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CEBI WORKING PAPER SERIES

Working Paper 02/22

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ISSN 2596-44TX

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No Evidence that Siblings' Gender Affects Personality Across Nine Countries

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This manuscript has been accepted for publication in Psychological Science. Please cite as:

Dudek, T., Brenøe, A. A., Feld, J., & Rohrer, J. M. (in press). No evidence that siblings' gender affects personality across nine countries. *Psychological Science.*

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Additional online material can be retrieved from https://osf.io/yznq6.

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Abstract

Does growing up with a sister rather than a brother affect personality? In this paper, we provide a comprehensive analysis of the effects of siblings' gender on adults' personality, using data from 85,887 people from 12 large representative surveys covering 9 countries (the United States, the United Kingdom, the Netherlands, Germany, Switzerland, Australia, Mexico, China, and Indonesia). We investigated the personality traits risk tolerance, trust, patience, locus of control, and the Big Five. We found no meaningful causal effects of the gender of the next younger sibling, and no associations with the gender of the next older sibling. Based on high statistical power and consistent results in the overall sample and relevant subsamples, our results suggest that siblings' gender does not systematically affect personality.

Statement of Relevance

Siblings are a central part of the childhood family environment, which is often believed to play a crucial and long-lasting role in personality development. For example, growing up with siblings of the opposite gender (as opposed to the same gender) may lead to different interactions between siblings and their parents. These different interactions may in turn leave a mark on one's personality. However, existing theories make opposing predictions—siblings of the opposite gender may plausibly either result in less gender-stereotypical personalities (e.g., a girl may take on more masculine traits because she imitates her brother) or more gender-stereotypical personalities (e.g., a girl may take on a more feminine role to differentiate herself from her brother). Previous empirical studies have resulted in inconsistent findings. In this study, we analyzed 12 large surveys from 9 different countries to clarify the situation. Overall, we found that siblings' gender has no meaningful effects on personality.

No Evidence that Siblings' Gender Affects Personality Across Nine Countries

Personality is an important predictor of economic, social, and physical well-being (e.g., Almlund et al., 2011; Heckman et al., 2006; Soto, 2019). While there is consensus that both genes and the environment shape personality (Vukasović & Bratko, 2015), comparatively little is known about whether and to which extent specific environmental factors matter, such as the childhood family environment. In this paper, we focus on one part of this environment: the gender of one's siblings. Growing up with a sister rather than a brother may affect the interactions between siblings as well as those between parents and their children. These interactions take place at a crucial time—when children are young and their personality is most malleable (Roberts & DelVecchio, 2000; Sutter et al., 2019).

Two theories make opposing predictions about the causal effects of siblings' gender on personality. The theory of social learning states that siblings learn from each other and assimilate to each other through social interactions (e.g., Brim, 1958). Thus, having a sister would lead to more feminine characteristics; having a brother would lead to more masculine characteristics. From this, it follows that children with an opposite-gender sibling will have fewer gender-stereotypical characteristics compared to those with a same-gender sibling. In contrast, the theory of sibling differentiation states that, due to sibling rivalry, siblings will differentiate themselves in the process of developing their identities (Bossard & Boll, 1956). The differentiation process may also be driven by parental behavior; for example, fathers might spend more time with their sons and mothers more time with their daughters in households with children of both genders (Brenøe, 2021). According to the sibling differentiation theory, having a sister reduces feminine characteristics, while having a brother reduces masculine characteristics. Consequently, children

with an opposite-gender sibling should have more gender-stereotypical characteristics compared to those with a same-gender sibling.

Both theories have received some empirical support since the 1950s. Studies have found results supporting the social learning theory, in particular in children, (e.g., Brim, 1958; Okudaira et al., 2015; Stoneman et al., 1986; Sutton-Smith et al., 1964), but also of the sibling differentiation theory in both children (e.g., Grotevant, 1978; Leventhal, 1970; Rodgers et al., 1998) and, more recently, in adults (Brenøe, 2021). In addition, multiple studies resulted in either mixed findings, or not much support for either theory (e.g., Detlefsen, Friedl, Lima de Miranda, Schmidt, & Sutter, 2018; Endendijk et al., 2013; Lamke, Bell, & Murphy, 1980; McHale, Crouter, & Tucker, 1999). The literature thus remains inconclusive.

Why do previous studies fail to paint a clear picture about the effects of siblings' gender on personality? A closer look at the studies reveals a number of potential problems, such as highly selective samples, a multitude of different outcome variables, and statistical evidence of unknown or weak strength. The seminal study on the effects of sibling gender investigated 384 school children from Chicago (Brim, 1958). All children came from White, urban, two-child families. Teachers rated children on 58 items divided into instrumental masculine traits (e.g., aggressiveness, curiosity) and expressive feminine traits (e.g., anger, affectionateness), and each item was tested for statistical differences. Findings suggested that children with an opposite-gender sibling had more traits of the opposite gender, although it is impossible to evaluate the strength of the evidence given incomplete reporting.

A later study by Leventhal (1970) investigated a sample of male psychology students at North Carolina State University. Among the assessed outcomes were 30 extracurricular interests, an unspecified number of additional questions (e.g., interest in joining a social fraternity), and

records of athletic performance. Results revealed that men with a sister showed greater interest in outdoor activities, and that men with an older sister had higher motor fitness scores and showed more interest in social fraternities. This was interpreted as evidence for sibling differentiation, but again the strength of the statistical evidence seems questionable.

McHale et al. (2001) investigated 198 pairs of first- and second-born children from almost exclusively White, “intact”, working and middle-class families. The researchers assessed gender role attitudes, expressivity and instrumentality, and “sex-typed leisure activities” (e.g., handicrafts as a feminine activity; hunting and fishing as masculine activities). The findings support the social learning theory: girls with younger brothers had less traditional gender role attitudes. But once again, given the number of hypotheses conducted, the statistical evidence was not quite compelling.

The problems that make it hard to interpret these findings are not idiosyncrasies of the literature on the effects of siblings’ gender, but rather reflect both common research practices and the limited data availability at the time. Researchers now have the possibility to draw on large and nationally representative panel studies. For example, Golsteyn and Magnée (2020) made use of data from the British Cohort Study, which provides a representative picture of the British population born around 1970. Mothers rated their children’s personality at both age 10 and age 16 on a number of adjectives which could be mapped onto the Big Five personality traits conscientiousness, extraversion, agreeableness, and emotional stability. Based on a sample of 2,868 children, their findings support the social learning theory, showing that boys with younger sisters scored higher on agreeableness (assessed with negatively coded items, such as “destroys belongings”, “fights with others”, “disobedient”); this pattern held at both ages but was more pronounced at age 16.

Apart from effects of siblings' gender on attitudes and personality, studies in economics have mainly investigated siblings' gender effects on educational achievement, career choices, and wages. Butcher and Case (1994) investigated the effects on education in three national US surveys. They found that women with one or more sisters receive less education than women who only have brothers, holding the number of siblings constant. However, the authors also raised potential issues with the interpretation of these differences if parents have preferences over the gender composition of their children. For example, parents who prefer daughters may be more likely to stop having children after they had a girl, meaning that these daughters are less likely to have a sister. These families may also be more likely to invest more resources into their daughter's education. Such behavior could induce spurious associations between siblings' gender and educational outcomes when analyses condition on the number of siblings—an issue that questions whether the estimates reported in the literature on sibling gender can be interpreted as causal effects.

More recently, researchers in economics have established a way to identify causal effects of sibling gender—by focusing on the gender of the next younger sibling. Parents' decision to have another child likely depends on the gender, but also on the personality of their current children (Jokela, 2010). Thus, the ultimate sibling composition is not random. As a result, differences between people with a brother and people with a sister may exist even in the absence of causal effects of siblings' gender. But once parents decided to have another child, the gender of that next younger sibling is essentially random (Brenøe, 2021; Cools & Patacchini, 2019; Peter, Lundborg, Mikkelsen, & Webbink, 2018). This results in a natural experiment that allows for the estimation of causal effects of the next younger sibling's gender: differences between

people with a next younger sister and people with a next younger brother can be attributed to the next younger sibling's gender.

Using this approach, Cools and Patacchini (2019) reported a "brother earnings penalty" in data from the US. Women with a younger brother earned about 7% less than women with a younger sister. Brenøe (2021) used Danish administrative data to uncover a potential mechanism underlying this earnings penalty: traditional gender roles. Women with a younger brother were more likely to choose traditionally female occupations, and their wages dropped more drastically when entering motherhood than women with a younger sister. These studies provide convincing, albeit indirect evidence for one form of sibling differentiation: women with brothers seem to take more "traditional" paths through life.

In this study, we combine the focus on causal identification from economics with the rich data sources available to modern researchers to settle the question whether siblings' gender has lasting effects on personality. We analyze a broad range of common personality measures across 12 representative surveys covering 9 countries (the United States, the United Kingdom, the Netherlands, Germany, Switzerland, Australia, Mexico, China, and Indonesia). The resulting sample size of 85,887 people allows us to detect even very small effects of siblings' gender on adult personality.

Among both men and women, social learning predicts that sisters (as opposed to brothers) lead to more typically female characteristics, while sibling differentiation predicts that sisters lead to more typically male characteristics. But the dynamics the theories imply may play out differently for men and women (e.g., one theory may apply to women and the other one to men), which is why we conducted analyses separately for men and women.

Following the model of studies from economics, our central analyses focused on the effects of the gender of the next younger sibling, which results in estimates that can be interpreted as causal effects. Because these estimates only address a narrow research question, we additionally investigated associations between personality and the gender of the next older sibling. Furthermore, going beyond consecutive siblings, we also probed for potential dose-response relationships—testing whether the total number of sisters (vs. brothers) within the sibship is associated with personality. The estimates from these additional analyses may not correspond to the causal effect of interest, but they help us provide a more comprehensive picture of the relationships between siblings' gender and personality.

Method

Data

To estimate the effect of siblings' gender on personality, we searched for representative surveys that (1) would allow us to identify the respondents' sibling gender composition, (2) included at least two of the personality measures we considered, and (3) had large sample sizes. Based on these criteria, we compiled a dataset including data from 12 surveys (Table 1). Our final sample consists of 85,887 people; 55,203 of them have a younger sibling, 50,909 have an older sibling, and 20,225 have both. The survey respondents are on average 33 years old and 52% are female. Detailed acknowledgments for each of the surveys, including the data versions and waves included in our analyses, can be found in the Supplemental Material.

Table 1

Surveys Included in Our Analyses

Country	Name	Abbreviation	Reference
United States	National Longitudinal Study of Adolescent to Adult Health	AddHealth	Harris & Udry (2014)
	National Longitudinal Survey of Youth 1979	NLSY79	Bureau of Labor Statistics (n.d.-a)
	National Longitudinal Survey of Youth Children and Young Adults 1979	NLSY79CHYA	Bureau of Labor Statistics (n.d.-b)
United Kingdom	United Kingdom Household Longitudinal Study	UKHLS	University of Essex (2019)
	Millenium Cohort Study	MCS	University of London (2017)
Netherlands	Longitudinal Internet Studies for the Social Sciences	LISS	CentERdata (2007)
Germany	Socioeconomic Panel	SOEP	Wagner et al. (2007)
Switzerland	Swiss Household Panel	SHP	SHP Group (2020)
Australia	Household, Income and Labour Dynamics in Australia	HILDA	Department of Social Services (2017)
Mexico	Mexican Family Life Survey	MxFLS	Rubalcava & Teruel (2006, 2008, 2013)
China	China Family Panel Studies	CFPS	Institute of Social Science Survey (2015)
Indonesia	Indonesian Family Life Survey	IFLS	Frankenberg & Karoly (1995), Frankenberg & Thomas (2000), Strauss et al (2004), Strauss et al. (2009), Strauss et al. (2016)

Personality Measures

We considered ten personality dimensions: risk tolerance, trust, patience, the Big Five personality traits (openness to experience, conscientiousness, extraversion, agreeableness, neuroticism), locus of control, as well as a "typical female personality index" (TFP index). We generated the TFP index using five personality traits for which we observe systematic gender

differences. Table S1 shows the number of unique people for whom we observe each personality measure across surveys. We standardized the outcomes within each survey/year combination ($M = 0$, $SD = 1$).

Individual Measures. Risk tolerance was assessed with a variety of measures ranging from single self-report items (e.g., "I like to take risks", AddHealth) to hypothetical decisions (e.g., "Suppose that you are the only income earner in the family, and that you have to choose between two new jobs…", NLSY79) to simple decision tasks (e.g., selecting a chip color for a bag of possible payments representing risky gambles of varying payments, MXFLS). Risk tolerance was measured in all 12 surveys (see Table S2 for more details).

Trust was assessed with between one (e.g., "Generally speaking, how often can you trust other people?", NLSY79CHYA) to four self-report items (multiple questions about their trust in their village and other people, IFLS). It was measured in ten surveys (see Table S3 for details).

Patience was assessed through either self-reporting (e.g., "On a scale of 0-10, where 0 is never and 10 is always, how patient would you say you are?", MCS) or through the selection of different payment options (e.g., $1,000 now versus $1,500 in a month, MXFLS). It was measured in four surveys (Table S4).

The Big Five personality traits were assessed with self-report questionnaires including between two and ten items per dimension. It was measured in nine surveys (Table S5).

Locus of control was assessed with self-report questionnaires including between two and ten items (e.g., "I have little control over the things that happen to me/in my life"). It was measured in six surveys (Table S6).

Typical Female Personality. Both social learning and sibling differentiation suggest effects on the gender-typicality of one's personality. However, when considering personality traits in isolation, gender differences are often small (Del Giudice, Booth, & Irwing, 2012; Hyde, 2005)—as a consequence, chances to detect effects of siblings' gender on gender typicality when considering any particular trait in isolation may be small as well. To provide a fairer test of the idea that siblings' gender affects gender typicality, we constructed a summary index that maximizes personality differences between men and women.

This *typical female personality* (TFP) index is based on the five traits (risk tolerance, conscientiousness, extraversion, agreeableness, and neuroticism) where we found significant and consistent gender differences across the different surveys. To identify significant gender differences, we regressed each of the five standardized traits separately on a female dummy and a cubic polynomial of the respondents' age (i.e., age, age-squared, age-cubed). We included only traits for which the gender difference in a given survey is statistically significant at the 5% level (and points in the expected direction) in the calculation of the TFP index. As there were no reliable differences in neuroticism in NLSY79CHYA and HILDA, we excluded neuroticism from the TFP index for these two surveys, and we additionally found no significant gender differences in MXFLS which is why this survey does not have a TFP index. Finally, we weighted the gender differences for these traits in each survey. The index is thus calculated as the gender-difference-weighted average of the observed traits per respondent within a year.

Importantly, this index is not meant to be interpreted as an underlying personality trait ("femininity"). Instead, it is simply an index with the highest weight on traits for which the largest gender differences were observed within the particular surveys. Thus, if siblings' gender indeed leads to more or less gender-typical personalities, this index maximizes the chances of

detecting these effects, taking into account that what counts as gender typical may vary by context. The gender difference on the resulting index was 0.39 SD, but it varied between studies from a low of 0.16 (MCS) to a high of 0.79 (LISS) (Figures S5.1 and S5.2).

Data Validation. Due to the large number of heterogeneous and largely brief measures, concerns about their validity naturally arise. Wolfram Ritter, a master's student supervised by Anne Brenøe with assistance from Thomas Dudek, investigated the validity of the nine primary personality dimensions (excluding the TFP index) in 11 of the 12 surveys included in our study; his thesis can be downloaded from http://www.merlin.uzh.ch/publication/show/19495 (Ritter, 2020). NLSY79CHA was added to our investigation after Ritter had finished his thesis. Ritter reviewed the literature on (1) the intercorrelations between different personality dimensions and (2) the correlations between personality and relevant socio-economic and demographic variables, and then assessed which of these correlations could be replicated across the 11 surveys. Any measure employed in a study was deemed "validated" if it replicated at least 70% of the correlations found in the literature. Using this criterion, 63 out of 69 measures were validated. Only risk tolerance in AddHealth and NLSY79; patience in IFLS; and trust in IFLS, SOEP and UKHLS failed to replicate at least 70% of the correlations found in the literature. This criterion is rather conservative, as it is of course possible that the associations between personality and other variables systematically vary between countries.

Sample Restrictions

We limited the sample to respondents aged 10-60 years. The surveys generally excluded younger respondents; given the age requirements for survey participation, it is probable that they were miscoded. We excluded older respondents, as their inclusion could bias estimates if siblings' gender has effects on longevity (which may be mediated through effects on personality

but also through other channels). We also excluded observations with age gaps to the relevant sibling of less than 9 months, as these could result from multiple births (e.g., twins) which would result in different family dynamics. For a similar reason, we also excluded people whose age gaps to their younger or older sibling exceeded six years—those siblings are potentially less likely to spend time with each other and might thus dilute any existing effects of siblings' gender. Our exclusion criteria remove 3,659 people over the age of 60 and 17,976 people who have sibling age gaps exceeding six years from our analyses. We additionally ran analyses without these two restrictions and results were virtually unchanged (see Tables S7.1-S7.3, S8.1-S8.3). In short, sample restrictions did not qualitatively affect our estimates.

We applied additional survey specific sample restrictions during data cleaning (e.g., excluding respondents reporting contradictory birth years, omitting respondents with unclear gender, excluding "siblings" who identify as being in a different relation to the sibling, such as cousins). In general, we did not identify whether siblings were biological as opposed to adopted or step-siblings, thus applying an inclusive definition of the term.

Statistical Analysis

We estimated the effect of having a younger sister (as opposed to a younger brother) for those who have a younger sibling (between 9,205 and 23,548 people depending on the trait and the respondents' gender, see Table S7) with the following empirical model:

$$Personality_{it} = \beta\, younger\ sister_i + \gamma' \boldsymbol{X}_{it} + u_{it}\,, \quad (1)$$

where $Personality_{it}$ is the personality trait of person *i* at time *t*; $younger\ sister_i$ is a dummy variable equaling 1 if the next younger sibling is female and 0 if the next younger sibling is male; $\boldsymbol{X}_{it}$ is a vector of control variables. These controls were added to account for the nested nature of

the data (i.e., multiple surveys and multiple survey waves), and to increase the precision of the estimation. Importantly, we did not include any controls that could be influenced by personality or the sibling's gender, meaning that these controls cannot induce any bias. We additionally report a robustness check without controls (Table S11). Controls included dummy variables for each combination of survey and wave (i.e., survey-wave fixed effects), as well as person *i*'s family composition (*prior* to the birth of the next younger sibling). Family composition represents all possible unique combinations of birth order (1st born, 2nd born, 3rd+ born), birth spacing to the next younger sibling (spacing <=2 years, spacing >2 years), and older siblings' gender (no older brothers or sisters, 1+ older sister & no older brother, 1+ older brother & no older sister, 1+ older sister & 1+ older brother). This model specification allows us to compare, for example, the risk tolerance of people with a next younger sister with those with a next younger brother, among those who took the same survey in the same wave, who have the same birth order, the same age spacing to their next younger sibling, and the same constellation of older siblings.

Additionally, $\boldsymbol{X}_{it}$ includes cubic polynomials of person *i*'s own age, cubic polynomials of the mother's and father's age at birth of person *i*, as well as dummy variables indicating whether the mother's or father's age was missing. We imputed mother's and father's age if values were missing or implausible (less than 10 years for mothers, less than 12 years for fathers) by taking the average age of those mothers and fathers whose ages we observed in a given survey and a given year. u_{it} is the error term.

Because we include personality measures of the same person in multiple years, we cluster our standard errors at the individual level (see Huang, 2016, for more on this alternative to

multilevel modeling). Our parameter of interest is β, which represents the causal effect of the next younger sibling being female (instead of male) on the next older sibling's traits.

Our empirical model for estimating the relationship between older siblings' gender and one's personality for those who have an older sibling (between 8,544 and 22,065 people depending on the trait and the respondents' gender, see Table S8) is analogous to the one estimating causal effects of siblings' gender shown above:

$$Personality_{it} = \alpha\ older\ sister_i\ +\ \mu' \boldsymbol{Z}_{it}\ +\ \varepsilon_{it}\ , \qquad (2)$$

where $Personality_{it}$ is the personality trait of person *i* at time *t*, $older\ sister_i$ is a dummy variable equaling 1 if the next older sibling is female and 0 if the next older sibling is male; $\boldsymbol{Z}_{it}$ is a vector of control variables. These controls again include survey-wave fixed effects, as well as family composition. Family composition represents all combinations of birth order and birth spacing to the next older sibling (see above); however, this specification does not include controls for older siblings' gender, which would be collinear with $older\ sister_i$. As above, $\boldsymbol{Z}_{it}$ includes cubic polynomials of person *i*'s own age, as well as mother's and father's (imputed) age at birth, and dummy variables indicating whether mother's and father's age was missing.

Analyses of the effects of the gender of the next younger or next older sibling rely on certain identifying assumptions. For the effects of the gender of the next younger sibling, we have to assume that people with a younger brother and those with a younger sister do not differ systematically in variables that are determined prior to sibling gender and that may affect personality (i.e., no confounders between sibling gender and personality). Likewise, for the effects of the gender of the next older sibling, we have to assume that people with an older brother do not systematically differ from people with an older sister. These assumptions could be

violated, for example, if there are differential survival rates or sex-selective abortions. To check the plausibility of our assumptions, we ran a number of balance checks, which confirmed that the compared groups (e.g., women with younger sisters vs. women with younger brothers) had similar pre-determined characteristics. Detailed results are reported in the Supplemental Material.

Robustness Checks and Analysis of Heterogeneity

For our central analyses of the effect of the gender of the next younger sibling, we ran a number of robustness checks and furthermore analyzed heterogeneity along a number of dimensions. Specifically, we tested whether the results changed if we did not control for any variables (Table S11); we tested whether limiting analyses to firstborns changed the results (Table S12); we limited the sample to firstborns with exactly one younger sibling (Table S13); we included controls for the total number of siblings, which is questionable from a causal inference perspective (Table S14); we reran analyses excluding data from three surveys in which we saw small gender imbalances (UKHLS, HILDA, MXFLS) or have concerns about sex-selective abortion (CFPS) (Table S15). We also investigated whether the effects of siblings' gender varied by year of birth, age of personality assessment, birth order position, or birth spacing. Detailed reports can be found in the Supplemental Material.

Investigating Dose-Response Relationships

The effects of sibling gender may "add up" across the whole sibship, in which case it may be instructive to look at the total number of sisters for people with the same total number of siblings, regardless of age. These comparisons do not necessarily identify the causal effect of having sisters (as opposed to brothers), but they help to fully describe any correlation between

sibling gender and personality. For this purpose, we plotted mean personality scores against the total number of sisters separately for people with one, two, three or four siblings in total (Figure S16).

Results

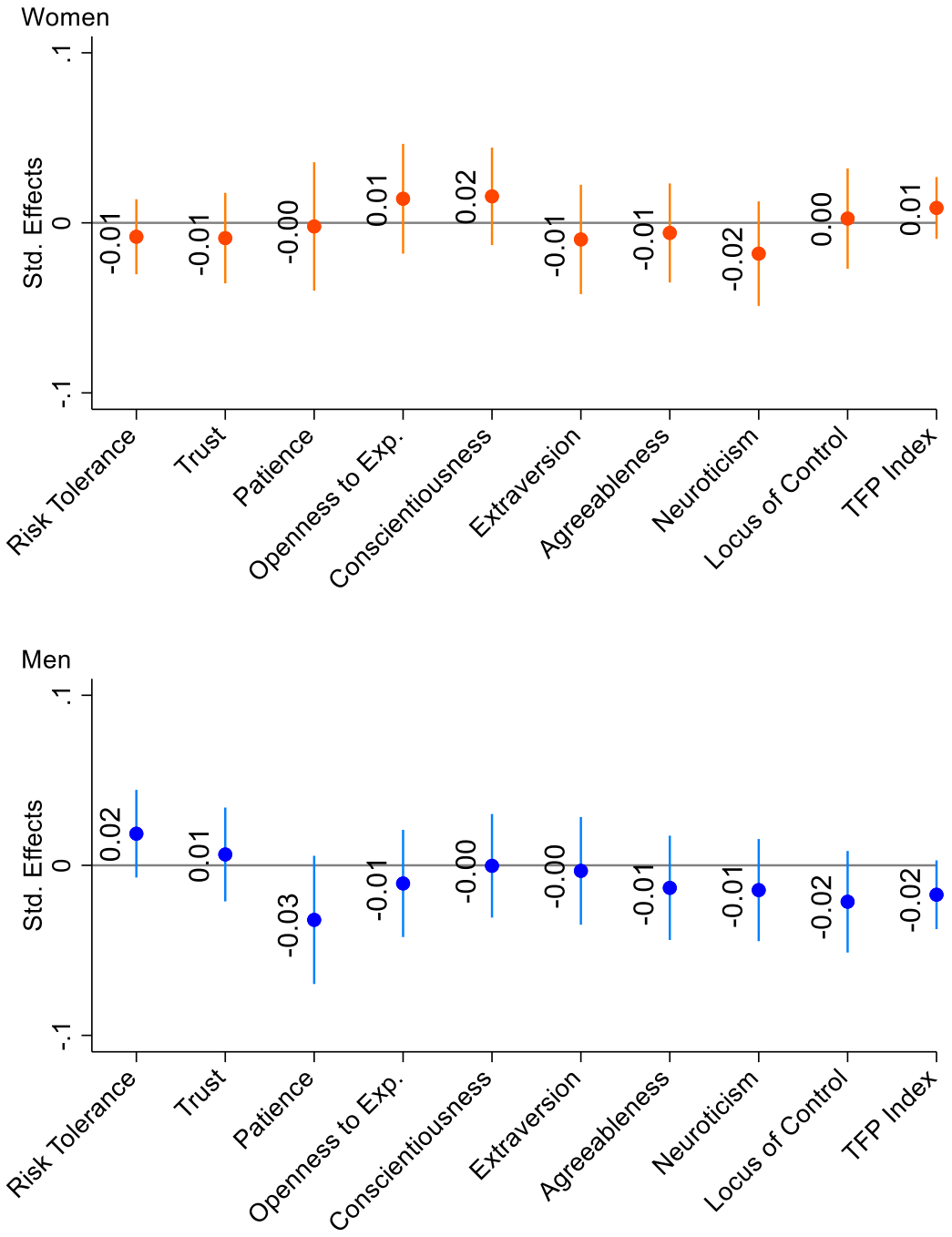
Across all surveys, we found that the gender of the next younger sibling has no meaningful effects on women's or men's personality (risk tolerance, trust, patience, openness to experience, conscientiousness, extraversion, agreeableness, neuroticism, locus of control, and our index of typical female personality, see Figure 1). All point estimates were statistically insignificant and lay within a narrow range between -0.03 and 0.02 *SD*. Furthermore, 95% confidence intervals allowed us to rule out effect sizes larger than 0.08 *SD* in absolute terms. The use of our combined measure of typical female personality allowed us to test the two competing theoretical predictions (social learning and sibling differentiation), and we were able to rule out effects larger than 0.04 *SD*. For comparison, studies on birth order effects on cognitive ability in Western countries have reported declines more than twice as large in magnitude from firstborns to laterborns (e.g., Rohrer et al., 2015), and these effects are conventionally interpreted as small.

Some simple back of the envelope calculations considering potential downstream consequences may also help put the magnitude of these findings into perspective. Almlund et al. (2011) report that a one *SD* increase in locus of control is associated with an up to 6.8 percentage point increase in the probability of graduating from high school. If we assume that this estimate represents a causal effect and naively combine it with an effect of sibling gender on locus of control of 0.03 *SD* for women (the upper, more extreme boundary of the 95% confidence interval in our analyses, Table S7), we conclude that, for women, having a younger sister (as opposed to a younger brother) leads to a 0.20 percentage point increase in the probability of graduation

mediated via locus of control. To take another example in which we assume an extreme effect of personality on an outcome, Soto (2019) reports a correlation of .45 between extraversion and leadership. If we assume that this correlation can be fully attributed to a causal effect of 0.45 *SD* in leadership per *SD* of extraversion, and combine it with an effect of sibling gender on extraversion of -0.04 SD for either men or women (the lower, more extreme boundary of both corresponding 95% confidence intervals, Table S7), we would conclude that having a younger sister (as opposed to a younger brother) leads to a change of -0.02 *SD* in leadership mediated via extraversion. Thus, even assuming that personality is highly consequential, the possible effects of sibling gender on personality that our estimates suggest would have fairly small consequences.

Figure 1

Effect of Having a Next Younger Sister (as Opposed to an Older Brother) on the Older Sibling's Personality



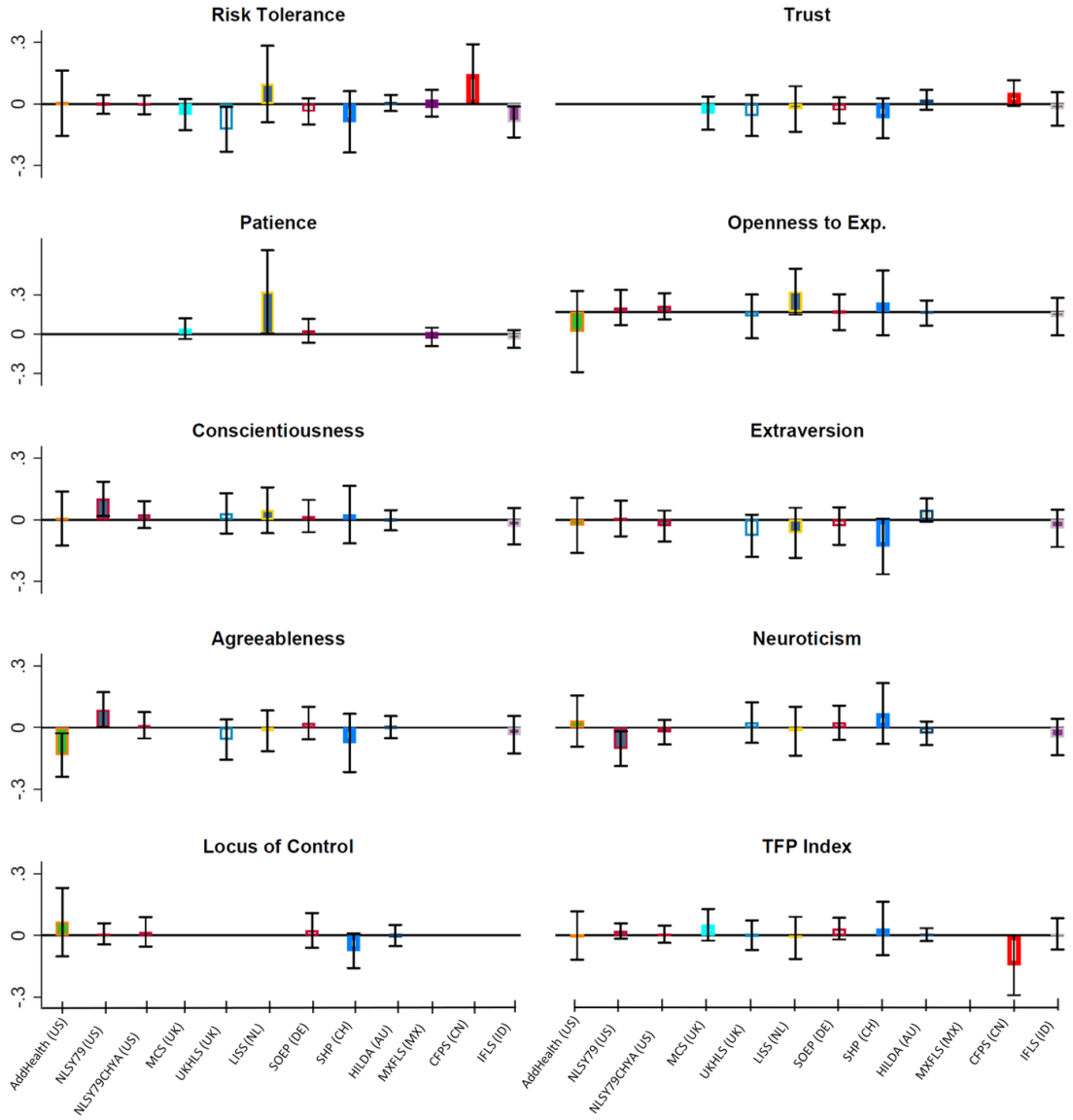
Note. Error bars indicate 95% confidence intervals based on standard errors clustered at the individual level. For underlying regression estimates, see Table S7.

The overall pattern survived all robustness checks and all difference in point estimates were small. We found no meaningful heterogeneity by year of birth (Figures S8-S9), age (Figures S10-S11), birth order position (Figures S12-S13), or birth spacing (Fig. S14-S15).

Combining all 12 surveys may hide important differences between different cultural settings. We thus re-ran analyses for each survey separately. Figure 2 and Figure 3 show no systematic heterogeneity across surveys. As expected by chance alone when estimating 174 separate regressions, some estimates were statistically significant when considered in isolation. However, none of these estimates reached a more stringent cut-off of $p < .005$, which has been recommended as a safeguard against high rates of false positive findings in the literature (Benjamin et al., 2018). We additionally checked whether any single study was statistically significant for any particular construct when accepting a false discovery rate of .05 (Benjamini & Hochberg, 1995). This was not the case (see OSF for implementation of the procedure).

Figure 2

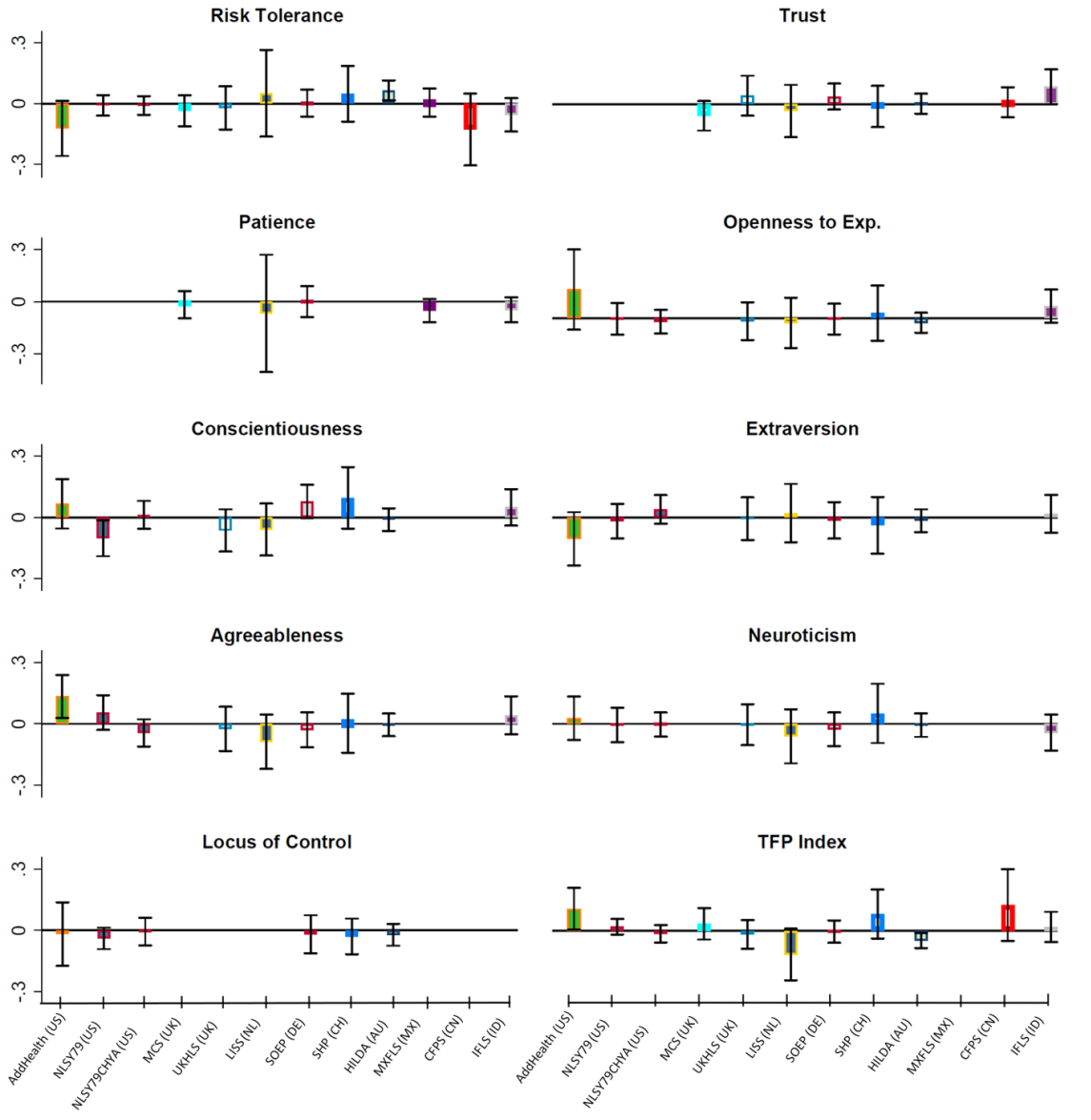
Effect of Having a Next Younger Sister on Women's Personality by Survey.



Note. Error bars indicate 95% confidence intervals based on standard errors clustered at the individual level. For underlying regression estimates, see Tables S9.01-S9.10.

Figure 3

Effect of Having a Next Younger Sister on Men's Personality by Survey.



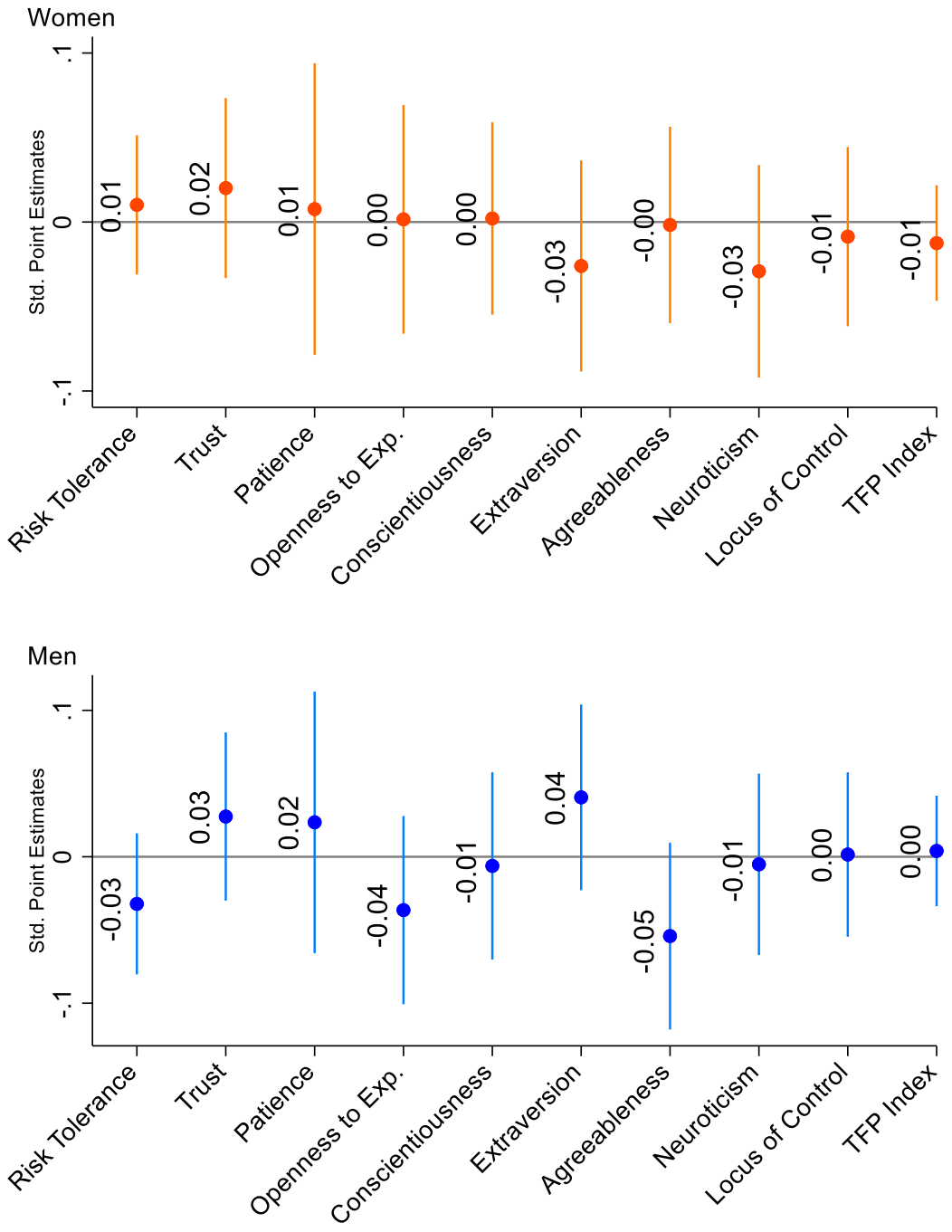
Note. Error bars indicate 95% confidence intervals based on standard errors clustered at the individual level. For underlying regression estimates, see Tables S10.01-S10.10.

Considering the gender of the next older sibling, we found no meaningful correlations with personality (Figure 4). Point estimates ranged from -0.05 *SD* to +0.04 *SD*, and none of them were statistically significant; 95% confidence intervals allowed us to rule out effect sizes larger than 0.12 *SD* in absolute terms. Considering the combined measure of typical female personality, we were able to rule out effects larger than 0.05 *SD* in absolute terms. The absence of a meaningful correlation was not driven by offsetting correlations in different surveys (see Figures S6-S7). While it is in principle possible that these correlations might be biased in a manner that hides meaningful causal effects, it is implausible that such a bias would lead to offsetting effects which lead to the null-effects for all ten outcomes across both genders. As we saw little evidence for selection bias, we interpret these results as evidence that the gender of one's older sibling does not have broad and meaningful effects on personality.

Lastly, what if we compare people based on the number of sisters in total (i.e., combining younger and older siblings)? Visual inspection of mean personality scores by the number of sisters, split by total number of siblings, also did not reveal any systematic pattern (see Figure S16).

Figure 4

Correlation Between the Next Older Sibling Being a Sister and the Younger Sibling's Personality



Note. Error bars indicate 95% confidence intervals based on standard errors clustered at the individual level. For underlying regression estimates, see Table S8.

Discussion

Overall, we conclude that siblings' gender does not meaningfully affect personality. While data came from only nine countries (with a predominance on Western countries), the consistently small associations challenge the notion that any type of universal, gendered sibship dynamics affect personality. This conclusion also aligns with recent findings suggesting that one's ordinal position among siblings does not meaningfully affect personality (Botzet et al., 2020; Damian & Roberts, 2015a; Lejarraga et al., 2019; Rohrer et al., 2015; Rohrer et al., 2017). Of course, it is possible that the effects of siblings' gender and birth-order position are even more subtle and thus not detectable even when investigating very large samples. This interpretation would align with recent suggestions that environmental influences, just like genetic influences, may be driven by thousands of factors, each with *very* small effect sizes (von Stumm & d'Apice, 2021). However, taking findings from behavioral genetics into account, it seems like these environmental causes are more likely to be found outside of the family environment (Vukasović & Bratko, 2015; Briley & Tucker-Drob, 2014).

It is also possible that the proposed mechanisms of both social learning and sibling differentiation theory apply in varying degrees in different families, resulting in average effects that net out at zero, but which may occasionally "show up" in individual studies as significant effects. However, this account does not provide the most parsimonious explanation for discrepancies between our study and the past literature on the topic. Given inconsistent methodologies and small sample sizes, it seems reasonable that at least some of the incoherence can be attributed to publication bias (Ioannidis, 2005), which can result in a "continuous stream

of conflicting results" (Damian & Roberts, 2015b). Furthermore, both social learning and sibling differentiation suggest that the effects of siblings' gender are mediated through siblings' personality—but the link between gender and personality is only of medium strength in the first place, even when using an index designed to maximize differences. Thus, large effects of sibling gender may be implausible to begin with.

Lastly, sibling gender may not affect the widely used broad personality measures we investigated, but recent economic research suggests that it *does* affect important life outcomes. Findings suggest that brothers decrease women's labor earnings, and that this may be partly driven by increased traditional family attitudes (Brenøe, 2021; Cools & Patacchini, 2019; Rao & Chatterjee, 2018). Investigating the specific mechanisms behind this brother earnings' penalty—whether they are psychological, sociological, or economic in nature—seems a worthwhile research endeavor. Our findings suggest that personality differences do *not* play a major part in this story.

Open Practice Statement

We analyzed survey data that are not under our direct control; requests to access the data should be directed to the respective data-holding institutions. Analysis scripts are provided at https://osf.io/yznq6.

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