variance unique to that variable which PCA would forcefully attribute to a component (factor). In the meanwhile FA recognizes that variance as independent from the common variance. Furthermore, variables can usually not be assumed error free, something that PCA does not take into account. Seeing that the resulting factors are not assumed to predict the complete variance of the variables, FA is adopted in this research as opposed to PCA (Rietveld & van Hout, 1993 p. 267-272).

The three extraction methods that are left to choose from in my statistical package are the principal-factor (FA), iterated principal-factor and maximum-likelihood factor methods. Principal-factor (FA) uses the squared multiple correlations as estimations for the communalities in the correlation matrix and while iterated principal-factor uses these values as a starting point, it reestimates the communalities iteratively. However, I was not able to find convincing arguments as to why iterated principal-factor estimation should be preferred. Costello and Osborne (2005, p.2) argue that either FA (Principal Axis Factoring is the name that they use) or maximum-likelihood factor method are giving you the best results in general. The choice between these two depends on the normality of the data. If multivariate normality clearly does not apply to the data, the principal-factor method should be preferred. Since I was not able to confirm the normality of my data, I will employ FA.

8.3 Factor retention

The following, non-trivial step consists of choosing how many factors to retain. According to Hayton (2009), "Identification of too few or more typically too many factors can lead to confusing or nonsignificant or nonreplicable findings" (p. 390). He warns particularly for overfactoring, leading at least to "construct proliferation" or at worst a "phantom factor structure". Retention of factors used to be and is often still decided upon with the help of certain heuristics such as the 'Guttman-Kaiser' rule (which involves retaining the amount of factors for which the eigenvalues exceed 1), the retention of factors that account for 70-80% of the total variance and keeping those factors of which the eigenvalues fall before the breaking point when they are plotted in a so called 'scree plot' (Field, 2000, p. 436-437; Rietveld & van Hout, 1993, p. 272-274). Notably, even if it is the default in most statistical packages, the use of (only) the Guttman-Kaiser rule is strongly advised against by Costello and Osborne (2005, p.2) as well as Rietveld and van Hout (1993, p.

 $^{^{47}}$ Next to exploratory factor analysis and principal component analysis, I have also considered employing confirmatory factor analysis. However, since I have no knowledge of the process in which the data has been obtained and the theory that underlies the choice of the attitudinal questions, exploratory factor analysis is employed instead of confirmatory factor analysis. See the discussion of Hurley, Scandura, Schriesheim and Brannick (1997) for a more substantive discussion with regard to this topic.



Figure 3: Scree plot comparing the eigenvalues from Parallel Analysis and Factor Analysis

 $273).^{48}$

In addition to the previous, more modern methods are available with improved accuracy (Costello & Osborne, 2005). Of these, I will employ Horn's parallel analysis which is currently deemed one of the major if not the primary standard by which factor retention decisions ought to be made (Dinno, 2009; Hayton 2009). The method concerns the comparison between eigenvalues of the factors obtained with the data of interest and the mean eigenvalues of factors obtained from datasets of randomly generated observations. The eigenvalues of the real dataset that exceed that of the random dataset should be retained.

First I will consider what the heuristics are telling me to do. After the initial estimation of the factors it appears that 2 factors have eigenvalues that exceed 1. From the scree plot I would be tempted to conclude that 3 factors ought to be kept since the breaking point seems to occur at the fourth factor. Looking at the proportion of variance accounted for the cumulative proportion exceeds 100% at the third factor which is not very informative.⁴⁹

When I conduct a parallel analysis in which the eigenvalues average over 10 replications (see figure 3), it appears that 5 of the 15 factors generated from the twin dataset have an eigenvalue that exceeds the mean eigenvalues generated by the random datasets. Since the eigenvalue of the fifth factor is very small and comparable to the eigenvalue from parallel analysis, I choose to exclude the fifth factor. Contrastingly, the eigenvalue of the fourth factor is about three times larger than the mean eigenvalue generated by parallel analysis. Consequently I decide to retain 4 factors.

8.4 Type of rotation

Factor rotation is often necessary to improve interpretation of the extracted factors. After all, the initial extraction of the factors is only informative about the total amount of common variance the

 $^{^{48}}$ Rietveld and van Hout point out that in PCA, the retention of factors with eigenvalues exceeding 1 makes sense because the variance of variables are not split into different parts which means they all have communalities of 1. "One may then argue that it is not worthwhile retaining components which which explain less than the variance of a single (standardized) variable." Since in FA the variance shared with other variables is lower than 1, this reasoning does not apply.

 $^{^{49}}$ This appears to happen more frequently in FA since the estimated communalities are not perfectly accurate and therefore some of the eigenvalues have to become negative in order to make sure that the cumulative proportion equals 100% after going through all the factors (Suhr).

data retains and the minimum amount of dimensions or factors in which that common variance can be divided without loss of information. The loadings of the variables on the factors are determined concurrently with the extraction of factors and tell us how strongly the variables relate to them. Factors are initially chosen in such a way that the first factor accounts for most of the variance, the second factor for most of the remaining variance etcetera (Rietveld & van Hout, 1993 p. 258-259). Unfortunately this process does not necessarily provide a clear picture of certain variables relating strongly with one factor and minimally with another while such a clear pattern of loadings, also referred to as 'simple structure', can significantly aid the interpretation of the factors (Thurstone, 1947).

In table A.15 in the appendix, the results of the analysis are shown when no factor rotation has been employed.⁵⁰ As expected, there is no clear pattern of loadings to be perceived. The desired result might be achieved by rotating the factor axes such that one particular group of variables clusters on the factor axis (Rietveld & van Hout, 1993 p. 278-279). The pattern of factor loadings changes and the total variance is redistributed over the factors. As such, different factors from those that arose from the initial estimation are then established. When a simple structure is obtained, a resulting factor describes first and foremost an underlying attitude for that particular group of variables and explains to a much lesser extent the common variance of other groups of variables.

There are two main types of rotation to choose from, orthogonal and oblique. The first type of rotation assumes uncorrelated factors while the second allows the factors to be correlated. Rotating orthogonally provides a simpler interpretation and better replicability while an oblique rotation accounts for a better fit of the data. Researchers warn for ignorant use of orthogonal rotation (Thurstone, 1947; Cattel, 1978). In fact, it is warranted that orthogonal rotations should only be used when it is established that the factors are not strongly correlated after the employment of oblique rotation (Pedhazus & Schmelkin, 1991, p. 615; Tabachnick & Fiddell, 2007, p. 646; Field, 2000, p. 439; Cudeck & O'Dell, 1994, p.483). On the other hand Kim and Mueller (1978, p. 50) state that even when correlation between the factors occurs after use of oblique rotation, the arbitrary imposition that the factors remain orthogonal/ uncorrelated could be preferred nonetheless simply for the reason that the resulting factors are easier to interpret. In other words, the achievement of simple structure ought to be the primary concern of a researcher. Brown (2009) therefore advises to try both an oblique and an orthogonal rotation. I will employ Varimax (orthogonal) and Oblimin (oblique) rotations and compare the two resulting factor structures based on their simplicity. In determining simple structure I will adhere to the five criteria proposed by Thurstone (1947):

- 1. Each variable should produce at least one zero loading
- 2. Each factor should have at least as many zero loadings as there are factors
- 3. Each pair of factors should have variables with significant loadings on one and zero loadings on the other
- 4. Each pair of factors should have a large proportion of zero loadings on both factors (if there are four or more factors)
- 5. Each pair of factors should have only a few complex variables

Of course the determination of what 'zero loadings', 'significant loadings' and 'complex variables' really are, needs to be elaborated on. Simply put, 'zero loadings' are extremely small loadings, 'significant loadings' are large loadings and 'complex variables' are those for which the factor loadings are significant for more than one factor.⁵¹ A magnitude of 0.30 or a bit higher is often considered a significant loading in the literature (Rietveld & van Hout, 1993; Brown, 2009;

 $^{^{50}}$ Note that all the loadings that are presented from now one have been extracted from an analysis in which 4 factors have been retained.

 $^{^{51}}$ Even if the variable is not related to the factor in the population, loadings that are exactly zero are extremely unlikely to occur due to sample variability and measurement error.

Costello and Osborne, 2005). However, Rietveld and van Hout (1993) emphasize that "one has to admit ... that such a criterion is not well founded" (p.274). It would at least be important to know whether the zero hypothesis that a loading is actually zero in the population can be rejected. In fact, there have been attempts to account for the sampling variability of the loadings through the construction of standard errors, a practice that is complicated by the fact that it ideally should include the method of estimation, type of rotation, size of the sample, number of factors, clarity of the solution (or presence of simple structure), the degree of correlation among the factors and the number of coefficients estimated (Cudeck & O'Dell, 1994, p.475). Not only the 0.30 rule, but also the more simple methods of standard error estimations as means of determining significance have been identified as problematic by Cudeck and O'Dell:

Any guideline based on only one condition can be quite inaccurate for judging the significance of individual rotated loadings. For example, a large sample with a small number of variables and a clear solution may result in all coefficients greater than \pm .10 being significant; in another data set, even loadings as large as .80 may be nonsignificant if N is small. With some collections of variables, loadings on .40 on a dominant factor may be significant, whereas a loading of .70 on a smaller factor may be not. Loadings of identical magnitude on the same factor may be significant for some variables but not even approach significance for others. (1994, p.476)

Though the authors point to the existence of standard error estimates that are very valuable, they are unaware of any computer program that computes them. It indeed turned out that for the loadings in my factor analysis, I was not able to find any way of significance testing for factor loadings in my statistical package STATA. This leaves me no choice but to rely on one of the other methods that the literature presents me with. Rietveld and van Hout (1993, p.275) propose, amongst other methods, using the critical values of the distribution of the product moment correlation coefficient, two-tailed with a significance level of 0.1. The critical value should then be doubled and if the loading exceeds that number, it can be concluded that it is significant. Our actual sample size is 1717 but the closest I came to that going through online sources was when I came across a critical value for a sample size of 1500. Doubled (0.066445 * 2), it tells us that the loading of a variable on a factor should exceed 0.133 for the confidence interval to exclude zero and for us to deem the loading statistically significant.

Based on the previous it is not to be concluded that loadings which are smaller or higher than 0.133 can be considered a Thurstonian 'zero loading' or 'significant loading' respectively.⁵² Any variable that negligibly relates to a factor should be regarded a 'zero loading' and the same counts for the definition of a 'significant loading'; it ought to be significant both statistically and in magnitude. From here on, I will follow the rule of thumb of Gorsuch (1983, p.180) and consider loadings between -0.10 and 0.10 'zero loadings'. Since the zero hypothesis of having a zero loading can be rejected for a loading of 0.133 according to the method described in the last paragraph, I am confident that loadings higher than 0.30 can be considered statistically significant even when their individual significance can greatly vary. On top of that I have taken note of Costello and Osborne (2005, p.4) referring to the 0.32 rule of thumb as a good rule because it equates to about 10% of overlapping variance with the other variables in that factor meaning that a 0.30 loading can also be considered significant in magnitude. Therefore a loading higher than 0.30 will be called a 'significant loading' from now on.

With these definitions in mind, I move on to the estimation of the Varimax and Oblimin rotations. The resulting factors have similar interpretations in both cases but Oblimin rotation provides a more simple structure according to the five criteria proposed by Thurstone (for comparison see table A.16 and table A.17 in the appendix). You will be spared the tedious steps of going through all of the criteria but it should be noted that the Varimax rotation yielded two complex

 $^{^{52}}$ This would imply that an increase in sample size would make the attainment of simple structure even harder which was not the intent behind the formulation of the criteria. To see this I like to imagine that when the whole population would be accounted for in my sample, variables always relate to some extremely small extent to all of the obtained factors. Of course that does not mean that all variables should be interpreted as significant variables for the determination of simple structure.

variables while the Oblimin rotation yielded none. Costello and Osborne (2005, p.4) state that complex variables indicate that "the items may be poorly written or the a priori factor structure could be flawed." In this scenario, we can conclude that imposing orthogonality on the factors contributes to a flawed factor structure. Since there is no reason to assume that the general attitudes underlying the measured attitudes would not be correlated, oblique rotation can be expected to provide the most correct view of what underlying attitudes describe the observed attitudes of the twins and how these general attitudes interact with one another. Hence, Oblimin is the preferred rotation based on which the factors and factor scores can be constructed.

8.5 Interpretation and scoring of factors

For the interpretation of the factors, you are referred to the main text under section 3. Here, it suffices to know that four factors have been distilled which describe a person's attitude towards 'Humanism', 'Christianity', 'Unnatural reproduction' and 'Inclusivity'.

Then we move on to the last aspect of the analysis, the construction of scores for the factors. The scores have been constructed with Thomson's regression method (1951).⁵³ My statistical package, STATA, also offered the option of creating factor scores with Bartlett's method. Although Bartlett's factor score estimates have the advantage of being unbiased, Thomson's scores account for a maximized correlation between the factor scores and the estimated factor. Importantly, both methods counteract the problem of "indeterminacy" in different ways. The problem states that the factor solution is not uniquely defined due to the researcher's unique choice of a communality estimate and indeterminacy can be observed by examining the factor scores for validity, univocality and correlational accuracy (DiStefano, Zhu & Mindrila, 2009, p.6). Validity, which is the correlation between the factor scores and their respective factor, is maximized in case of Thomson's regression method. For univocality, which is the extent to which factor scores are related to other factors in the analysis, I was not able to test but it is to be expected that Bartlett scoring would provide a better result. However, since the interpretation of the factors does not depend on the imposition of orthogonality, this aspect of indeterminacy might not carry the most weight. I was able to test whether the constructed factor scores were comparably correlated to one another (correlational accuracy) in comparison to the factor correlation matrix and found that Thomson's scores overstated the relationships while Bartlett's scores understated the relationships (see table A.19 in the appendix). Finally, when one looks to find estimates that most accurately describe factor scores for particular individuals, Barlett scores are better, but seeking estimates that provide the best prediction for the population as a whole, Thomson's regression is the method to use for factor score estimation (Bartholomew, Deary & Lawn, 2009).

 $^{^{53}\}mathrm{The}$ rounded factor scores per variable can be found in appendix II

9 Appendix II: Tables

1.	Death penalty	26.	Multiculturalism
2.	Casual sex	27.	Chastity
3.	Privatisation	28.	Fluoridation
4.	Medicare	29.	Royalty
5.	Stiffer jail terms	30.	Women judges
6.	Trade unions	31.	Strict rules
7.	Patriotism	32.	Test-tube babies
8.	Voluntary euthanasia	33.	Apartheid
9.	Nuclear power	34.	Asian immigration
10.	Working mothers	35.	Church authority
11.	Bible truth	36.	Disarmament
12.	Gay rights	37.	Censorship
13.	Inborn conscience	38.	White lies
14.	Government welfare	39.	Caning
15.	Divine law	40.	Teenage dole
16.	Socialism	41.	Private schools
17.	White superiority	42.	Chiropractors
18.	Herbal remedies	43.	defense spending
19.	Charity work	44.	Divorce
20.	Suicide	45.	Foreign ownership
21.	Conservationists	46.	Surrogate mothers
22.	Licensing laws	47.	Legalised abortion
23.	Birth control	48.	Modern art
24.	Evolution theory	49.	Condom machines
25.	Sabbath observance	50.	Legalised prostitution
Agre	ement with a topic was indic	cated w	vith 'Yes', '?' or 'No'.

Table A.1: Fifty attitudinal topics from the ALCY (yellow) dataset

Attitude	Mean attitude female -	% of standard deviation
	Mean attitude male	
Casual sex	-0.63***	70%
Nuclear power	-0.41***	54%
Legalised prostitution	-0.45***	50%
Gay rights	0.36^{***}	41%
Women judges	0.14^{***}	35%
Charity work	0.15^{***}	33%
Modern art	0.23***	31%
Censorship	0.26^{***}	30%
Herbal remedies	0.22***	28%
Socialism	0.19^{***}	26%
Privatisation	-0.15***	20%
Birth control	0.10***	24%
Royalty	0.21***	24%
defense spending	-0.17***	21%
Caning	-0.17***	21%
Apartheid	0.14^{***}	21%
Multiculturalism	0.14^{***}	20%
Inborn conscience	0.11***	19%
Evolution theory	-0.13***	18%
Sabbath observance	0.12***	18%
Church authority	0.13***	17%
Death penalty	-0.15***	17%
Stiffer jail terms	0.09***	17%
Bible truth	0.13***	16%
Government welfare	0.11***	15%
Trade unions	0.11***	14%
Medicare	0.09***	13%
Conservationists	0.09***	13%
Working mothers	0.06**	10%
Suicide	-0.06*	9%
Licensing laws	0.05^{*}	9%
Test-tube babies	0.07^{*}	9%
Chastity	0.06^{*}	8%
Humanism	-0.08*	10%
Christianity	0.15***	19%
Unnatural birth	0.03	not significant
Inclusivity	0.20***	26%

Table A.2: Differing mean attitudes between men and women

Note: Two-sided testing has been used to establish whether the answers of men and women on these topics differ significantly. The attitudinal variables not listed here showed no statistically significant mean differences between the answers given by men and women. The values of the answers to most of the attitudinal questions are either 1 (no), 2 (?) or 3 (yes). Since some questions were answered more equally by all people, comparing between the mean answers of men and women is not completely informative of how strongly their opinions differ. Therefore the difference in means as a proportion of the standard deviation in each answered question is included. The total of observations ranged from 1759 to 1824.

*** p<0.01, ** p<0.05, * p<0.1

	(1)	(2)	(3)	(4)
Obs. 1243	Liberal	National	Democrat	Labor
Female	0.134	-0.0848	0.208	-0.198
	(0.121)	(0.239)	(0.197)	(0.126)
Social class	0.708***	-0.333	0.338*	-0.750***
Social class	(0.127)	(0.258)	(0.181)	(0.119)
	(0.121)	(0.200)	(0.101)	(0.110)
	(5)	(6)	(7)	(8)
Obs 1225	Liberal	(0) National	Democrat	(0) Labor
0.053. 1220	Шостал	rational	Democrat	Labor
Fomalo	0.174	0 165	0.949	0.222*
remarc	(0.174)	(0.241)	(0.242)	(0.120)
Social alarg	(0.124) 0.764***	(0.241)	(0.201)	(0.130) 0.720***
Social class	(0.120)	-0.520	(0.105)	-0.739^{+++}
	(0.132)	(0.260)	(0.185)	(0.123)
	0.100	0.0000	0.000	0.0057
Education	-0.160	-0.0223	0.206	0.0857
TT 1	(0.135)	(0.268)	(0.213)	(0.142)
Homemaker	-0.349	0.513	-0.177	0.288
	(0.265)	(0.471)	(0.450)	(0.273)
Part-time	-0.238	0.290	-0.141	0.202
	(0.263)	(0.497)	(0.451)	(0.259)
Student	-0.294	0.0571	0.922^{***}	-0.163
	(0.188)	(0.376)	(0.279)	(0.196)
Unemployed	-0.647^{*}	-0.585	0.248	0.640^{**}
	(0.332)	(0.740)	(0.496)	(0.299)
	(9)	(10)	(11)	(12)
Obs. 1225	Liberal	National	Democrat	Labor
Female	0.348	-0.0349	0.241	-0.469*
	(0.237)	(0.386)	(0.329)	(0.239)
Social class	0.772***	-0.318	0.168	-0.751***
	(0.132)	(0.259)	(0.186)	(0.123)
	(0.102)	(0.200)	(0.100)	(0.120)
Education	-0.159	-0.0197	0.206	0.0831
Laucation	(0.135)	(0.268)	(0.200)	(0.142)
Homomakor	0.550	(0.200)	0.175	(0.142) 0.560
HOMEINGREI	-0.000	(0.505)	(0.551)	(0.350)
Dont time	0.300)	0.166	(0.001)	(0.009)
1 at t-time	-0.402	(0.100)	-0.139	(0.910)
Ctord out	(0.320)	(0.320)	(0.320)	(0.318)
Student	-0.429*	-0.0451	0.924^{**}	0.0146
TT 1 1	(0.245)	(0.446)	(0.372)	(0.253)
Unemployed	-0.769**	-0.673	0.250	0.800**
	(0.368)	(0.767)	(0.522)	(0.336)
Female*full-time	-0.240	-0.187	0.00248	0.326
	(0.269)	(0.462)	(0.393)	(0.275)

Table A.3: Party-specific voting behavior

Note: The effects are estimated with logistic regression analysis. All the regressions control for birth year fixed effects. Standard errors in parentheses are robust and clustered by twin pair. *** p<0.01, ** p<0.05, * p<0.1

	(1) Voting spectrum	(2) Voting spectrum	(3) Voting spectrum	(4) Voting spectrum	(5) Voting spectrum	(6) Voting spectrum	(7) Voting spectrum
Female		-0.461***		-0.132	-0.196*	-0.188	-0.451***
		(0.125)		(0.119)	(0.117)	(0.124)	(0.136)
Social class	-0.613^{***}	-0.601^{***}	-0.885***	-0.883***	-0.739^{***}	-0.877***	-0.701^{***}
	(0.124)	(0.125)	(0.120)	(0.120)	(0.117)	(0.123)	(0.132)
Privatisation	-0.438*** (^)	-0.474*** (0.0296)					-0.462*** (0.0864)
Medicare	(0.529^{***})	0.553^{***}					(0.521^{***})
	(0.0905)	(0.0908)					(0.0948)
Trade unions	0.486^{***}	0.488^{***}					0.447^{***}
Socialism	(0.0770) 0 35/***	(0.0771)0.370***					(0.0820)0 369 $***$
Inclusion	(0.0850)	(0.0854)					(0.0901)
Humanism	~	~	-0.266	-0.287		-0.207	-0.153
			(0.197)	(0.197)		(0.199)	(0.203)
Christianity			-0.532^{***}	-0.533^{***}		-0.509***	-0.453^{***}
			(0.115)	(0.115)		(0.116)	(0.121)
Unnatural birth			0.137	0.156		0.138	0.102
			(0.159)	(0.160)		(0.161)	(0.165)
Inclusivity			0.440^{***}	0.450^{***}		0.455^{***}	0.206^{**}
ŗ			(0.0788)	(0.0796)		(0.0837)	(0.0919)
Education					0.130	0.0495	0.154
TT					(0.125)	(0.130)	(0.134)
nomemaker					0.949) (0.949)	0.403 (0.266)	0.030 (0.263)
Part-time					0.216	0.146	0.291
					(0.240)	(0.242)	(0.250)
$\mathbf{Student}$					0.116	-0.0913	-0.0863
					(0.159)	(0.174)	(0.187)
Unemployed					0.687^{**}	0.707^{**}	0.622^{*}
					(0.291)	(0.297)	(0.328)
Observations	1,220	1,220	1,199	1,199	1,225	1,182	1,169
Note: For these est spectrum. The mea Liberal, National, L	imations, ordered logist sure used for this voting Democrat and Labor res	ic regression analysis h g spectrum orders the p pectively. Social class i	as been employed whi arties from most right s answered with values	works with the ass -wing to left-wing as d s 1 'working class', 2 '	umption that the politi escribed in table 1 such middle class' and 3 'up	ical parties can be ord that the values 1, 2, 3 per class'. Female take	and 4 represent s the value 0 for
men and the value and differing maxim	I IOF WOMEN. AUTUUGINE 1111 and minimum value	at variables take values as. Standard errors in p	arentheses are robust a	s) while the general att and clustered by twin	pair. *** p<0.01, ** p<	ctor analysis nave a m <0.05, * p<0.1	ean value of zero

Table A.4: Attitudes and voting behavior on a Right-Left political spectrum

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Liberal	National	Democrat	Labor	Liberal	National	Democrat	Labor
Female	0.0729	-0.173	0.303	-0.148	0.396^{***}	0.0290	0.206	-0.396***
	(0.129)	(0.249)	(0.204)	(0.135)	(0.144)	(0.261)	(0.208)	(0.145)
Social class	0.803***	-0.263	0.138	-0.783***	0.693***	-0.263	0.241	-0.706***
boolar olabb	(0.134)	(0.271)	(0.187)	(0.125)	(0.148)	(0.273)	(0.202)	(0.137)
	(0.101)	(0.211)	(0.101)	(0.120)	(0.110)	(0.210)	(0.202)	(0.101)
Privatisation					0.566***	-0.208	-0.0768	-0 418***
1 11/2015201011					(0.0064)	(0.147)	(0.125)	(0.0032)
Madiaana					(0.0304) 0.476***	(0.147)	(0.125)	(0.0952)
medicare					-0.470	-0.230	(0.221)	(0.114)
m 1 ·					(0.101)	(0.177)	(0.180)	(0.114)
Trade unions					$-0.472^{-0.47}$	-0.355	0.420^{-10}	$0.389^{(-1)}$
a					(0.0876)	(0.163)	(0.134)	(0.0867)
Socialism					-0.411***	-0.201	0.0838	0.380***
					(0.0987)	(0.189)	(0.129)	(0.0951)
Humanism					0.167	0.119	0.00886	-0.206
					(0.220)	(0.342)	(0.324)	(0.217)
Christianity	0.396^{***}	0.265^{*}	-0.206	-0.397***	0.528^{***}	0.351	-0.267	-0.433***
	(0.0805)	(0.154)	(0.126)	(0.0847)	(0.130)	(0.239)	(0.180)	(0.131)
Unnatural birth					0.0122	-0.0153	-0.292	0.173
					(0.185)	(0.291)	(0.281)	(0.181)
Inclusivity					-0.339***	-0.355**	0.512***	0.114
					(0.102)	(0.175)	(0.154)	(0.100)
					(0110=)	(01110)	(01101)	(01200)
Education	-0.171	-0.0494	0.200	0.0958				
Eddoarion	(0.139)	(0.282)	(0.215)	(0.145)				
Homemaker	-0.390	(0.202) 0.327	-0.148	0 383				
Homemaker	(0.280)	(0.521)	(0.452)	(0.281)				
Part time	0.200)	(0.303)	(0.432) 0.172	(0.201)				
1 at t-time	(0.220)	(0.307)	-0.172	(0.262)				
Ci 1 i	(0.269)	(0.498)	(0.435)	(0.203)				
Student	-0.300	0.0518	0.945^{***}	-0.191				
	(0.198)	(0.393)	(0.283)	(0.207)				
Unemployed	-0.712**	-0.558	0.314	0.658**				
	(0.346)	(0.739)	(0.497)	(0.309)				
Observations	1,182	1,182	1,182	1,182	1,185	1,185	1,185	1,185

Table A.5: Party-specific effects of attitudes on voting behavior

Note: The effects are estimated with logistic regression analysis. Female takes the value 0 for men and the value 1 for women. Attitudinal variables take values 1 (no) 2 (?) and 3 (yes) while the general attitudes obtained with factor analysis have a mean value of zero and differing maximum and minimum values. Standard errors in parentheses are robust and clustered by twin pair. *** p<0.01, ** p<0.05, * p<0.1

	(1)	(2)	(3)	(4)
Obs. 1243	Liberal	National	Democrat	Labor
Female	0.360^{*}	-0.141	0.352	-0.498**
	(0.199)	(0.430)	(0.305)	(0.211)
Social class	0.368^{*}	-0.834**	0.586^{*}	-0.385*
	(0.220)	(0.410)	(0.303)	(0.209)
Constant	-1.032^{**}	-1.359	-3.646***	0.556
	(0.487)	(0.842)	(0.691)	(0.462)
Observations	453	433	453	453
	(5)	(6)	(7)	(8)
Obs. 1225	Liberal	National	Democrat	Labor
Female	0.405^{*}	-0.335	0.495	-0.586**
	(0.214)	(0.441)	(0.318)	(0.229)
Social class	0.559^{**}	-0.976**	0.449	-0.488**
	(0.243)	(0.445)	(0.310)	(0.228)
Education	-0.471**	0.0389	0.309	0.342
	(0.227)	(0.461)	(0.330)	(0.247)
Homemaker	-0.818*	0.854	-1.084	0.882^{*}
	(0.447)	(0.713)	(1.060)	(0.470)
Part-time	-0.189	0.508	-0.729	0.319
	(0.518)	(1.136)	(1.069)	(0.487)
Student	-0.403	1.029^{*}	0.556	-0.195
	(0.308)	(0.555)	(0.446)	(0.341)
Unemployed	-0.347		0.757	0.0961
	(0.546)		(0.632)	(0.541)
Church attendance	-0.192**	-0.0512	0.0309	0.212**
_	(0.0866)	(0.160)	(0.140)	(0.0893)
Protestant	0.720***	0.157	-0.379	-0.669***
	(0.229)	(0.416)	(0.313)	(0.239)
(Comptoint)	0 700	1 190	9 101***	0 1 1 9
Constant	-0.799	-1.130	-3.404***	0.112
	(0.631)	(1.035)	(0.862)	(0.599)
Observations	440	410	449	449
Observations	442	410	442	442

Table A.6: Party-specific voting behavior in a religious sample

Note: The sign of the coefficient for church attendance is negative because the variable for church attendance denotes a 1 for the most frequent visitation of the church and a 5 for the least frequent visitation. Church attendance takes value 1 when someone visits church more than once a week, 2 for once a week, 3 for every month or so, 4 for once or twice a year and 5 for rarely. The effects are estimated with logistic regression analysis. All the regressions control for birth year fixed effects. Standard errors in parentheses are robust and clustered by twin pair. *** p<0.01, ** p<0.05, * p<0.1

General sample								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Humanism	Christianity	U.B.	Inclusivity	Humanism	Christianity	U.B.	Inclusivity
SS co-twin	-0.0688	0.00912	-0.0515	-0.0241	-0.0633	-0.0275	-0.0477	-0.0294
	(0.0581)	(0.0545)	(0.0515)	(0.0492)	(0.0594)	(0.0562)	(0.0533)	(0.0483)
Add. controls	No	No	No	No	Yes	Yes	Yes	Yes
Observations	$1,\!053$	1,053	$1,\!053$	1,053	969	969	969	969
R-squared	0.007	0.009	0.005	0.002	0.022	0.021	0.012	0.116
Religious sample								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Humanism	Christianity	U.B.	Inclusivity	Humanism	Christianity	U.B.	Inclusivity
SS co-twin	-0.0194	0.0314	0.0172	-0.0507	0.0339	-0.0604	0.0564	-0.0321
	(0.103)	(0.0887)	(0.0895)	(0.0802)	(0.107)	(0.0946)	(0.0930)	(0.0821)
Add ontrols	No	No	No	No	Ves	Ves	Ves	Ves
Observations	380	380	380	380	330	330	330	330
	0.025	0.001	0.020	0.010	0.190	0.071	0.107	0.147
K-squared	0.035	0.021	0.032	0.010	0.136	0.071	0.107	0.147

Table A.7: Women: Sibling gender effects on general attitudes

Note: U.B. abbreviates unnatural birth. SS co-twin stands for same sex co-twin. All the regressions control for birth year fixed effects. Additional controls include social class, education and employment status in both the general sample and the religious sample. The controls of the general sample also include religiousness of the parents. The effects are estimated with Ordinary Least Squares regression analysis. Standard errors in parentheses are robust and clustered by twin pair. *** p < 0.01, ** p < 0.05, * p < 0.1

Table A.8: Men: Sibling gender effects on general attitudes

General sample								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Humanism	Christianity	U.B.	Inclusivity	Humanism	Christianity	U.B.	Inclusivity
SS co-twin	-0.0530 (0.0671)	-0.0431 (0.0684)	-0.0814 (0.0608)	-0.0203 (0.0701)	-0.0389 (0.0688)	-0.0250 (0.0668)	-0.0484 (0.0646)	$0.0151 \\ (0.0703)$
Add. controls	No	No	No	No	Yes	Yes	Yes	Yes
Observations	706	706	706	706	610	610	610	610
R-squared	0.019	0.028	0.014	0.007	0.170	0.206	0.106	0.142
Religious sample								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Humanism	Christianity	U.B.	Inclusivity	Humanism	Christianity	U.B.	Inclusivity
SS co-twin	-0.0694 (0.148)	0.00732 (0.123)	-0.0338 (0.129)	0.0543 (0.125)	-0.0330 (0.154)	0.00167 (0.128)	0.00 (0.135)	0.0959 (0.120)
Add. controls	No	No	No	No	Yes	Yes	Yes	Yes
Observations	247	247	247	247	237	237	237	237
R-squared	0.027	0.044	0.027	0.018	0.063	0.076	0.063	0.153

Note: U.B. abbreviates unnatural birth. SS co-twin stands for same sex co-twin. All the regressions control for birth year fixed effects. Additional controls include social class, education and employment status in both the general sample and the religious sample. The controls of the general sample also include religiousness of the parents. The effects are estimated with Ordinary Least Squares regression analysis. Standard errors in parentheses are robust and clustered by twin pair. *** p<0.01, ** p<0.05, * p<0.1

	(1)	(2)	(3)	(4)
	Death penalty	Patriotism	Charity work	Conservationists
SS co-twin	-0.234^{*}	-0.287**	-0.483*	-0.254^{*}
	(0.128)	(0.129)	(0.264)	(0.144)
Constant cut1	-1.310***	-2.816^{***}	-4.406***	-3.076***
	(0.176)	(0.228)	(0.369)	(0.242)
Constant cut2	-0.486***	-0.744***	-2.916^{***}	-1.326^{***}
	(0.172)	(0.194)	(0.327)	(0.212)
Observations	1,094	1,086	1,097	1,088
	(5)	(6)	(7)	
	Evolution theory	Chastity	Legalized prostitution	
SS co-twin	-0.233*	-0.239*	-0.217*	
	(0.124)	(0.122)	(0.122)	
Constant cut1	-1.789***	-0.728^{***}	-0.794***	
	(0.189)	(0.184)	(0.177)	
Constant $cut2$	0.321^{*}	1.272^{***}	-0.0836	
	(0.173)	(0.191)	(0.175)	
Observations	1,087	1,082	1,094	

Table A.9: Women: Sibling gender effects on attitudes

Note: Ordered logistic regressions are employed to estimate the effect of sibling gender attitudes. All the regressions control for birth year fixed effects. Standard errors in parentheses are robust and clustered by twin pair. *** p<0.01, ** p<0.05, * p<0.1

	(1)	(2)	(3)	(4)
	Socialism	Conservationists	Women judges	Caning
SS co-twin	0.414^{**}	-0.461*	0.783^{*}	-0.331*
	(0.200)	(0.240)	(0.424)	(0.200)
Constant $\operatorname{cut1}$	-0.670*	-3.561***	-3.425***	-0.842***
	(0.342)	(0.464)	(0.740)	(0.320)
Constant $cut2$	1.554^{***}	-1.832***	-2.170***	0.989^{***}
	(0.355)	(0.399)	(0.594)	(0.322)
Observations	405	404	405	399

Table A.10: Women: Sibling gender effects on attitudes in a religious sample

Note: Ordered logistic regressions are employed to estimate the effect of sibling gender attitudes. All the regressions control for birth year fixed effects. Standard errors in parentheses are robust and clustered by twin pair. *** p<0.01, ** p<0.05, * p<0.1

	(1)	(2)	(3)	(4)
	Patriotism	Nuclear power	Socialism	Birth control
SS co-twin	-0.273*	-0.240*	0.294^{**}	0.505^{**}
	(0.155)	(0.144)	(0.141)	(0.232)
Constant cut1	-2.310***	-0.261	-0.0183	-2.752^{***}
	(0.260)	(0.200)	(0.197)	(0.370)
Constant cut2	-0.772***	0.594***	1.603***	-1.923***
	(0.238)	(0.202)	(0.209)	(0.354)
Observations	725	726	722	728
	(5)	(6)	(7)	
	Private schools	defense spending	Royalty	
SS co-twin	-0.292*	-0.312**	-0.264*	
	(0.173)	(0.151)	(0.144)	
Constant cut1	-2.133***	-1.067***	-0.557***	
	(0.257)	(0.231)	(0.200)	
Constant cut2	-1.307***	-0.0631	0.275	
	(0.244)	(0.226)	(0.199)	
Observations	725	726	725	

Table A.11: Men: Sibling gender effects on attitudes

Note: Ordered logistic regressions are employed to estimate the effect of sibling gender attitudes. All the regressions control for birth year fixed effects. Standard errors in parentheses are robust and clustered by twin pair. *** p < 0.01, ** p < 0.05, * p < 0.1

	(1)	(2)	(3)	(4)
	Patriotism	Socialism	Chastity	Divorce
SS co-twin	-0.607**	0.465^{*}	0.427^{*}	0.466^{*}
	(0.284)	(0.268)	(0.245)	(0.241)
Constant cut1	-2.257^{***}	0.120	-0.0876	0.134
	(0.410)	(0.378)	(0.347)	(0.311)
Constant cut2	-0.809**	1.946^{***}	1.510^{***}	1.185^{***}
	(0.380)	(0.410)	(0.375)	(0.314)
Observations	256	254	253	254
	(5)			
	Modern art			
SS co-twin	0.470^{*}			
	(0.251)			
Constant cut1	-0.856***			
	(0.316)			
Constant cut2	0.220			
	(0.318)			
	. ,			
Observations	255			

Table A.12: Men: Sibling gender effects on attitudes in a religious sample

Note: Ordered logistic regressions are employed to estimate the effect of sibling gender attitudes. All the regressions control for birth year fixed effects. Standard errors in parentheses are robust and clustered by twin pair. *** p<0.01, ** p<0.05, * p<0.1

Subject to item ratio	% of studies	Cumulative %
2:1 or less	14.7%	14.7%
>2:1, <5:1	25.8%	40.5%
>5:1, <10:1	22.7%	63.2%
>10:1, <20:1	15.4%	78.6%
>20:1, <100:1	18.4%	97.0%
>100:1	3.0%	100.0%

Table A.13: Current Practice in Factor Analysis

Source: Costello & Osborne (2005, p.4)

Variable	SMC	Communality**	KMO
1. Death penalty	0.17	0.26	0.68
8. Voluntary euthanasia	0.20	0.27	0.87
11. Bible truth	0.38	0.48	0.77
12. Gay rights	0.29	0.38	0.83
15. Divine law	0.20	0.28	0.82
24. Evolution theory	0.20	0.25	0.90
26. Multiculturalism	0.26	0.36	0.68
32. Test- tube babies	0.21	0.31	0.77
34. Asian immigration	0.28	0.39	0.65
35. Church authority	0.37	0.47	0.77
44. Divorce	0.20	0.25	0.89
46. Surrogate mothers	0.21	0.30	0.79
47. Legalised abortion	0.38	0.47	0.87
49. Condom machines	0.22	0.27	0.89
50. Legalised prostitution	0.23	0.30	0.89

Table A.14: Resulting variables

Note: These are the variables that resulted after iterative deletion of those variables with a communality < 0.25. **Obtained after the use of principal-factor extraction (FA) on the listed variables.

	Factor1	Factor2	Factor3	Factor4
1. Death penalty	0.29	-0.41	0.28	0.10
8. Voluntary euthanasia	0.45		0.12	0.15
11. Bible truth	-0.53	0.23	0.36	0.10
12. Gay rights	0.45	0.43		
15. Divine Law	-0.38	0.16	0.29	0.15
24. Evolution theory	0.48			0.14
26. Multiculturalism	0.13	0.58		
32. Test-tube babies	0.37		0.34	-0.24
34. Asian immigration		0.61	-0.13	
35. Church authority	-0.53	0.27	0.35	
44. Divorce	0.47			
46. Surrogate mothers	0.40		0.29	-0.25
47. Legalised abortion	0.66		0.15	
49. Condom machines	0.50		0.13	
50. Legalised prostitution	0.51			0.14

Table A.15: Loadings without rotation

Factor loadings smaller than ± 0.10 are surpressed

	Factor1	Factor2	Factor3	Factor4
1. Death penalty		0.15	-0.46	
8. Voluntary euthanasia	-0.14	0.45		0.13
11. Bible truth	0.67	-0.14		
12. Gay rights	-0.13	0.33	0.48	0.16
15. Divine Law	0.51			-0.10
24. Evolution theory	-0.25	0.42		
26. Multiculturalism	0.10	0.13	0.57	
32. Test-tube babies		0.22		0.51
34. Asian immigration			0.62	
35. Church authority	0.65	-0.21		
44. Divorce	-0.24	0.32	0.13	0.23
46. Surrogate mothers		0.22		0.50
47. Legalised abortion	-0.30	0.55		0.27
49. Condom machines	-0.21	0.42		0.22
50. Legalised prostitution	-0.24	0.45	0.12	0.11

Table A.16: Loadings after Varimax rotation

Factor loadings smaller than ± 0.10 are surpressed

	Factor1	Factor2	Factor3	Factor4
1. Death penalty	0.20	0.15		-0.49
8. Voluntary euthanasia	0.48			
11. Bible truth		0.68		
12. Gay rights	0.28		0.10	0.45
15. Divine Law	0.10	0.55		
24. Evolution theory	0.44	-0.11		
26. Multiculturalism	0.14	0.12		0.55
32. Test-tube babies			0.55	
34. Asian immigration				0.62
35. Church authority	-0.15	0.62		
44. Divorce	0.24	-0.15	0.19	0.11
46. Surrogate mothers			0.54	
47. Legalised abortion	0.52	-0.11	0.17	
49. Condom machines	0.38		0.15	
50. Legalised prostitution	0.46	-0.10		

Table A.17: Loadings after Oblimin rotation

Factor loadings smaller than ± 0.10 are surpressed

Table A.18: Factor correlation matrix

	Factor1	Factor2	Factor3	Factor4
Factor1	1	0	0	0
Factor2	-0.49	1	0	0
Factor3	0.59	-0.25	1	0
Factor4	0.15	0.05	0.05	1

Table A.19: Test for correlational adequacy

Factor correlation matrix				
	Factor1	Factor2	Factor3	Factor4
Factor1	1	0	0	0
Factor2	-0.49	1	0	0
Factor3	0.59	-0.25	1	0
Factor4	0.15	0.05	0.05	1

Factor	correlation	matrix

Thomson factor score correlation matrix					
	Factor1	Factor2	Factor3	Factor4	
Factor1	1	0	0	0	
Factor2	-0.66	1	0	0	
Factor3	0.81	-0.42	1	0	
Factor4	0.21	0.05	0.09	1	

Bartlett factor score correlation matrix				
	Factor1	Factor2	Factor3	Factor4
Factor1	1	0	0	0
Factor2	-0.24	1	0	0
Factor3	0.20	-0.13	1	0
Factor4	0.05	0.02	0.03	1

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