

School Outcomes of Children Raised in Same-Sex Families: Evidence from Administrative Panel Data

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Although widely used in policy debates, the literature on children's outcomes in same-sex families has mostly relied on small selective samples or on samples based on cross-sectional survey data. This led to a lack of statistical power and the inability to separate children born in same-sex families from children of divorced parents. We address these issues by using unique administrative longitudinal data from the Netherlands: the first country to legalize same-sex marriage in the world. The results indicate that children raised in same-sex families perform better than children raised in different-sex families in both primary and secondary education. Our findings are robust to the use of Cousin Fixed Effects, as well as Coarsened Exact Matching to improve covariate balance and to reduce model dependence. Further analyses using a novel bounding estimator suggest that the selection on unobserved characteristics would have to be more than two and a half times higher than the selection on observed characteristics to reduce the positive estimates to zero.

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1. Introduction

A rising number of children grow up in non-traditional family structures (Powell, et al. 2016). Families nowadays increasingly include two mothers or two fathers, stepparents, and single parents. An important debate on non-traditional family structures focuses on the marriage and adoption rights of same-sex couples. The legal issue of same-sex marriage and adoption often revolves around the outcomes of children raised in same-sex families (Alvaré 2005, Wolfson 2005). Hence, the social science research about the effects of same-sex families on children has featured prominently in most public debates to both support as to challenge same-sex marriage and adoption. For instance, in an interview with *The New York Times*, former United States President George Bush, Jr. defended Florida's ban on gay adoption rights stating that "studies have shown that the ideal is where a child is raised in a married family with a man and a woman" (Carey 2005). By contrast, in the U.S. Supreme Court case *Obergefell v. Hodges* (2015), the American Sociological Association stated that "the clear and consistent social science consensus is that children raised in same-sex families fare just as well as children raised in different-sex families."

In this paper, we compare school outcomes of children raised in same-sex families to the school outcomes of children raised in different-sex families. A large literature has documented that education is likely to influence many social outcomes such as employment, earnings, crime, health, life expectancy and overall happiness (see review in Oreopoulos and Salvanes (2011)). We employ unique administrative longitudinal data from the Netherlands, the first country to legalize same-sex marriage in the world. The data include the entire population of children born between 1995 and 2005 and their educational performance can be tracked until 2017. This enables us to study the academic achievement of 1,200 children raised in same-sex families and more than a million children raised in different-sex families, followed from birth until the end of primary education. In addition, we also follow about 15% of these children until the end of secondary education (other children were too young to have graduated from high school), enabling us to study diploma attainment. To the best of our knowledge, this is the first study to address how children who were actually raised in same-sex families from birth (instead of happening to live in a same-sex family at some point in time), perform in school while retaining a large representative sample.

Our results indicate that children who were raised in same-sex families from birth outperform children raised in different-sex families on standardized test scores at the end of primary education by 0.18 standard deviations. Further, we also find that children raised in same-sex families continue

to outperform children raised in different-sex families in secondary education. In particular, the results suggest that children raised in same-sex families are 6.7% more likely to graduate from high school than children raised in different-sex families. Finally, we use a novel bounding estimator developed by Oster (2019) to bound the causal effect of being born and raised in a same-sex family. Treatment effect bounds indicate that the selection on unobserved characteristics would have to be more than two and a half times higher than the selection on observed characteristics to reduce the positive association to zero. Therefore, we conclude that children raised in same-sex families are likely to outperform children raised in different-sex families in school.

Previous literature on children's school outcomes¹ in same-sex families has been limited either by very small selective samples that could identify children who were raised in same-sex families from birth, or by large representative census data that are cross-sectional, and only able to identify children who happened to live in a same-sex family at one point in time. Most studies in this literature have relied on small convenience samples of individuals recruited from sperm banks or homosexual events, by word of mouth or through newspaper advertisements (Gartrell and Bos 2010, Golombok, Tasker and Murray 1997, Golombok, Perry, et al. 2003, MacCallum and Golombok 2004, Sarantakos 1996).² With the exception of Sarantakos (1996),³ these studies did not find a statistical difference between children in same-sex and different-sex families on a range of school outcomes. Nonetheless, in the absence of a representative sample, the validity of these studies is questionable.

A second strand of literature employed random samples but could not address the issue of small sample size. More specifically, Wainright, Russell, and Patterson (2004) and Sullins (2015) drew their sample from the National Longitudinal Study of Adolescent Health (Add Health); Fedewa and Clark (2009), and Potter (2012) from the Early Childhood Longitudinal Study – Kindergarten (ECLS-K); and Regnerus (2012) and Cheng & Powell (2015) from the New Family Structures

¹ We solely reviewed papers that focused either exclusively or partially on school outcomes. For a recent overview of children's other outcomes in same-sex families, see Allen (2015). Other recent papers include Reczek et al. (2017) and Cenegy, Denney, and Kimbro (2018). Although the outcomes differ, this literature is characterized by similar limitations as the literature on children's school outcomes in same-sex families.

² Often in combination with snowball methods in which friends and acquaintances of the recruited individuals were also included in the study.

³ Sarantakos (1996) estimated that children in same-sex families performed worse than children in different-sex families on both language and mathematics tests.

Study (NFSS). With the exception of Regnerus (2012),⁴ these studies found that children in same-sex families performed at least as well, if not better (Sullins 2015), in school as children in different-sex families. However, as same-sex families with children comprise a small percentage of the overall number of families (around 0.5% in most western countries), the maximum number of children in same-sex families among these studies was 158 children in Potter (2012).⁵ Such small samples have low statistical power, leading to a small probability of rejecting a potentially false null hypothesis.

A more recent literature has addressed the issues of both selective and small samples by using census data. More specifically, Rosenfeld (2010) used the 2000 U.S. Census 5% Public Use Microdata Sample and found that children in same-sex families were equally likely to progress normally through school as were children in different-sex families. By contrast, Allen, Pakaluk, and Price (2013) and Allen, Pakaluk, and Price (2014) estimated a negative association between same-sex families and progress through school using the same data as Rosenfeld (2010), but with different sample restriction choices. Similarly, employing the 2006 Canada Census 20% restricted master file, Allen (2013) estimated that children in same-sex families were less likely to graduate from high school than children in different-sex families. More recently, using the 2012, 2013, and 2014 waves of the American Community Survey (ACS), Watkins (2018) reanalyzed progress through school as an outcome and found no significant differences between children in same-sex families and children in different-sex families. Extending the analyses to 2008-2015 ACS waves, Boertien and Bernardi (2019) confirmed these findings.

Although these studies use large representative samples, census data provide only a cross-sectional snapshot of family structure. As a result, these studies do not analyze school performance of children who were raised in a same-sex family from birth, but rather the school performance of children who lived in a same-sex family at a certain point in time. This is an important limitation as many children enter a same-sex family through divorce of a homosexual parent from a heterosexual partner, and therefore were not born and raised in a same-sex family (Biblarz and

⁴ Regnerus (2012) found that children in same-sex families have a lower educational attainment than children in different-sex families (among other outcomes). Cheng & Powell (2015), however, could not replicate this finding.

⁵ It should be noted that the original Regnerus (2012) study identified 248 children in same-sex families. As noted by Cheng and Powell (2015), however, once the misclassification error was taken into account, the number reduced to 51.

Stacey 2010, Stacey and Biblarz 2001). Moreover, divorce may exert an independent negative effect on school outcomes (see review by McLanahan, Tach, and Schneider, 2013). Consequently, studies based on these data may mistakenly attribute a negative coefficient to living in a same-sex family. Another limitation of census data is misclassification of same-sex families due to misreporting, especially given that many U.S. Censuses were compiled at the time same-sex marriage was unlawful. For instance, the U.S. Census Bureau estimated that about one-half of those reporting as same-sex married couples in the 2010 ACS were actually different-sex married couples who misreported on the sex question (Kreider and Lofquist 2015). As a result, the Census Bureau retracted its 2010 estimate of the number of same-sex families in the U.S (O'Connell and Feliz 2011). Given that this type of measurement error is not classical, it is unclear in which direction the endogenous coefficients are biased. Lastly, in the absence of a measure of student achievement such as standardized test scores, studies that used the U.S. Census or ACS data are limited to a crude measure of progress through primary school calculated using current age and highest grade completed.⁶

The closest paper to our study is a concurrent Discussion Paper by Aldén, Björklund, and Hammarstedt (2017). Similar to our design, they use administrative longitudinal data to compare health outcomes of about 750 children in lesbian families to the health outcomes of children in different-sex families in Sweden. Overall, they find a positive association between living in lesbian families and health outcomes. In additional analyses, they also estimate a positive association between living in lesbian families and mathematics and language test scores. However, due to data unavailability, the authors could estimate school outcomes for only 56 children in lesbian families.

Using administrative longitudinal data that include the entire population of children born between 1995 and 2005 in the Netherlands, we are able to address the issues above. First, the data enable us to go beyond a cross-sectional snapshot of a family structure and analyze school outcomes of children who were actually raised in same-sex families from birth while retaining a large representative sample. Second, we can add to the current literature by studying student

⁶ For instance, the 2000 U.S. Census does not provide information on the exact grade attended, but groups students into two separate groups: grades 1-4 in one category and grades 5-8 in the other. This introduces a measurement error when constructing the progress through school variable. Although the recent ACS data provide more detailed information, it is difficult to account for academic redshirting, where parents may purposefully delay the entry of their child into school to increase school readiness (Boertien and Bernardi 2019).

achievement in primary education based on standardized high stakes test scores – and for earlier cohorts, we can also include diploma attainment – instead of a crude measure of progress through school or test scores evaluated by the teachers. Moreover, the Netherlands is a particularly interesting country to study, as it was the first country in the world to legalize same-sex marriage in 2001. In addition, the Netherlands is recognized as being among the most favourable countries for same-sex families (European Commission 2015). This makes it unlikely that the results are influenced by factors uniquely problematic for same-sex families and their children such as a lack of social support, stress arising from persistent stigma and sex discrimination, and limited legal security for same-sex families.

The remainder of the paper is structured as follows. Section 2 provides information on the Dutch institutional background for same-sex families and on the Dutch education system. Section 3 outlines potential theoretical mechanisms through which children raised in same-sex families may perform differently in school compared to children raised in different-sex families. Section 4 describes the data and sample restrictions. Section 5 formulates the empirical model. Section 6 presents the results and bounds the causal effect of being raised in a same-sex family using treatment effect bounds. The paper ends with a discussion of the results and several limitations of the analysis in Section 7.

2. Background

2.1. Institutional Context for Same-Sex Couples

The Netherlands has been one of the most supportive countries for same-sex couples (De Witte, Itebeke and Holz 2019). This is apparent from the Eurobarometer survey in which attitudes towards same-sex couples were compared among the countries of the European Union (European Commission 2015). In 2015, the Netherlands scored second highest on all measures, with only Sweden having a more positive attitude towards same-sex couples. In particular, 96% of the Dutch respondents agreed that homosexual persons should have the same rights as heterosexual persons. Moreover, 85% of the respondents would have been comfortable having a homosexual person holding the highest political office in the country, and 92% of the respondents would have been comfortable working with a homosexual person. Furthermore, 86% of the respondents from the Eurobarometer survey would have been comfortable with their son or daughter having a relationship with someone of the same sex.

The Netherlands was the first country in the world to legalize same-sex marriage in 2001. Nonetheless, same-sex couples have been able to formalize their relationship through a registered partnership since 1998. Registered partnership was designed to be a substitute for marriage and is available for both same-sex as different-sex couples. Although registered partnership is in practice almost a perfect substitute for marriage (Trandafir 2014), it differs from marriage on contract dissolution in the absence of children: a registered partnership can be dissolved at the civil registry by mutual agreement, while marriage can only be dissolved in court. Nonetheless, couples with children must dissolve a registered partnership in court. The Netherlands allows for the regulation of an informal relationship through a cohabitation agreement. This agreement settles certain important matters related to living together. Nonetheless, for all child-related matters, a cohabiting relationship is considered an informal relationship with or without a cohabitation agreement (Government of the Netherlands 2019).

In general, same-sex couples may have children from a previous heterosexual relationship, through adoption, or through artificial insemination. First, same-sex families may include children through divorce of a homosexual person from a different-sex partner and has a subsequent relationship with a new same-sex partner. Second, same-sex couples have been able to adopt Dutch children (often from foster care) since 2001 and foreign-born children since 2009. Regardless of the gender, the couple must have been living together for at least three years. A single person is also allowed to adopt, albeit with more stringent requirements. Nonetheless, a single-person adoption is rather rare as adoption agencies typically prefer couples. The costs for adoption typically range between 15,000 and 40,000 euros.

Finally, same-sex couples may also have children through the process of artificial insemination. In particular, lesbian couples or single women can use medically assisted insemination or in vitro fertilization techniques (IVF), and gay male couples or single men can use surrogacy. The Dutch law allows for both known donors (e.g. a friend or a relative) and unknown donors. Although unknown donors are anonymous to the legal mother, their identifying information is recorded by the clinic. Under Dutch law, the child can have access to physical and medical information about the donor at Age 12, and personally identifying information at Age 16. The costs for artificial insemination are typically high (about 1,500 euros per treatment with a success rate of about 15%). Although different-sex couples can get reimbursed by insurance, this is not necessarily the case for

same-sex couples and single women as the absence of a male partner may not count as a medical issue depending on the situation at hand.

In the Netherlands, the woman who gives birth (*birth mother*) is the child's legal mother. Before 2014, the female partner of the birth mother (*social mother*) could only become a legal mother through adoption (*second-parent adoption*). As mentioned above, the adoption procedure is typically cumbersome and costly. For this reason, the Dutch government introduced the "Law of Lesbian Parenthood" in 2014. As a result of this law, a social mother automatically becomes the child's legal mother if the lesbian couple is married or in a registered partnership and the donor is an unknown donor. If one of these criteria is not satisfied, a social mother could also become the child's legal mother by recognising the child with the consent of the birth mother. The latter procedure typically costs about 1,100 euros. Therefore, the 2014 law dramatically reduced the costs of becoming a parent for social mothers. For gay male parents, however, little legal progress has been made regarding having a child. Although surrogacy is allowed by law, it was only in 2019 that two clinics started performing these practices for gay male couples. Moreover, as mentioned previously, the birth mother is the legal mother of the child in the Netherlands, regardless of the arrangements made before the conception of the child. The situation becomes even more complicated if the birth mother is also in a married relationship with another partner. Therefore, for the gay male couple to become legal parents of the child, the legal mother would first have to be divested of her parental responsibility through a complicated legal procedure. Afterwards, the gay male couple would have to file for joint adoption.

2.2. Dutch Education System

The Dutch education system provides for compulsory education beginning at the age of five and continuing either until the age of 18 or until a younger age if a student has already obtained a high school diploma. Primary education lasts for seven years until the age of 12. At this point, students enter a tracking system in secondary education that includes three main tracks: pre-vocational track (VMBO), general track (HAVO) and pre-university track (VWO). Students decide on the track based mainly on a compulsory standardized test taken by all students in their final year of primary education. Technically, schools may choose from several standardized tests, and although the employed tests may differ by school, all students within a school complete the same standardized test. In practice, these tests are very comparable. Nonetheless, most schools use the so-called Central Institute of Test Development test (CITO-test). This test includes multiple choice questions

testing students' Dutch and comprehension skills, mathematics, world orientation (involving geography, biology and history) and study skills. It is considered a high-stakes test by students and parents, and is also used for school evaluation (Scheerens, et al. 2012). In addition to the standardized test, students receive advice from their primary school teacher on which track to follow in secondary education.

The pre-university track is considered the most prestigious as it is mainly attended by students who scored in the top quartile on the standardized test in primary education. It lasts for six years, until the age of 18, and is meant to prepare students for university education (WO). The general track (HAVO) lasts for five years and prepares students for higher professional education (HBO) at a university college. The pre-vocational track (VMBO) lasts for four years, from the age of 12 to 16, and prepares students for the vocational track (MBO). Within the vocational track are four programs, with decreasing levels of difficulty; level 1 is the most difficult, level 4 being the least difficult. In contrast to the pre-university track, the pre-vocational and vocational tracks are typically considered the least prestigious tracks, as they mostly include students who scored in the bottom quartile on the standardized test in primary education. A student must successfully complete a program in either the pre-university track, the general track, or the vocational track, level 2 (at minimum) to obtain a high school diploma. Students who left secondary education before completing a program in one of these three tracks are considered high school dropouts.

3. Theoretical Mechanisms

Several theoretical mechanisms could explain how parental gender might affect the school outcomes of their children. Given that there is no consensus on the mechanisms behind these potential effects, we distinguish between theoretical mechanisms that predict that children raised in same-sex families may perform worse in school than children raised in different-sex families, and theoretical mechanisms that predict that they are likely to perform just as well if not better. In the discussion in Section 7, we come back to these theoretical mechanisms and attempt to eliminate some of them based on our empirical results.

Theoretical mechanisms predicting that children raised in same-sex families may perform worse in school are the specialization theory, the kin selection theory, and the discrimination theory. Specialization theory suggests that children may need a parent of each gender because parents differ in their parenting styles, and mothers and fathers teach different skills (Allen 2013). However, in a review of 81 studies, Biblarz and Stacey (2010) found no support for such a theory,

stating that “research has not identified any gender-exclusive parenting abilities” (Biblarz and Stacey 2010, 16).

Kin selection theory is an evolutionary theory suggesting that because parents incur economic, physical and mental costs in raising a child, they display discriminative parenting (W. D. Hamilton 1964). In particular, they invest most in their biological children who share their genetic material. Given that at least one of the same-sex parents is not a biological parent of the child,⁷ kin selection theory predicts that total parental investment will be lower in same-sex families than in different-sex families. As a result, if the kin selection theory drives parental behaviour, children raised in same-sex families are likely to perform worse in school than children raised in different-sex families.

The last theoretical mechanism predicting that children raised in same-sex families may perform worse in school is the discrimination theory. This theory suggests that same-sex parents may face increased stressors due to their gender (Stacey and Biblarz 2001). These stressors include negative feedback from family and friends who question the authenticity of their roles as parents, persistent stigma from society, and modest or absent legal security, among others. In the educational context, Diaz-Serrano and Meix-Llop (2016) found that schools are more hesitant to interact with same-sex parents than with different-sex parents. Studies have shown that such stressors may lead to more parenting stress among same-sex parents, potentially culminating in mental illness such as depression in these parents (LeBlanc, Frost and Bowen 2018, Wight, LeBlanc and Badgett 2013). Additionally, these stressors may adversely affect the likelihood that parents stay together. For instance, Kalmijn, Loeve, and Manting (2007) found that Dutch same-sex couples were more likely to break up than different-sex couples. In turn, children of same-sex parents may be affected by these burdens of discrimination faced by their parents (Bos, et al. 2004, McLanahan, Tach and Schneider 2013) and perform worse in school as a result. Additionally, children of same-sex parents can also directly experience discrimination by being bullied about the sexual orientation of their parents (Perrin, et al. 2019), leading to lower school performance (Robinson and Espelage 2011). As mentioned in Section 2.1, however, the Netherlands is one of the most supportive nations for same-sex couples. Therefore, we contemplate that the discrimination theory will play a limited role in our setting.

⁷ Absent a prior sex change or surrogacy for gay men in which both partners donate genetic material.

Other theoretical mechanisms predict that children raised in same-sex families are likely to perform just as well (if not better) than children raised in different-sex families. These mechanisms include the compensation theory and the selection theory. The compensation theory (Hamilton, Cheng and Powell 2007) agrees with the discrimination theory that same-sex parents face unique stressors. However, unlike the discrimination theory, compensation theory argues that same-sex parents channel these stressors as motivation to prove themselves as good parents. For instance, Prickett, Martin-Storey, and Crosnoe (2015) found that same-sex parents spend more time with their children than different-sex parents. Thus, compensation theory predicts that children raised in same-sex families are likely to perform just as well as, if not better than, children raised in different-sex families.

Finally, selection theory suggests that differences in outcomes among children raised in same-sex families and children raised in different-sex families may be a function of selection on socioeconomic characteristics such as parental income, education and age. Given the time-consuming and costly procedures necessary for same-sex couples to obtain children (e.g., adoption, artificial insemination, or surrogacy), same-sex couples with children typically have high levels of income and education, and are older than both same-sex couples without children and the general population (Black, Sanders and Taylor 2007). As these background variables typically enter as parental inputs in an education production function (Hanushek 1986), the selection approach predicts that children raised in same-sex families are likely to perform better in school than children raised in different-sex families.

4. Data

4.1. Sample Construction

We rely on unique administrative records collected by Statistics Netherlands that cover the entire Dutch population as of 2017. These administrative records are based on automated municipal population registers (Steenhof and Harmsen 2003). Every municipality in the Netherlands has its own population register containing information on all inhabitants of that municipality. Each Dutch inhabitant has been given a unique personal identification number, which allows us to link their data to those on their children, parents, and partners. Moreover, starting from 1995 and annually until 2017, the data contain household and address identifiers as well as marital history and demographic characteristics (i.e. date of birth, gender, birth country) for each individual. Thus,

linking all individuals (children, parents, and partners) to their household, address, and marital history, we are able to identify all the members of a household and their relationship.⁸ In addition, by observing the gender of each household member, we can identify children in same-sex households. Furthermore, we also observe labour market information from tax authorities of each individual annually from 1999 to 2016. This allows us to construct a control variable for household income (see below). Finally, the data provide information on student achievement in primary education between school years 2008-2009 and 2016-2017. For about 15% of these children, we also have information on diploma attainment in secondary education.

Our data offer four primary advantages over the census data used in previous studies. First, we can determine each year whether children actually lived with their parents in the same household. As stated previously, census data provides only a snapshot of the family in a given year. Second, we can determine whether and when children entered a same-sex household. This is an important advantage over the studies based on census data, as we observe whether children were born in a same-sex household or whether they entered a same-sex household through parental divorce. Moreover, we observe whether and when a child was adopted, and whether this happened through foster care. Third, as we observe most of the information annually over a more than 20 year period, we can construct pre-treatment characteristics (e.g. socioeconomic status based on household income) for the majority of individuals in our sample. As we measure characteristics at birth, we can limit endogeneity issues arising from control variables measured at the time or even after treatment as in the studies using census data (Elwert and Winship 2014). The last advantage of our data compared to census data is that we observe scores on a high-stakes standardized exit test in primary education, instead of a crude measure of progress through school as used in most studies.

To study school outcomes of children raised in same-sex families, we restrict the sample in four ways. First, as a measure of student achievement, our data include the score on the standardized test conducted in the final year of primary education (see below), when students are typically 12 years old. We remove children who had not reached the last grade of primary education by 2016-2017 (last school year in the data), as these children are not yet old enough to take the test. Second, as our data do not include a direct measure of sexual orientation, we restrict the sample to couples. Therefore, we do not include children in single parents and children who resided with single

⁸ We could find a match for 91% of the population.

persons, as we do not observe whether a single parent or a single person is homosexual. Following Watkins (2018), who used the ACS, we have removed these children from the analysis (3.46% of the sample). Nonetheless, we have also tried an alternative approach, used by Rosenfeld (2010) and Allen (2013), in which we consider single parents to be heterosexual. The coefficients (available upon request) remained virtually unchanged. Third, we do not include children who were in an institution as they do not fall within the common definitions of same-sex or different-sex households. Lastly, we remove a small percentage (0.02%) of children in missing control variables, none of which are children in same-sex families. The final sample includes 1,201,012 children born between 1995 and 2005.

4.2. Variables Construction

Children in Same-Sex Families. Our administrative data do not include a measure of sexual orientation.⁹ As a result, we identify children in same-sex families by observing the household composition of each child and the gender of each household member. If the child lives with both parents who are either both men, or both women, we conclude that the child lives in a same-sex family. It should be noted that, unlike the studies using census data, we observe unique child and parent identifiers, as listed in the municipal registers. Therefore, relatives of the same sex who live in the same household as the child are not misclassified as same-sex couples. For instance, if a child lives with her mother and her aunt, we notice this as the child's father identifier is different from the aunt identifier. Further, a child is also in a same-sex family if he or she lives with only one parent who lives with a new same-sex partner that is not the parent of the child. Similar to child and parent identifiers, we also observe the identifier of the partner of each household member. The partner is identified if the persons were married or in a registered partnership. Finally, if a child was adopted or lives in a foster home, we observe the gender of these persons as both adoptive and foster parents are recorded with unique identifiers. If the adoptive or foster parents are persons of the same-sex, we consider the child as from a same-sex couple.

It should be noted that two types of same-sex families cannot be identified in our data. First, we cannot identify a same-sex family if a parent is cohabiting with a same-sex partner without being married or in a registered partnership. In our data, these children are considered children in a

⁹ It is possible that one of the parents is married to a person of a different sex but identifies as a homosexual or is attracted to or aroused by a person of the same sex.

different-sex family. Second, as noted previously, children who lived with a single parent, a single person or in an institution are not considered in this paper, as we do not possess a direct measure of parental sexual orientation.

In the analyses, we will use an indicator given a value of 1, if the child is in a same-sex family at least one year and a value of 0, if the child is in a different-sex family. We have also estimated models with a continuous variable indicating the number of years spent in a same-sex family. These models (available upon request) lead to very similar conclusions. Nonetheless, as most of the children have resided with a same-sex family since birth (see **Figure 1** in Section 5), the cell sizes for each year are rather small. Therefore, we opted for a dummy variable in the main analyses.

Outcome Variables. Our outcome variables closely follow the main transition points in the Dutch education system. As mentioned previously, students decide on a secondary education track based on a standardized test in the final year of primary education (Age 12) and based on the teacher's recommendation.¹⁰ We will use the score on this standardized test as our primary outcome of interest as it is an objective measure of student achievement. In supplemental analyses in **Table A1** in the Appendix, we also used teacher's recommendation at the end of primary education as an outcome. We do not present these results as part of the main analysis as teacher's recommendation is by definition a subjective opinion of the teacher. Nonetheless, this outcome yields analogous conclusions as the standardized test. We observe that 84.56% of the children in our sample have taken the CITO-test. To maximize sample size, however, we also use tests other than the CITO-test. Nonetheless, if we solely consider the CITO-test, our results remain unchanged. To make the test scores comparable across different tests and years, we standardize test scores by the test and year to have a mean zero and unit variance. Further, for about 15% of the population, we also observe diploma attainment in secondary education. This variable is measured as an indicator given a value of 1 if the student obtained an upper secondary education diploma according to the

¹⁰ It should be noted that it is possible for children to repeat a grade and therefore take the test at a later age. This would introduce a mechanical relationship between the number of years observed in the data and the probability of residing with a same-sex family. The longer a child is observed in the data (e.g. a child who needed 6 years to take the test and a child who needed 8 years to take the test), the higher the probability that a child could reside with a same-sex family. Therefore, we will observe each child until they are 12 years old. Nonetheless, observing children until the actual age at which they conducted the test does not influence our results.

International Standard Classification of Education framework (i.e. qualification at ISCED 2011 level 3), and 0 if the student was a high school dropout.

Control variables. At the individual level, we control for the gender of the child (1 is boy, 0 is girl) and the year of birth. As a measure of socioeconomic background, we include six variables. First, we construct a variable for a child's ethnicity based on parental birth country. It is given a value of 1 if at least one parent was born outside the Netherlands and a value of 0 if both parents were born in the Netherlands. Similar to Watkins (2018) who finds that children in same-sex families are more likely to be white, we control for children in same-sex families likely having parents born in the Netherlands rather than having parents who emigrated from potentially more conservative countries such as Turkey or Morocco. Second, we include indicators for neighbourhood at birth to account for children in same-sex families potentially being located in wealthier neighbourhoods (Aldén, Björklund and Hammarstedt 2017, Black, et al. 2002).

Further, we include a measure for household annual net income in increments of 10,000 euros¹¹ at birth, and an indicator for parental education given a value of 1 if at least one parent did not complete upper secondary education and 0 otherwise. Neighbourhood and household net income are measured at birth for most of the children in the sample (83%) to avoid endogenous controls (Elwert and Winship 2014).¹² If the information at birth was not available, we used information from subsequent years.¹³ Rosenfeld (2010) has found that measures of parental income and education account for most of the differences between children in same-sex and different-sex families. Lastly, we include categorical variables for the average age of the parents at the birth of the child¹⁴ (*younger than 35, 36 to 40, older than 40*) and for the number of siblings (*only child, one sibling, two or more siblings*), given that same-sex couples are typically older and have fewer

¹¹ We calculate this measure based on net income of the parents. If a child resided with one parent and his or her partner, we consider the income of both the parent as the partner. If the child resided with adoptive parents or in a foster home, we consider the income of these persons.

¹² It should be noted, however, that many of the mothers did not work during pregnancy or were on reduced pay. Therefore, this variable will underestimate the true household income. Nonetheless, our results are robust to the measurement of household income (and neighbourhood) at the start and end of primary education.

¹³ Removing these children does not significantly alter the results.

¹⁴ If a child resided with one parent and his or her partner, we consider the average of the ages of both the parent and the partner. If the child resided with adoptive parents or in a foster home, we consider the average age of these persons.

children than different-sex couples (Aldén, Björklund and Hammarstedt 2017, Black, Sanders and Taylor 2007). Note that the indicators for socioeconomic background are categorical to maximize cell sizes, as children in same-sex families comprise less than 1% of the overall sample.¹⁵

As a last control variable, we include a discrete measure of family structure at birth¹⁶, comprising three categories: *married parents*, *cohabiting parents*, and *other*. Although marriage and registered partnership are available through municipal registers, we identify *cohabiting parents* if the parents of the child (using unique parent identifiers) are living together but are neither married nor in a registered partnership. In the Netherlands, about half of the cohabitants who were not married or in a registered partnership had a cohabitation agreement in 2008 (Statistics Netherlands 2010). Nonetheless, we do not observe cohabitation agreements in our data. The category *other* includes children born into a family with one parent and a stepparent as well as adopted children and/or foster children.¹⁷ The distinction between married and cohabiting parents is used in most studies of same-sex parenting (Allen 2013, Rosenfeld 2010, Watkins 2018). However, it should be noted that we do not make a distinction between marriage and a registered partnership because, in practice, registered partnerships are an almost perfect substitute for marriage in the Netherlands (Trandafir 2014). Consequently, we chose to maximize cell sizes by treating registered partnership as marriage.¹⁸ It is also worth mentioning that registered partnership was introduced in 1998 for both same- and different-sex couples, while same-sex marriage was legalized in 2001. This means that some children in same-sex families in our sample were born before either the registered partnership or marriage was legal. As a result, although these children are classified as living with cohabiting parents, their parents' relationship could more accurately be described as married.

¹⁵ Nonetheless, using continuous measures yields analogous results. Further, we find that altering the number of categories for control variables does not significantly alter our results. Overall, our results are robust to various constructions of control variables.

¹⁶ Using a variable for family structure at birth may not be representative for children who entered a same-sex family at an older age as a result of the divorce of a homosexual parent from a heterosexual partner. Nonetheless, the results are robust to the use of a variable for family structure at first entry into a same-sex family.

¹⁷ It should be noted that we cannot distinguish between more complex forms of parenting, such as three-way parenting (e.g., two mothers and a father who are raising a child together).

¹⁸ Nonetheless, our results are robust to treating marriage and registered partnership as separate categories (available by request).

Nonetheless, as this is a small percentage of children (about 6%), excluding them from the analysis does not significantly alter the results.

4.3. Descriptive Statistics

Descriptive statistics are presented in **Table 1**. We observe the standardized test scores at the end of primary education for 1,201,012 children, from which 1,661 children (0.14%) are with a same-sex couple. When we divide the sample by the gender of the parents, we find that only 29 children are in a gay male family. This low number of children in gay male couples is mostly likely due to three reasons. First, as mentioned in Section 2.1, little legal progress has been made facilitating the path to biological children for gay male couples. It was only in 2019, beyond the time window of our analysis, that two clinics started performing surrogacy procedures for gay male couples. Moreover, although gay male couples can jointly adopt children, this procedure is very cumbersome and costly, and is rarely chosen by both lesbian as gay male couples. Second, in the Netherlands, children are likely to reside with the mother after a divorce. Thus, in our dataset, children who reside in a same-sex family after a divorce of a homosexual parent from a heterosexual partner are likely to reside with a lesbian family. If the homosexual parent was the mother, the child would reside with the mother and her new homosexual partner. If the homosexual parent was the father, the child would almost certainly reside with the heterosexual mother and her new partner. It should be noted, however, that we do not observe post-divorce arrangements between parents. Thus, it is possible that a child lives half of the time with the heterosexual mother and the other half of the time with the homosexual father. In our data, this arrangement would appear as living solely with the mother and we would count this child as from a different-sex family. Lastly, gay male couples with children are a recent phenomenon and the children in our sample have to be at least 12 years old to take the standardized test at the end of primary education. In sum, given the low sample size of children in gay male families, we refrain from making statements about the potential heterogeneity in findings by gender of the parents.¹⁹

Table 1 suggests that a child in a same-sex family is equally likely to be a boy as are children in different-sex families. Further, we observe that compared to children in different-sex families, children in same-sex families enjoy a significantly higher socioeconomic status. Their parents are

¹⁹ Nonetheless, if we separate the sample into lesbian and gay male families, we find very similar results for both samples, although the results for the gay male sample are not significant (available upon request).

more likely to be older, to be born in the Netherlands, to earn more and to be well educated. Moreover, children in same-sex families are more likely to have fewer siblings. However, children in same-sex families are less likely to be born into a married family. This is not surprising as for some of the earlier cohorts, same-sex marriage was unavailable. If we solely consider children born after same-sex marriage was introduced in 2001 (not shown in **Table 1**), the difference in family structure between children in same-sex and different-sex families reduces, but remains significant. In particular, children in same-sex families are 0.029 percentage points less likely to be born in a married family, and 0.040 percentage points more likely to be born into other family types.

Finally, the descriptive statistics suggest that children in same-sex families perform significantly better on the standardized test at the end of primary education. They score 0.269 standard deviations higher than children in different-sex families. Although children in same-sex families have a higher mean diploma attainment, this difference is not significant. Nonetheless, these descriptive statistics do not account for the selection on socioeconomic status and family instability.

TABLE 1 – DESCRIPTIVE STATISTICS

	Children in same-sex families	Children in different-sex families	Difference (T-test)
<u>Control variables:</u>			
Gender (1 is boy, 0 is girl)	0.493	0.503	-0.010 (0.012)
Ethnicity (1 is foreign, 0 is Dutch)	0.215	0.261	-0.046 (0.011)***
Household annual net income at birth			
At most 10,000 EUR	0.168	0.262	-0.094 (0.011)***
10,001 EUR – 20,000 EUR	0.494	0.513	-0.019 (0.012)
20,001 EUR – 30,000 EUR	0.288	0.184	0.104 (0.010)***
More than 30,000 EUR	0.050	0.041	0.009 (0.005)**
Parental education at birth (1 is no high school degree)	0.033	0.106	-0.073 (0.008)***
Average age of the parents at birth			
Younger than 35	0.498	0.754	-0.256 (0.011)***
36 to 40	0.340	0.173	0.166 (0.009)***
Older than 40	0.163	0.073	0.090 (0.006)***
Number of siblings			
Only child	0.530	0.429	0.101 (0.012)***
One sibling	0.370	0.384	-0.014 (0.012)
Two or more siblings	0.101	0.187	-0.086 (0.010)***
Family structure at birth			
Married parents	0.654	0.803	-0.149 (0.010)***
Cohabiting parents	0.314	0.196	0.119 (0.010)***
Other ^b	0.032	0.002	0.030 (0.001)***
<u>Outcomes:</u>			
Test score at the end of primary education (standardized)	0.310	0.041	0.269 (0.024)***
High school diploma (1 is graduated, 0 is dropout) ^a	0.895	0.873	0.021 (0.021)
Number of children	1,661	1,199,351	

Notes. Standard errors are in parentheses.

^a As children are born from 1995 to 2005 and the last observed school year is 2016-2017, a high school diploma is observed for 212,432 children from which 256 children are in a same-sex family.

^b This category includes children born into a family with one parent and a stepparent as well as adopted children and foster children.

*** Significance at the 1% level.

** Significance at the 5% level.

In **Table 1**, we divided the sample into children who were in a different-sex family and children who were in a same-sex family for at least one year. The group of children who were in a same-sex family for at least one year is heterogeneous; the group includes children who were born into a same-sex family, children from a parents' prior heterosexual relationship, and adopted children (often from foster care). Although we do not directly observe how same-sex couples obtained children (for instance, we do not know whether a couple used donor insemination), we do know when a child entered a same-sex family and whether the child was adopted or was previously in foster care. Moreover, we also observe whether and when parents divorced, therefore, we can separate children in same-sex families into three groups: birth children, adopted children, and children from a prior heterosexual relationship. Birth children are children (a) who have been in a

same-sex family from birth, (b) who were neither adopted nor in foster care, and (c) whose parents were not divorced before their birth, nor in the year of their birth. We identify 1,200 birth children in our sample. It should be noted that it is still possible that these children experienced parental divorce while living in a same-sex family. For instance, a child could have been born into a same-sex family through artificial insemination, but experienced parental divorce at a later age. Afterwards, the child's parent may have partnered with another same-sex partner. Therefore, although birth children did not enter a same-sex family because of parental divorce, it is not excluded that they experienced parental divorce at a later age. Indeed, we observe in our data that 10.44% of birth children have experienced parental divorce.

Next, we identify 21 children (1.26%) in same-sex families who were adopted or were with foster parents.²⁰ Thus, as expected from the cumbersome and costly adoption procedures, same-sex couples do not appear to make use of adoption in the Netherlands. As this group of children is very small, we make no further distinction between adopted children on the one hand, and children in foster parents on the other. Moreover, we also do not distinguish between adopted children who were adopted at birth and children who were adopted at a later age. Ideally, we would like to compare school outcomes of adopted children in same-sex parents with school outcomes of adopted children in different-sex parents. However, the sample of adopted children in same-sex parents is too small to come to a meaningful conclusion. Nonetheless, it is reassuring that when we conduct this analysis, the results are similar, although they lose significance (available upon request).

Finally, we identify 440 children from a prior heterosexual relationship. These children are neither birth children nor adopted children; they have either (a) entered a same-sex family after birth, or (b) entered a same-sex family at birth with parents being divorced either prior to or in the year of the child's birth. **Figure 1** presents the cumulative number of years spent in a same-sex family for these children. Only 20% of the children from a prior heterosexual relationship spent more than six years in a same-sex family (*median* = 4.37, *SD* = 2.86).²¹ The relative stability of

²⁰ By adoption, we mean same-sex couples adopting a child who was conceived by another couple, and not second-parent adoptions.

²¹ It should be noted that some children spent all 12 years in a same-sex family. However, children of these parents divorced in the year of birth. Therefore, we were conservative and counted these children as children from a previous heterosexual relationship. Counting these children as birth children does not significantly alter the results.

same-sex and different-sex families is an important issue in the literature. For instance, whereas Kalmijn, Loeve, and Manting (2007) found that same-sex couples were more likely to separate than different-sex couples in the Netherlands, Rosenfeld (2014) found no difference in the United States. Our data confirm the findings by Kalmijn, Loeve, and Manting (2007). We have already mentioned that 10.44% of all birth children have experienced parental divorce. However, for all children in same-sex families, the percentage of those children who have experienced parental divorce rises to 34.02%. By contrast, the corresponding percentage of children in different-sex families is 17.64%.

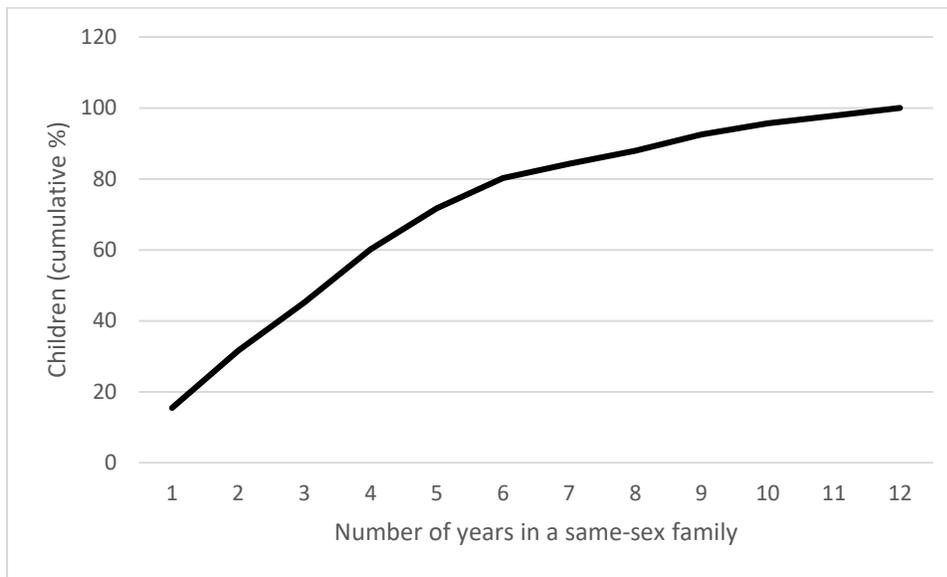


FIGURE 1 – CUMULATIVE NUMBER OF YEARS CHILDREN FROM PREVIOUS HETEROSEXUAL RELATIONSHIPS SPENT IN A SAME-SEX FAMILY ($N = 440$)

5. Empirical Methodology

We estimate school outcomes among children in same-sex families by an Ordinary Least Squares (OLS)²² model that is formulated as follows:

$$(1) \quad y_i = \alpha_0 + \beta_1 H_i + \theta X_i + \varepsilon_i$$

²² This means that for diploma attainment, we estimate a Linear Probability Model (LPM) for the ease of interpretation and for comparison with the results obtained by Coarsened Exact Matching. Nonetheless, results from a logit model are similar to the LPM results (available upon request).

where y_i is the outcome variable of the individual i (i.e., the standardized test score at the end of primary education and diploma attainment in secondary education). The variable of interest is H_i , given value of 1 if the child was in a same-sex family at least one year and 0 if the child was in a different-sex family. Depending on the specification, we also include in **Equation (1)** control variables defined above as part of X_i .²³ Each specification is estimated using clustered standard errors at the household level to account for dependence of observations within households, e.g. siblings.

Several points about **Equation (1)** are worth mentioning. The comparison between children in same-sex and different-sex families is econometrically challenging. As children from parents' prior heterosexual relationships enter a same-sex family around the period of divorce, the effect of living in a same-sex family is conflated with the potential independent negative effect of family instability (McLanahan, Tach and Schneider 2013). Moreover, as seen in **Figure 1**, these children often did not reside with a same-sex family for a long time. Similarly, adopted children and foster children may face exceptional challenges during their lives and may be at a disproportionate risk of adverse outcomes throughout life (Doyle 2007, Font, et al. 2018). Consequently, we are unable to separate the effect of living in a same-sex family from the independent effect of adoption. There is considerable disagreement among sociologists about how to treat children from a prior heterosexual relationship and adopted children. Whereas Rosenfeld (2013) argues that these children should be dropped from the analysis, Allen, Pakaluk, and Price (2013) argue that these children should be included. We estimate a model with all children included as well as a model without children from previous heterosexual marriages and adopted children.²⁴ Further, results solely for children from previous heterosexual marriages and adopted children (with children raised in same-sex families from birth excluded) show a negative association between residing with a

²³ As mentioned above, we consider control variables measured at birth to avoid endogeneity issues arising from post-treatment bias (Elwert and Winship 2014). Nonetheless, our results are robust to measuring control variables in the year of outcome. Moreover, we have also estimated models while controlling for the last school a child attended as well as models that included birth order. The results remained virtually unchanged (available upon request).

²⁴ We have also estimated a model with indicators for divorce, adoption, and foster parents as control variables. These results yield very similar results (available upon request). Nonetheless, as mentioned above, these variables are endogenous.

same-sex family and test scores (see **Table A2** in the Appendix). Evidently, these results are merely suggestive as they are prone to selection bias.

Despite that we observe 1,200 children who were raised in same-sex families from birth, these children represent less than 1% of the total sample. As a result, the treatment group of children in same-sex families is much smaller (and therefore less heterogeneous) than the control group of children in different-sex families. To account for this, we perform Coarsened Exact Matching (CEM) as in Blackwell et al. (2009) and Iacus, King, & Porro (2012). This technique selects for every child in a same-sex family, a corresponding child in a different-sex family having either exact same values or same coarsened values on observed characteristics in X_i in **Equation (1)**. The goal of CEM is to both reduce the imbalance in covariates as to reduce model dependence stemming from a disproportionately large control group. Iacus, King, & Porro (2012) find that CEM performs better than the commonly used Propensity Score Matching (PSM).²⁵

Finally, a word of caution is necessary about the causal interpretation of our findings. Unlike earlier studies, our administrative longitudinal data enable us to identify children who were born into a same-sex family instead of happening to live in a same-sex family at a certain point in time. Nonetheless, although we control for the main observable characteristics (*selection on observables*), we are unable to control for unobservable characteristics (*selection on unobservables*). As mentioned in Section 4.3, same-sex parents appear to have a higher socioeconomic status than different-sex parents. In **Table A3** in the Appendix, we describe socioeconomic characteristics of same-sex parents in more detail and compare them to same-sex couples without children, different-sex couples without children, and different-sex couples with children. Based on ethnicity and net income per year as proxies for socioeconomic status, we conclude that same-sex couples with children have the highest socioeconomic status among the four groups, followed by different-sex couples with and without children. Same-sex couples without children seem to have the lowest socioeconomic status.²⁶ Therefore, selection on observables stems from two sources: same-sex couples with children have a higher socioeconomic

²⁵ Nonetheless, PSM yields analogous results.

²⁶ This conclusion also holds if we consider lesbian and gay male couples separately. Gay male couples with children have the highest socioeconomic status, followed by lesbian couples with children, different-sex couples with children, different-sex couples without children, and gay male couples without children. Lesbian couples without children have the lowest socioeconomic status.

status than the overall population; and same-sex couples with children have an even higher socioeconomic status than same-sex couples without children. In addition to selection on observed characteristics, children in same-sex families may also be selected on unobserved characteristics such as ability and parental motivation. First, Dutch law allows use of a known donor for donor insemination. Therefore, lesbian couples in the Netherlands may select a donor with the most favourable characteristics, such as ability, leading to selection on unobservables. Second, lesbian couples conceiving via donor insemination also go through a process of selection between each other on which of the two mothers will carry the child. Finally, due to the cumbersome and costly procedures faced by same-sex couples to have a child, these couples may be highly motivated to become parents, and may therefore take additional steps, such as considerable family planning. To the extent that these selection issues apply to same-sex couples, we would expect our results to represent an upper bound of the causal effect of being raised in a same-sex family.

To explore these selection effects in more depth, we perform an additional analysis using a novel bounding estimator developed by Oster (2019). By analyzing coefficient and R^2 movements before and after the inclusion of observed characteristics, we can calculate how large the effect of unobserved characteristics would have to be compared to the effect of observed characteristics to reduce the estimates to zero. If we find that the effect of unobservables would need to be several times larger than the effect of observables, this would suggest that our findings are likely to have a causal interpretation. Nonetheless, this estimation assumes that selection on observables is informative on the selection on unobservables. The results should be interpreted bearing this in mind.

In a supplemental analysis, we also include cousin fixed effects. This is possible as our data allows for linking individuals across two generations. Thus, we compare children who share a grandmother/grandfather pair on the father's or mother's side, where one child has lived in a same-sex family while his or her cousin has not. This approach has been used in the literature based on the rationale that cousins share some genetic material (Geronimus, Korenman and Hillemeier 1994, Hällsten and Pfeffer 2017). A limitation of this approach is, however, that we need grandparents with multiple children and enough variation in the treatment. Therefore, the sample size is reduced, and the estimates are less precise. Moreover, although cousins share some genetic material, these children are still likely to be different in many ways. As a result, the selection on unobservables is

potentially reduced, but not eliminated. The results are presented in **Table A4** in the Appendix and are very similar to the main results.

6. Results

This section starts by estimating how children in same-sex families perform on the standardized test at the end of primary education compared to children in different-sex families. In addition, we estimate heterogeneous associations based on gender, ethnicity, and family structure. For the earlier cohorts, we estimate whether children in same-sex families differ in diploma attainment in secondary education from children in different-sex families. Finally, we use treatment effect bounds to assess the causal interpretation of our findings.

6.1. Children in Same-Sex Families and Achievement in Primary Education

Table 2 compares the standardized test scores, measured at the end of primary education, of children in same-sex families with children in different-sex families. The first two columns include all children who resided with a same-sex couple for at least one year. This group of children includes children raised in same-sex families from birth as well as children from previous heterosexual relationships and adopted children. It appears from column (1) that children in same-sex families perform significantly better at the end of primary education than their peers in different-sex families. In particular, we find that children in same-sex families have test scores 0.252 standard deviations higher than children in different-sex families. We further observe that boys perform better than girls, and that children of foreign ethnicity have a considerably lower achievement than children of Dutch ethnicity. In column (2), we control for socioeconomic variables. All coefficients have the expected signs. The results indicate that a higher parental education and income, as well as older parents, increase children's academic performance. On the other hand, children in larger families and children whose parents are not married are likely to perform worse on the standardized test. We further observe that, once we control for socioeconomic variables, the estimated coefficient on same-sex families drops significantly. This is consistent with the socioeconomic approach predicting that same-sex parents invest considerable resources into obtaining children in the first place, and therefore enjoy a higher socioeconomic status than different-sex parents on average. Nonetheless, even after controlling for socioeconomic variables, children in same-sex families still have test scores 0.112 standard deviations higher at the end of primary education than their peers in different-sex families.

In the last two columns, we only consider children who were raised in same-sex families from birth. We exclude children from previous heterosexual relationships and adopted (and foster) children, as divorce and adoption may have negative independent effects on test scores, and therefore create selection bias (Rosenfeld 2010). Our preferred specification in column (3) confirms this finding. If we only consider children raised in same-sex families from birth, the coefficient increases significantly to 0.18 standard deviations, which is a rather large association. To place this estimate in perspective, in his synthesis of over 800 meta-analyses, Hattie (2009) finds that the average association of having a good teacher on student achievement is 0.32 standard deviations. The association we find of residing with a same-sex family and student achievement is almost half the average teacher association.

As a final specification, we perform Coarsened Exact Matching applied on control variables used in the previous specification. As this technique selects for every child in a same-sex family, a corresponding child in a different-sex family having either the exact same values or same coarsened values on observed characteristics, CEM is able to account for a much larger group of children in different-sex families compared to the group of children in same-sex families. As a result, CEM can reduce both the imbalance in covariates and the model dependence (Blackwell, et al. 2009, Iacus, King and Porro 2012). Despite the alternative specification in which we compare children in similar observed characteristics, column (4) indicates that CEM left the estimated coefficients from Table 2 virtually unchanged. The estimated coefficient is slightly higher (though not significantly higher) at 0.193 standard deviations. This similarity to the estimate obtained by CEM yields more confidence in our main results.

TABLE 2 – CHILDREN IN SAME-SEX FAMILIES AND STANDARDIZED TEST SCORES AT THE END OF PRIMARY EDUCATION

	Full sample		Children raised in same-sex families from birth ^a	
	(1)	(2)	(3)	(4)
Child in same-sex family (1 is yes)	0.252*** (0.024)	0.112*** (0.023)	0.180*** (0.026)	0.193*** (0.027)
Gender (1 is male)	0.011*** (0.002)	0.006*** (0.002)	0.006*** (0.002)	
Ethnicity (1 is foreign)	-0.192*** (0.002)	-0.054*** (0.002)	-0.054*** (0.002)	
Parental education at birth (1=no diploma SE)		-0.512*** (0.003)	-0.513*** (0.003)	
Household income at birth (ref: <= 10k EUR)				
10,001 EUR – 20,000 EUR		0.108*** (0.002)	0.108*** (0.002)	
20,001 EUR – 30,000 EUR		0.357*** (0.003)	0.358*** (0.003)	
More than 30,000 EUR		0.504*** (0.005)	0.505*** (0.005)	
Mean parental age at birth (ref: <35)				
36-40		0.101*** (0.002)	0.102*** (0.002)	
>40		0.101*** (0.003)	0.101*** (0.003)	
Number of siblings (ref: only child)				
One sibling		-0.089*** (0.002)	-0.089*** (0.002)	
Two or more siblings		-0.134*** (0.003)	-0.134*** (0.003)	
Family structure at birth (ref: married parents)				
Cohabiting parents		-0.069*** (0.002)	-0.069*** (0.002)	
Other		-0.276*** (0.023)		
Fixed effects:				
Birth year	Yes	Yes	Yes	
Neighbourhood at birth	No	Yes	Yes	
Method	OLS	OLS	OLS	CEM ^b
Number of children	1,201,012	1,201,012	1,198,433	75,333
Number of children in same-sex families	1,661	1,661	1,200	1,200
Adj. R ²	0.012	0.109	0.109	0.081

Notes. Standard errors clustered at the household level are in parentheses.

^a This means that children from previous heterosexual relationships and adopted children (including foster children) have been excluded.

^b CEM stands for Coarsened Exact Matching (see Section 5). Due to a large control group, we searched for an exact match on all the covariates.

*** Significance at the 1% level.

6.2. Heterogeneity by Gender, Ethnicity, and Family Structure

In **Table 3**, we perform the analysis by gender, ethnicity, and family structure. In additional analyses (available upon request), we have also estimated our models using other potential moderators, such as household income and neighbourhood of residence (e.g. big cities, such as Amsterdam and Rotterdam on the one hand, and rural parts of the Netherlands on the other). However, we found no heterogeneous results. Therefore, we solely present the results by gender, ethnicity, and family structure for which potential heterogeneous associations have been made in the literature (Allen 2013, Sullins 2015, Watkins 2018). To conserve space, we only present the coefficient of the treatment variable. Nonetheless, each model was estimated while controlling for covariates as in **Table 1**. Allen (2013) finds that girls, rather than boys, are more negatively affected by residing with a same-sex family. Columns (1) and (2) do not support these findings. The coefficient for both boys and girls is around 0.18 standard deviations.

We also split the sample by ethnicity. Children in same-sex families born outside the Netherlands may experience more stigma than children in same-sex families born in the Netherlands. However, only 28 children in our sample had parents who were both born outside the Netherlands, and among these, only 10 children had parents who were both born outside the European Union. Thus, it appears that same-sex couples with children are rare in the population of minorities in the Netherlands. Therefore, to maximize sample size, we split the sample into children with at least one parent born outside the Netherlands, and children whose parents were both born in the Netherlands. We find that children in same-sex families from both foreign and Dutch ethnicity perform better on standardized tests than children in different-sex families. The coefficient for foreign ethnicity children, shown in column (3), is higher than the coefficient for Dutch children in column (4), but so is the standard error due to a smaller sample size. A test of equality of coefficients does not reject the hypothesis of equal coefficients ($p = 0.245$).

Finally, we also split the sample by family structure. Watkins (2018) estimates that children in same-sex families progress through school faster if the couple is married rather than cohabiting. Sullins (2015), on the other hand, argues that children in same-sex families perform worse on Grade Point Average (GPA) if the couple is married rather than cohabiting; our results are more in line with Sullins (2015). We find that children in same-sex families outperform children in different-sex families by 0.129 standard deviations if both the same-sex and the different-sex couple is married, and by 0.235 standard deviations if both the same-sex and the different-sex couple is

cohabiting. Thus, it appears that children in same-sex cohabiting families perform exceptionally better than children in different-sex cohabiting families. In **Table A5** in the Appendix, we treat family structure as a categorical variable comprised of four categories: *different-sex married*, *different-sex cohabiting*, *same-sex married*, and *same-sex cohabiting*. We find that children in same-sex cohabiting families perform the best, followed by children in same-sex married families and different-sex married families. Children in different-sex cohabiting families appear to perform the worst. Using children in same-sex married families as a reference category, we see no significant difference between these children and children in cohabiting same-sex families. Thus, it appears that the large coefficient on children in same-sex cohabiting families was driven by children in different-sex cohabiting families performing significantly worse than other groups, rather than a difference in achievement between children in married and cohabiting same-sex families.

TABLE 3 – CHILDREN RAISED IN SAME-SEX FAMILIES FROM BIRTH AND STANDARDIZED TEST SCORES AT THE END OF PRIMARY EDUCATION BY GENDER, ETHNICITY, AND FAMILY STRUCTURE

	Boys (1)	Girls (2)	Foreign (3)	Dutch (4)	Married (5)	Cohabiting (6)
Child in same-sex family (1 is yes)	0.181*** (0.036)	0.184*** (0.035)	0.238*** (0.058)	0.159*** (0.029)	0.129*** (0.032)	0.235*** (0.043)
Additional controls ^a	Yes	Yes	Yes	Yes	Yes	Yes
Number of children	602,560	595,873	312,484	885,949	963,315	235,118
Number of children in same-sex families	603	597	256	944	774	426
Adj. R ²	0.106	0.115	0.140	0.092	0.107	0.128

Notes. Standard errors clustered at the household level are in parentheses.

^a Additional controls include gender, ethnicity, birth year, parental education at birth, household income at birth, neighbourhood at birth, average age of the parents at birth, number of siblings, and family structure at birth.

*** Significance at the 1% level.

6.3. Bounding the Causal Effect

Section 6.1 and Section 6.2 show that children in same-sex families are likely to outperform children in different-sex families on standardized tests at the end of primary education. This result, however, is an association and not a causal effect. **Table 2** suggested that the selection mechanism plays a role when comparing test scores of children in same-sex families to children in different-sex families. Once we controlled for socioeconomic variables, the positive coefficient dropped significantly. Moreover, selection on unobservable characteristics such as ability and parental

motivation may also be present. Therefore, we would expect our results to represent an upper bound of the causal effect of being raised in a same-sex family.

To better understand these selection effects, we perform the bounding approach of Oster (2019).²⁷ This approach exploits coefficient and R^2 movements before and after the inclusion of observed characteristics to bound the treatment effect.²⁸ Column (3) in **Table 4** indicates that even when the selection on unobserved characteristics is twice as high as selection on observed characteristics, children in same-sex families outperform children in different-sex families by 0.043 standard deviations. We calculate in column (4) that the selection on unobserved characteristics would have to be at least 2.62 times higher than the selection on observed characteristics already included in the model to reduce our estimate to zero. It is, therefore, unlikely that selection mechanism alone can explain our findings. Nevertheless, it is important to note that this bounding method assumes that selection on observed characteristics is informative about the selection on unobserved characteristics. This is likely the case in our setting as observed characteristics such as parental education, household income, and neighbourhood of residence are likely to be correlated with unobserved characteristics such as academic motivation and behaviour.

TABLE 4 – BOUNDING THE CAUSAL EFFECT OF BEING RAISED IN A SAME-SEX FAMILY FROM BIRTH ON STANDARDIZED TEST SCORES AT THE END OF PRIMARY EDUCATION

Selection ratio ^a	1	1.5	2	2.62
	(1)	(2)	(3)	(4)
Child in same-sex family (1 is yes)	0.112	0.078	0.043	0.000
Number of children	1,198,433	1,198,433	1,198,433	1,198,433
Number of children in same-sex families	1,200	1,200	1,200	1,200

Notes. The table shows a bounding analysis for children raised in a same-sex family from birth (children from prior heterosexual relationships and adopted children have been excluded). The results show that selection on unobservables, such as ability and parental motivation, would need to be 2.62 times higher than selection on observables (all control variables used in the main analysis: gender, ethnicity, birth year, parental education at birth, household income at birth, neighbourhood at birth, average age of the parents at birth, number of siblings, and family structure at birth) to reduce the effect of being raised in a same-sex family on standardized test scores at the end of primary education to zero.

^a For instance, a selection ratio of 2 indicates that when the selection on unobserved characteristics is two times higher than the selection on observed characteristics, the association between being raised in a same-sex family and standardized test scores at the end of primary education is 0.043.

²⁷ See also Altonji, Elder, & Taber (2005) and Lindquist & Santavirta (2014).

²⁸ R^2_{\max} is set at 1.3 times R^2 from the regression including all controls as recommended by Oster (2019).

6.4. Children in Same-Sex Families and Diploma Attainment in Secondary Education

Table 5 compares children in same-sex families, with children in different-sex families on diploma attainment in secondary education. As children in our sample are born between 1995 and 2005, we can only analyze children from earlier cohorts as they alone are old enough to have graduated from secondary education. The first two columns include all children who resided with a same-sex family at least once. It appears from columns (1) and (2) that children in same-sex families perform just as well as their peers in different-sex families on diploma attainment. However, once we consider children who were actually raised in same-sex families from birth in column (3), children in same-sex families are 6.7% more likely to graduate than children in different-sex families (from a mean diploma attainment of children in different-sex families of 87%). CEM confirms these results, although the coefficient is only significant at the 10% level. In sum, it appears that children raised in same-sex families from birth continue to outperform their peers raised in different-sex families in secondary education. Nonetheless, as we only observe 164 children in same-sex families in our preferred specification in column (3), these results should be interpreted with caution.

TABLE 5 – CHILDREN IN SAME-SEX FAMILIES AND DIPLOMA ATTAINMENT

	Full sample		Children raised in same-sex families from birth ^c	
	(1)	(2)	(3)	(4)
Child in same-sex family (1 is yes)	0.020 (0.018)	0.025 (0.019)	0.067*** (0.019)	0.042* (0.024)
Additional controls ^a	No	Yes	Yes	Yes
Method	OLS	OLS	OLS	CEM ^b
Number of children	212,432	212,432	211,975	24,057
Number of children in same-sex families	256	256	164	164
Adj. R ²	0.047	0.078	0.077	0.222

Notes. Standard errors clustered at the household level are in parentheses. Diploma attainment is coded as an indicator given a value of 1 is the child graduated from upper secondary education, and 0 if the child dropped out before graduating.

^a Additional controls include gender, ethnicity, birth year, parental education at birth, household income at birth, neighbourhood at birth, average age of the parents at birth, number of siblings, and family structure at birth.

^b CEM stands for Coarsened Exact Matching (see Section 5). Due to a large control group, we searched for an exact match on all covariates.

^c This means that children from previous heterosexual relationships and adopted children (including foster children) have been excluded.

* Significance at the 10% level.

*** Significance at the 1% level.

7. Discussion

Using a unique administrative longitudinal dataset from the Netherlands, this paper compared children in same-sex families with children in different-sex families on high-stakes standardized test scores at the end of primary education. The results indicated that children raised in same-sex families from birth outperformed children in different-sex families by 0.18 standard deviations on these tests. Further, we also found that children in same-sex families continued to outperform children in different-sex families in secondary education. Our results suggested that children raised in same-sex families from birth were 6.7% more likely to graduate than children in different-sex families. These results did not appear to be moderated by gender and ethnicity of the child. By contrast, a moderating effect was found by family structure, with children in same-sex cohabiting families having performed exceptionally better in school than children in different-sex cohabiting families.

Overall, these results are in contrast with the earlier literature using cross-sectional census data. The literature either finds a negative association between residing with a same-sex family and school outcomes (Allen 2013, Allen, Pakaluk and Price 2013), or no association at all (Rosenfeld 2010, Watkins 2018, Boertien and Bernardi 2019). We attribute this difference to the cross-sectional nature of the census data and to the Dutch institutional context. First, due to the cross-sectional nature of the census data, it is not possible to differentiate between children actually raised in same-sex families from birth and children who happened to live in a same-sex family at one point in time. When considering the only other study that used administrative data, we find that our results are in line with concurrent work by Aldén, Björklund, and Hammarstedt (2017), although they include only a limited sample of 56 children in lesbian families. Second, country differences are related to substantial differences in findings in the literature (Schumm 2018). Our study pertains to the Netherlands, a country with a more supportive cultural and legal context for same-sex parents than in most other countries. Moreover, we observe in our data that most children in same-sex families are raised in a same-sex family from birth in the Netherlands. The results are likely to differ in other national settings.

It is also possible to address some of the theoretical mechanisms that may be driving our results. As we estimated that children in same-sex families perform better in school than children in different-sex families, neither the specialization theory, the kin selection theory, nor the discrimination theory were supported by the data. Our results mostly support the selection theory

stating that given the time-consuming and costly procedures for same-sex couples to obtain children, same-sex parents typically have a higher socioeconomic status resulting in higher parental investment. Indeed, once we controlled for socioeconomic variables, the positive association between residing with a same-sex family and test scores dropped significantly. Nonetheless, the positive association was not entirely removed. We further used a bounding analysis to analyze the causal effect of living in a same-sex family. Treatment effect bounds indicated that the selection on unobserved characteristics would have to be more than two and a half times higher than the selection on observed characteristics to reduce the positive association to zero. Therefore, it is likely that mechanisms other than selection theory also play a role. One possible approach is the compensation theory stating that same-sex parents might compensate for their unique stressors by investing more time and energy into their children. We can partially refute this theory by separating the sample into two periods, the period before introducing same-sex marriage in 2001, and the period after the introduction of same-sex marriage. We find an association of 0.174 standard deviations (standard error: 0.031) before 2001, and an association of 0.181 (standard error: 0.027) after 2001. If compensation theory drives parental behaviour, we should find a more positive association after the introduction of same-sex marriage, given that attitudes towards same-sex couples have improved. However, our results suggest that this is not the case. The coefficients for the period before and after introducing same-sex marriage in 2001 are very similar to the main results. Nonetheless, we cannot rule out the compensation theory as our data do not include a measure on parental investment. For instance, we cannot test whether same-sex parents spent more time with their children than different-sex parents. A recent study by Prickett, Martin-Storey, and Crosnoe (2015) suggests that this may be the case.

Although we attempted to solve the main caveats in the research on children's outcomes in same-sex families, this study is not without limitations. First, our administrative data do not include a measure of sexual orientation. Second, we solely considered couples and made no claims about children living with single parents. Third, our sample of children in gay male families is too small to estimate heterogeneous associations by the gender of same-sex parents. In addition, we could estimate diploma attainment only for earlier cohorts leading to a relatively small sample size of children in same-sex families. Finally, survey data should accompany these administrative findings to explore potential mechanisms in detail. Further research should address these issues.

Appendix

TABLE A1 – CHILDREN IN SAME-SEX FAMILIES AND TEACHER ADVICE AT THE END OF
PRIMARY EDUCATION

	Full sample		Children raised in same-sex families from birth ^c	
	(1)	(2)	(3)	(4)
Child in same-sex family (1 is yes)	0.075*** (0.013)	0.056*** (0.013)	0.084*** (0.015)	0.086*** (0.016)
Additional controls ^a	No	Yes	Yes	Yes
Method	OLS	OLS	OLS	CEM ^b
Number of children	1,171,899	1,171,899	1,169,396	740,292
Number of children in same-sex families	1,625	1,625	1,181	1,181
Adj. R ²	0.055	0.088	0.088	0.089

Notes. Standard errors clustered at the household level are in parentheses. The outcome teacher advice is an indicator given a value of 1 if the teacher advised the pre-university track VWO (most prestigious track), and 0 otherwise. The original sample had 1,661 children in same-sex families and 1,200 children raised in same-sex families from birth. The difference in sample size is accounted by the number of missing values for the teacher advice variable.

^a Additional controls include gender, ethnicity, birth year, parental education at birth, household income at birth, neighbourhood at birth, average age of the parents at birth, number of siblings, and family structure at birth.

^b CEM stands for Coarsened Exact Matching (see Section 5). Due to a large control group, we searched for an exact match on all the covariates.

^c This means that children from previous heterosexual relationships and adopted children (including foster children) have been excluded.

*** Significance at the 1% level.

TABLE A2 – CHILDREN IN SAME-SEX FAMILIES AND STANDARDIZED TEST SCORES AT THE END OF PRIMARY EDUCATION: COMPARISON WITH CHILDREN FROM A PRIOR HETEROSEXUAL RELATIONSHIP

	Full sample		Children from a prior heterosexual relationship, adopted children, and foster children ^a	
	(1)	(2)	(3)	(4)
Child in same-sex family (1 is yes)	0.252*** (0.024)	0.112*** (0.023)	-0.065 (0.045)	-0.071 (0.059)
Gender (1 is male)	0.011*** (0.002)	0.006*** (0.002)	0.006*** (0.002)	
Ethnicity (1 is foreign)	-0.192*** (0.002)	-0.054*** (0.002)	-0.054*** (0.002)	
Parental education at birth (1=no diploma SE)		-0.512*** (0.003)	-0.512*** (0.003)	
Household income at birth (ref: <= 10k EUR)				
10,001 EUR – 20,000 EUR		0.108*** (0.002)	0.108*** (0.002)	
20,001 EUR – 30,000 EUR		0.357*** (0.003)	0.357*** (0.003)	
More than 30,000 EUR		0.504*** (0.005)	0.504*** (0.005)	
Mean parental age at birth (ref: <35)				
36-40		0.101*** (0.002)	0.101*** (0.002)	
>40		0.101*** (0.003)	0.101*** (0.003)	
Number of siblings (ref: only child)				
One sibling		-0.089*** (0.002)	-0.089*** (0.002)	
Two or more siblings		-0.134*** (0.003)	-0.134*** (0.003)	
Family structure at birth (ref: married parents)				
Cohabiting parents		-0.069*** (0.002)	-0.070*** (0.002)	
Other		-0.276*** (0.023)		
Fixed effects:				
Birth year	Yes	Yes	Yes	
Neighbourhood at birth	No	Yes	Yes	
Method	OLS	OLS	OLS	CEM ^b
Number of children	1,201,012	1,201,012	1,199,812	744,981
Number of children in same-sex families	1,661	1,661	461	461
Adj. R ²	0.012	0.109	0.109	0.088

Notes. Standard errors clustered at the household level are in parentheses.

^a This means that children who were raised in a same-sex family from birth (birth children) have been excluded.

^b CEM stands for Coarsened Exact Matching (see Section 5). Due to a large control group, we searched for an exact match on all the covariates.

*** Significance at the 1% level.

TABLE A3 – SOCIOECONOMIC CHARACTERISTICS OF COUPLES WITH AND WITHOUT CHILDREN BY GENDER IN 2016

	Different-sex couple with children	Different-sex couple without children	Same-sex couple with children	Same-sex couple without children
	(1)	(2)	(3)	(4)
Ethnicity (1 is foreign, 0 is Dutch)	0.256 (0.436)	0.378 (0.485)	0.224 (0.417)	0.562 (0.496)
Net income per year in EUR	24,526 (33,069)	25,255 (28,654)	49,880 (26,741)	19,096 (25,074)
Number of couples	4,488,532	1,557,507	4,928	276,425

Notes. Standard deviations are in parentheses.

TABLE A4 – CHILDREN RAISED IN SAME-SEX FAMILIES FROM BIRTH AND STANDARDIZED TEST SCORE AT THE END OF PRIMARY EDUCATION USING COUSIN FIXED EFFECTS

	Cousin on father's side	Cousin on mother's side
	(1)	(2)
Child from same-sex couple (1 is yes)	0.240*** (0.067)	0.160** (0.076)
Number of children driving the results	1,129	849
Number of children in same-sex families	347	288
Adj. R ²	0.320	0.325

Notes. Standard errors clustered at the cousin level are in parentheses.

*** Significance at the 1% level.

TABLE A5 – CHILDREN RAISED IN SAME-SEX FAMILIES FROM BIRTH AND STANDARDIZED TEST SCORES AT THE END OF PRIMARY EDUCATION WITH CATEGORICAL FAMILY STRUCTURE

	(1)	(2)
Child in different-sex married family	(reference category)	-0.125*** (0.032)
Child in different-sex cohabiting family	-0.070*** (0.002)	-0.195*** (0.032)
Child in same-sex married family	0.125*** (0.032)	(reference category)
Child in same-sex cohabiting family	0.211*** (0.043)	0.086 (0.053)
Additional controls ^a	Yes	Yes
Children	1,198,433	1,198,433
Children in same-sex families	1,200	1,200
Adj. R ²	0.109	0.109

Notes. Standard errors clustered at the household level are in parentheses.

^a Additional controls include gender, ethnicity, birth year, parental education at birth, household income at birth, neighbourhood at birth, average age of the parents at birth, and number of siblings.

* Significance at the 10% level.

*** Significance at the 1% level.

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