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2020

Document Version:
Other version

Link to publication

Citation for published version (APA):
Ericsson, S. (2020). *Cultural Gender Norms and Neighbourhood Exposure: Impacts on the Gender Gap in Math*. (Working papers; No. 2020:6).

Total number of authors:
1

Working Paper 2020:6

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Cultural Gender Norms and Neighbourhood Exposure: Impacts on the Gender Gap in Math

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April 2020

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Cultural Norms and Neighbourhood Exposure: Impacts on the Gender Gap in Math☆

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April 15, 2020

Abstract

This paper investigates the interaction between cultural norms and neighbourhood characteristics. I estimate the effect of cultural gender norms on the gender gap in math, and explore whether this effect is mitigated by municipality gender equality. I use high-quality Swedish administrative data on the results of national standardised math tests. To separate the effect of cultural gender norms from formal institutions, I estimate the effect of mothers' source-country gender norms on the gender gap in math for second-generation immigrants. By contrasting the outcomes of opposite-sex siblings, I show that the sibling gender gap in math increases with mothers' adherence to traditional gender norms; such that girls with more gender-traditional mothers perform worse relative to their brothers. To investigate whether the cultural gender norm effect can be mitigated by municipality gender equality, I exploit a refugee placement policy to obtain random variation in municipality characteristics. I show that municipality gender equality can almost completely mitigate the negative cultural norm effect. Taken together, my results imply that while cultural gender norms play an important role for the gender gap in math, they are not immune to the effects of neighbourhood exposure.

Keywords: cultural gender norms, math gender gap, epidemiological approach, refugee placement policy, sibling fixed effects
JEL codes: I21, I24, J15, J16, Z13

☆I would like to thank my advisers, Petter Lundborg and Therese Nilsson, for their support and helpful insight during the process of writing this paper. I also thank Nùria Rodrìguez-Planas, the conference participants at Lund University, Copenhagen University, IFN and the Linneaus University for their useful comments. The data used in this paper comes from the Swedish Interdisciplinary Panel (SIP), administered by the Centre for Economic Demography, Lund University, Sweden. Corresponding author: Sanna Ericsson (sanna.ericsson@nek.lu.se).

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1. Introduction

Girls and boys differ in terms of their educational achievement. In most cases, a gender gap in education implies one that favours girls, as girls outperform boys along most educational dimensions (DiPrete and Buchmann, 2013). However, one exception is math. Girls systematically perform worse than boys on math tests, particularly at the top of the performance distribution (Bedard and Cho, 2010; Pope and Sydnor, 2010). The gender gap in math has been shown to correlate strongly with gender equality and norms regarding women's role in society, which suggests that social forces may, at least in part, be driving the differential performance of boys and girls (Guiso et al., 2008; Pope and Sydnor, 2010; Nollenberger et al., 2016).[1] In addition, Rodríguez-Planas and Nollenberger (2018) show that this relationship is not driven by math-specific norms, but rather, by general gender stereotypes about girls and educational outcomes.

One channel through which norms could affect educational outcomes is the formation of identities. Norms shape our expectations regarding the social group we identify with, which in turn affect our beliefs of what we are capable of, and our preferences for what we spend time on. Akerlof and Kranton (2000) develop a theoretical framework in which individuals choose to identify with different social categories, and derive utility from complying with the behaviour prescribed by these chosen categories.[2] In this framework, as well as in empirical studies testing its implications, identity concerns have a significant impact on educational outcomes (Akerlof and Kranton, 2002; Schüller, 2015).

But from where do we perceive the norms that, through identity formation, shape our behaviour and impact our economic outcomes? Several studies find that culture and historical traditions have a significant impact on both the attitudes and the economic outcomes of individuals today (see e.g. Fernández, 2011; Alesina et al., 2013; Nollenberger et al., 2016; Finseraas and Kotsadam, 2017; Rodríguez-Planas and Nollenberger, 2018; Dahl et al., 2020), which demonstrates that cultural norms are important determinants of our behaviour. However, another strand of the lit-

[1] Geographical variation in the math gender gap indicates that it is not driven solely by innate ability differences between boys and girls (Bedard and Cho, 2010). In addition, the gender gap in math does not exist at the point of school entry, but rather emerges over time when children are socialized into school (Fryer Jr and Levitt, 2010).

[2] One salient category is gender, where everyone is assigned to either being a "man" or a "woman", and where there are prescribed attributes and behaviours that are considered "manly" or "womanly". This way, gender identity changes the pay-off of different actions, and the choice of identity may impact our economic outcomes, including educational performance.

erature documents significant behavioural impacts of neighbourhood exposure and peer effects (see e.g. Chetty et al., 2016; Chetty and Hendren, 2018; Dahl et al., 2014; Olivetti et al., 2018), which indicates that our on-going exposure to institutions, peers, and other surrounding factors may also be an important determinant of our behaviour.[3] Taken together, a large literature shows that both family culture and neighbourhood characteristics affect our economic, including educational, outcomes. It is likely that these two channels do not operate independently of each other, however, there is limited empirical evidence combining the two channels.

This paper investigates the interaction between cultural norms and neighbourhood characteristics, in the context of their impact on the gender gap in math. Specifically, I ask two research questions: first, is there an effect of cultural gender norms on the gender gap in math, and second, to what extent can this effect be mitigated by surrounding neighbourhood gender equality? This way, I explore the effect of cultural norms on individuals' behaviour (measured by their educational outcomes), and I investigate how this effect interacts with exposure to neighbourhood characteristics and peers.

There are two main empirical challenges associated with estimating the effect of cultural gender norms. First, norms are correlated with institutional settings, which likely have an impact on educational outcomes. Second, parent's cultural norms are not randomly assigned, but instead are likely correlated with other parental characteristics that affect the educational outcomes of their children. Therefore, to answer the first research question, it is crucial to disentangle the impact of cultural norms from the impact of both formal institutions and of parental characteristics.

To isolate cultural gender norms from formal institutions, I estimate the effect of gender norms in mothers' countries of origin on the gender gap in math among second-generation immigrants. Second-generation immigrants, in this context, are all born and raised in Sweden and encounter the same formal institutions but potentially differ in their cultural heritage. Assuming that mothers transmit norms to

[3]See Kranton (2016) for more examples of determinants of identify formation. The distinction between cultural values and neighbourhood exposure is similar to the framework developed by Bisin and Verdier (2011), who contrast vertical and horizontal transmission of norms. Vertically transmission of norms occurs within the family, from parents to children, and happens if parents believe that their children will benefit from certain cultural traits. Horizontal transmission denotes the socialisation of norms that takes place within a community context, where norms are transmitted from peers and surroundings. However, the culture/neighbourhood distinction noted above is broader compared to that of Bisin and Verdier (2011), as the cultural (i.e. "vertical") channel includes also parents' peers and networks (sharing the same cultural beliefs), and the neighbourhood (i.e. "horizontal") channel includes not only the effect of norms, but also that of more formal institutions.

their children, and that these norms differ systematically depending on the mother's source country, second-generation immigrants provide the ideal experiment to isolate the effect of cultural norms from the effect of formal institutions.[4]

To account for the fact that gender norms are not randomly assigned to mothers, and therefore likely correlate with unobserved maternal characteristics, I follow Finseraas and Kotsadam (2017) and compare the gender gap in math only between opposite-sex siblings in a sibling fixed effects model. The sibling fixed effects control for everything that affects both siblings equally, including everything that correlates with source-country norms but that is unrelated to gender. By construction, the variation that remains is the *gender-specific* component of the cultural norms that affects opposite-sex siblings differently, i.e. gender norms.

To answer the second research question, I investigate the extent to which the cultural gender norm effect can be mitigated by municipality gender equality. The main empirical challenge of estimating the effect of neighbourhood characteristics is that there is selection in where people choose to live. Families will choose to reside in places that have certain desirable characteristics, and, in doing so, they themselves contribute to these characteristics. To account for this selection, as well as to obtain exogenous variation in municipality characteristics, I exploit a refugee placement policy. Under this policy, government officials assigned asylum-seeking immigrants their initial location of residence. As these immigrants were not free to chose where they would be placed, their initial location of residence is independent of unobserved individual characteristics.

I rely on high-quality Swedish administrative data on the universe of ninth-grade students who took the national standardised math test between 2004–2012. To proxy cultural gender norms and neighbourhood gender equality, I use female-over-male labour force participation rates, of both the immigrant mother's source country and of her assigned municipality of residence.

I show that mothers' cultural gender norms increase the sibling gender gap in math, such that girls with more gender-traditional mothers perform worse relative to their brothers. A one-standard-deviation increase in cultural gender norms (i.e. towards more traditional norms) increases the size of the math gender gap by 56%, in favour of boys. In addition, I find similar effects for final marks in other school subjects, which shows that the results are not driven by math-specific cul-

[4]This method, refereed to as the epidemiological approach, aims to identify the effect of culture through variation in outcomes among individuals who share economic and formal institutions, but who potentially differ in their social beliefs (see e.g. Fernández, 2011).

tural norms, but rather by general gender stereotypes about girls and educational outcomes.

However, I also show that municipality gender equality can almost completely mitigate the negative cultural gender norm effect. This result suggests that even though the sibling gender gap in math increases with mothers' adherence to traditional gender norms, this increase is smaller for siblings whose mothers were placed in more gender-equal municipalities. Taken together, my results show that while cultural gender norms play an important role for the gender gap in math, they are not immune to the influence of surrounding characteristics.

The first research question of my study relates to the growing body of literature on gender norms and educational outcomes.[5] Several studies show that girls' relative educational performance correlates positively with gender equality, both across countries and US states (Guiso et al., 2008; Fryer Jr and Levitt, 2010; Pope and Sydnor, 2010). One important issue here is the risk of reverse causality, as these studies cannot determine whether girls perform better because of increased gender equality or whether high-performing girls grow up to themselves contribute to increased gender equality. Nollenberger et al. (2016) and Rodríguez-Planas and Nollenberger (2018) account for this reverse causality, as they estimate the effect of mothers' cultural gender norms on the gender gap in math, reading and science, by using PISA data on the test scores of second-generation immigrants. The authors find that the educational gender gaps between boys and girls vary with mothers' cultural gender norms, such that girls with more gender-traditional mothers perform worse in all three subjects relative to boys with mothers from the same source country.

Dossi et al. (2019) show that girls who grow up in families that exhibit a preference for boys perform worse on standardised math tests, when compared to girls growing up in other families. Furthermore, the authors use survey data to show that mothers' attitudes regarding women's role in society correlate with girls' performance in mathematics, but not with boys'. Dahl et al. (2020) show that birthright citizenship for immigrant girls lowers their life satisfaction and self-esteem, a result they argue is due to the conflicting identities of German citizenship and parents' traditional cultural norms. They do not find the same effect for boys, which indi-

[5] In addition, my paper contributes to the literature on the effects of source country culture. Using the standard epidemiological approach, studies show that source country culture affects gender roles, women's work and fertility, social trust, political regulation, domestic violence, corruption, migration etc. See Fernández (2011) for a literature review.

cates that girls are pushed comparatively harder by their parents to conform with traditional gender norms, whereas boys are allowed to take advantage of the citizenship opportunities. Finally, using an estimation strategy similar to mine, Aldén and Neuman (2019) show that cultural gender norms affect the probability of girls choosing STEM, or other male-dominated fields, as their major in high school or university.[6]

The second research question of my study relates to the literature on the effects of neighbourhood characteristics on children's educational outcomes. Two well-identified papers by Chetty et al. (2016) and Chetty and Hendren (2018) show that neighbourhoods shape children's earnings, college attendance rates, marriage and fertility patterns, and that the effect increases linearly with time of exposure. In addition, they show that boys and girls are affected differently in neighbourhoods that are particularly beneficial for either gender.[7] Damm and Dustmann (2014) exploit random variation in neighbourhood exposure, caused by a refugee placement policy in Denmark, to show that children who were placed in high-crime neighbourhoods are more likely to themselves commit crimes. They find that social interaction is the key channel through which this neighbourhood exposure effect operates.

My study also relates to the literature on peer effects, where several papers show that the behaviour of peers affect individuals' economic outcomes, such as labour market decisions (Maurin and Moschion, 2009; Dahl et al., 2014; Olivetti et al., 2018). Finally, my study contributes to the literature that use the Swedish refugee placement policy to evaluate neighbourhood exposure effects, such as, for example, Edin et al. (2003) who show that living in ethnic enclaves improves immigrants' labour market outcomes, and Åslund et al. (2011) who show that immigrants' school performance is increasing with the number of highly educated individuals of shared ethnicity residing in the same neighbourhood.

To the best of my knowledge, my study is the first to estimate the interaction between neighbourhood characteristics and cultural norms. Thus, a novel and im-

[6]Unrelated to gender norms, but related to the gender gap in educational outcomes, Figlio et al. (2019) show that family disadvantage is disproportionally detrimental to the educational outcomes of boys relative to girls, and that this result is robust to specifications within neighbourhoods, schools and families.

[7]Chetty et al. (2016) estimate the effect of neighbourhood exposure using variation caused by the Moving To Opportunity experiment. They find that only children who moved when young experience positive effects of moving to a low-poverty neighbourhood. Chetty and Hendren (2018) exploit variation in age of children when families move, finding that the outcomes of children who move converge towards the outcomes of the people in the new neighbourhood at a rate of 4% per year of exposure. Furthermore, they show that neighbourhoods matter because of differences in childhood environment rather than because of differences in labour market conditions.

portant contribution of my paper is that I merge the literatures on cultural norms, neighbourhood exposure and educational outcomes. Moreover, my paper is also the first to establish a causal link between cultural gender norms and the gender gap in math. Because my study focuses on the gender gap between opposite-sex siblings, I am able to control for many potentially worrisome causes of variation that previous papers have not been able to control for, which allows me to more credibly isolate the effect of cultural gender norms.

The remainder of the paper is organised as follows. Section 2 provides some institutional background on the Swedish marking system and the refugee placement policy. Section 3 describes the data, after which Section 4 outlines the empirical strategy. Section 5 presents the results for both research questions, and further investigates heterogeneous effects and alternative outcomes. Section 6 ensures that my results are robust. Finally, Section 7 concludes this paper.

2. Institutional background

2.1. The Swedish marking system and the national standardised tests

Ninth grade is the last year of mandatory schooling in Sweden, and students at this level are between 15 and 16 years old. Students take 16 different subjects and receive a final mark for each subject. Marks are goal-oriented and not relative. The marks during this time period are IG (fail), G (pass), VG (pass with distinction) and MVG (pass with special distinction), which correspond to 0, 10, 15 and 20 points, all of which count towards the final total mark. The final total mark is the sum of all subject marks, with a maximum of 320 points.

The national standardised tests are issued in math, Swedish, English, social science and natural science. These tests, which students take during the spring semester of the ninth grade, are nationally standardised and mandatory for all students. The tests are developed to give all students an equal opportunity to demonstrate their knowledge, and act as means of supporting the teacher in making marking more fair. Students receive a mark on each subject test, which weigh heavily on the final mark for that subject.

The national standardised test in math consists of about 40 'pass-level' questions and about 35 'pass with distinction-level' questions. Students receive a test result, which is the sum of all correctly answered questions on each level, and an overall mark for the test. One significant benefit of using the math test score as the outcome variable is that it contains more, and continuous, variation than the final marks, which can only take one of four values.

2.2. The Swedish refugee placement policy

The refugee placement policy was introduced in 1985 and lasted until 1994. Its aim was to relieve pressure on the larger cities in times of large refugee inflows. By placing the asylum seekers in those municipalities with the most suitable reception characteristics, the government hoped to speed up the integration process.[8]

During the policy period the Immigration Board assigned asylum seekers their initial municipality of residence. Initially 60 municipalities participated in the policy, but due to the increased inflow of asylum seekers during the late 1980's the number of municipalities involved increased until 277 of the total 284 municipalities were participating. The strictest application of the policy was implemented during 1987 to 1991, when the assignment rate was almost 90% and the asylum seekers had very little ability to influence where they were assigned. For this reason, I focus my analysis on the refugees who arrived during the period 1987–1991.

The asylum seekers were placed in refugee centres while they waited for a decision from the immigration authorities. Mean duration before receiving a residence permit was between three and twelve months. While the assignment process did take the asylum seekers' preferences into account, most applied for residence in Stockholm, Gothenburg or Malmö. The Swedish housing market was booming at the time, and housing opportunities in these locations were very scarce; in practice this meant that the immigrants had very little influence over their placement.

When the number of applicants exceeded the number of available slots, municipal officers had the opportunity to choose which asylum seekers would be offered a residence permit. However, all selection was based on observable characteristics, as there was no interaction between the asylum seekers and the municipal officers. Priority was given to individuals who had attained higher education and to those who spoke the language as some of the residing immigrants. Furthermore, housing availability was dependent on family size. Edin et al. (2003) argues that municipality assignment can be viewed as random, conditional on observable immigrant characteristics.

However, Nekby and Pettersson-Lidbom (2017) identify some important empirical challenges regarding the use of the refugee placement policy as a proxy for

[8] The information in this section is obtained from Edin et al. (2003) and Åslund et al. (2011), who in turn base their information regarding the practical implementation of the policy on interviews with Immigration Board placement officials.

random placement. They argue that the municipalities had more to say in the placement process than what had been previously understood. Refugees could not be placed without consent from the municipality, and the placement within a municipality was carried out by local municipality immigration agencies. For example, the municipality of Bollnäs did not place immigrants in the first available apartment, but rather, waited until housing opened up in areas with few social problems. These types of decisions were not nationally standardised and could differ sharply between municipalities. As a result, there is a risk that municipality characteristics may correlate with placement and subsequent treatment, and therefore also with the outcomes of the asylum seekers. I address these empirical challenges in Section 4.2.

Following initial assignment, there were no restrictions on moving to a different location, provided that the immigrants themselves could find housing. Leaving the assigned municipality did not affect the welfare payments; the main cost of moving was delayed enrolment in Swedish courses.

3. Data

I rely on data from The Swedish Interdisciplinary Panel, which is administered by the Centre for Economic Demography. This is a two-generational dataset consisting of merged administrative registers. Using unique parental identifiers, I identify the parents and siblings of each individual in the data. The data contain information on the national standardised test results from years 2004–2012. Students take the tests when they are 16 years old; thus, my study contains cohorts born between 1987 and 1996. I restrict my sample to second-generation immigrants, which I define as individuals born in Sweden whose mothers were born in another country.[9]

Table 1 presents the summary statistics for three sample specifications: the total population of students taking the national standardised math test (1), the sample used for the first research question (henceforth the RQ1 sample) (2), the sample used for the second research question (henceforth the RQ2 sample) (3). The sample in column (1) acts merely as a reference point for the other two samples.

[9] As a robustness check I use a sample of second-generation immigrants defined by having a foreign-born father; the results can be found in Appendix Tables A4–A6.

3.1. Sample restrictions for RQ1

As my empirical strategy is based on comparisons between opposite-sex siblings, I implicitly restrict my sample to only families who have at least one child of each gender. I match each child to all of their biological opposite-sex siblings. This means that an individual with more than one opposite-sex sibling will be observed more than once in the data. All siblings are required to be born in Sweden and share both biological parents.[10]

I observe the source country for mothers born in 20 different countries, Sweden excluded.[11] Column (4) of Table 2 lists the frequency of children with mothers born in the various source countries of my sample. As I define a child as a second-generation immigrant based on their mother's country of birth, the children of my sample all have mothers born in one of the 20 foreign countries I can observe, but their fathers, however, can be missing from the data or born anywhere, including Sweden or one of the unobserved foreign countries. In total, 51% of the children have parents born in the same foreign country, and 78% of those with parents from different countries have a father born in Sweden.

Column (2) of Table 1 presents the summary statistics for this sample of second-generation immigrants. There are 24,632 observations, consisting of 12,316 unique sibling pairs. Compared to the full population of ninth grade students in column (1), the second-generation immigrants receive lower final marks and score lower on the math tests. In addition, they are more likely to live in households with below-median income, their parents have less education, and, by construction, their family size is larger than the national average.

3.2. Sample restrictions for RQ2

To answer the second research question, I impose additional sample restrictions, which creates a subset of the sample for the first research question. I require mothers to have immigrated to Sweden sometime between 1987–1991, the years in which the refugee placement policy was active. Unfortunately I cannot observe refugee status directly, but, following Edin et al. (2003) and Åslund et al. (2011), I assign refugee status using country of birth. The Swedish Migration Board lists the countries from

[10] For some children I do not have any information on the identity of the father; if that is the case, I compare the siblings who all have the same mother and a missing father.

[11] For reasons of anonymity, countries from which Sweden received few immigrants are aggregated up to regions by Statistics Sweden. To be a part of my final sample, the mother must have been born in a country I can identify in the data.

which Sweden received asylum seekers between 1984–1999 (Migrationsverket, 1999). Anyone immigrating from one of the countries mentioned in this list is defined as an asylum seeker in my sample. I exclude mothers whose spouses immigrated before them, as family immigrants were not subjected to the placement reform. This definition of refugee status leaves me with 10 different source countries. Column (5) of Table 2 shows the frequency of children with mothers coming from these countries as asylum seekers. In total, 80% of the children in this sub-sample have parents born in the same foreign country, and 35% of those with parents from different countries have a father born in Sweden.

Column (3) of Table 1 presents the summary statistics for the children whose mothers were subjected to the refugee placement policy. The total number of observations is 3,926, comprising 1,963 unique sibling pairs. Compared to the full population of ninth grade students in column (1), and to the second-generation sample in column (2), the children with mothers affected by the refugee placement policy receive lower final marks and math scores. Their parents have lower education levels and household income, and they immigrated from source countries with more traditional gender norms.

3.3. Dependent variable: standardized math test score

The main outcome variable is students' test scores on the national standardised math test. The raw test scores range between 0 to 75; about 40 of these are pass-level points and about 35 are pass with distinction-level points. As the tests differ slightly over the years, I standardise the scores by year to obtain a mean of zero and a standard deviation of one.[12]

Figure 1 illustrates the average gender gap in math (defined as girls' scores - boys' scores) for each year of my study. The top panel contains the RQ1 sample of second-generation siblings, while the bottom panel contains the RQ2 sample of second-generation siblings whose mothers were affected by the placement policy. For both samples, girls' test scores are about 7% of a standard deviation lower than boys' test scores, which is stable over the years.

[12] I standardise test scores for each sub-sample separately.

3.4. Independent variable: cultural gender norms

I proxy the source-country gender norms using female-to-male labour force participation ratios, defined in in the following way:

$$FLFP_c = \frac{FemaleLFP_c}{MaleLFP_c} \quad (1)$$

This way, I only measure the relative labour market changes for women as compared to men, and account for any general labour market shifts that affect men and women equally. The measure varies only by source-country c. I use modelled ILO estimates from the World Bank Indicators Database (World Bank, 2019). I construct an average of the female-to-male labour force participation ratios over the years 1990–1993, in order to avoid capturing temporary fluctuations.

It is not obvious when in time I should measure labour force participation rates in order to best reflect mothers' current norms. On the one hand, norms measured at the time when the mother emigrated from her source country may best capture the norms she carries with her. On the other hand, norms measured around the birth of the second generation may be a better proxy for the norms transmitted from the first to the second generation. Due to data availability, my earliest consistent measure of labour force participation is from 1990 and onwards, which corresponds to around the time of the second generation's birth (as well as the time of emigration for the asylum-seeking mothers). This way, I follow common practice in the literature to measure fairly contemporary norms (Fernandez and Fogli, 2009; Rodríguez-Planas and Nollenberger, 2018; Finseraas and Kotsadam, 2017). However, as a robustness check, I obtain earlier data from the International Labour Organisation's ILOSTAT Database for a subset of source countries where this is possible (ILO, 2019). I construct a measure of source-country norms that varies by decade of immigration and show that my results are not sensitive to the time at which norms are measured.

I define the source-country gender norms as $1 - FLFP$, such that the measure increases as the source-country female-to-male labour force participation ratio decreases; thus, the measure increases as gender norms become more traditional. The main benefit of using female-to-male labour force participation ratios to proxy source-country gender norms is that data on gender-specific labour force participation is consistently available both at the source-country level and for Swedish municipalities at time of immigration.

The purpose of the $1 - FLFP$ proxy is to capture variation that reflects source-country norms regarding the relative importance of boys' and girls' educational achievements. For this reason, I test the correlation between the $1 - FLFP$ proxy and the source-country level of agreement with the statement *"A university education is more important for a boy than for a girl."*, derived from the World Values Survey. Figure 2 presents the correlation, which is positive and strong, indicating that $1 - FLFP$ is a relevant proxy for source-country norms regarding gender and educational outcomes.[13]

Table 2 presents the average $1 - FLFP$, the level of agreement with the statement *"A university education is more important for a boy than for a girl."* from the World Values Survey, and the score on the World Economic Forum Gender Gap Index (GGI), for each source country in my study.[14]

3.5. Independent variable: municipality gender equality

To investigate the mitigation of traditional cultural gender norms by neighbourhood characteristics, I derive a measure of municipality-level gender equality. I proxy municipality gender equality with a similar measure of female-to-male labour force participation ratios as for the source countries:

$$FLFP_{mt} = \frac{FemaleLFP_{mt}}{MaleLFP_{mt}} \tag{2}$$

The measure varies with assigned municipality m and year of immigration t. I obtain information on gender-specific labour force participation rates from the Statistics Sweden Labour Statistics Database (SCB, 2019). To make the mitigation estimates of my study easier to interpret, I define this neighbourhood measure to work in the opposite direction of the cultural norm measure. For this reason, I define the municipality gender equality proxy as $FLFP$, such that it increases as the female-to-male labour force participation ratio increases. I measure municipality gender equality at the time of immigration and within the assigned municipality, as this is the only time it can be assumed to be exogenously given.

[13]The correlation coefficient is 0.89. Excluding Iran and Iraq decreases the correlation to 0.71, but does not alter my results.

[14]The GGI is commonly used in studies similar to mine. In a robustness check, I define the source-country norms as $1 - GGI$ and ensure that my results are robust to this specification. I derive the source-country GGI score from the World Economic Forum Global Gender Gap report of 2011 (WEF, 2011), as this is the year in which the most of the source countries of my study are included in the report.

4. Empirical strategy

4.1. Do cultural gender norms affect the math gender gap?

To investigate the effect of cultural norms, it is necessary to disentangle the effects of culture from the effect of formal institutions. To do so, I rely on an extended version of the epidemiological approach. The epidemiological approach aims to identify the effect of culture by examining variation in outcomes among individuals who share formal and economic institutions, but who potentially differ in their social beliefs (Fernandez, 2007; Fernandez and Fogli, 2009; Fernández, 2011). Second-generation immigrants provide a useful experimental cohort for such a study. The assumptions behind this strategy are that 1) mothers transmit cultural beliefs to their children, 2) these cultural beliefs vary in a systematic way that reflects the culture of the mother's source country, and 3) individuals growing up in the same country encounter similar economic and formal institutions.

In an ideal experimental setup mothers' cultural norms would be randomly assigned, such that the gender norms are orthogonal to everything unobserved that relates to the childhood environment. Unfortunately, such ideal setups are hard to come by, and a significant drawback of the epidemiological approach is that it cannot account for unobserved factors that may also vary in a systematic way by mothers' source country. For example, different immigrant groups may have different reasons for migrating, they may be more or less likely to live in ethnic enclaves, and they may face different levels and types of discrimination in the migrant country. In addition, family structure may be endogenous to the sex of children, as suggested by Dahl and Moretti (2008), and this endogeneity could correlate with source-country culture.

In lack of the ideal set-up, I follow Finseraas and Kotsadam (2017) and include sibling-pair fixed effects in the empirical epidemiological model. The sibling-pair fixed effect absorbs any variation that is constant across siblings; hence, they control for everything that affects both siblings equally, such as childhood environment, unobserved parental characteristics and endogenous family structure. This way, the sibling-pair fixed effect controls for everything that correlates with source-country cultural norms but that is unrelated to gender, such that the only variation that remains is the component of source-country norms that affects opposite-sex siblings in different ways. Thus, by construction, the model identifies only the effect of any *gender-specific* components of culture, i.e. gender norms, as anything that is not gender-specific will not vary across siblings and will therefore be absorbed by the sibling-pair fixed effect. I estimate the following model:

$$MathScore_{ij} = \alpha Girl_{ij} + \beta Girl_{ij} \times Norms_j + \gamma Birthorder_{ij} + Cohort_{ij} + \eta_j + \epsilon_{ij} \quad (3)$$

where i refers to individuals and j to sibling pairs. α captures the baseline math score difference between opposite-sex siblings. The baseline cultural gender norm measure does not vary within families and will be absorbed by the sibling-pair fixed effect η_j. The coefficient of interest is β, which captures how the sibling gender differences in math performance vary depending on the gender norms of the mother's source-country culture. I control for birth order and cohort fixed effects, and I cluster standard errors at the source-country times cohort level.[15] β identifies the causal effect of cultural gender norms under the identifying assumption that any latent gap in childhood outcomes between brothers and sisters is as good as randomly assigned between families from different source-countries.[16]

4.2. Is the effect mitigated by municipality gender equality?

When investigating any causal mitigation effect of neighbourhood characteristics, the ideal setup would be to randomise gender norms among children's mothers and then randomise the types of municipalities in which the children grow up. While, again, the ideal setup is not available, the refugee placement policy described in Section 2.2 offers quasi-random variation in municipality characteristics, as asylum seekers were not free to choose their assigned municipalities.

An important issue regarding the refugee placement policy, which was raised by Nekby and Pettersson-Lidbom (2017), is that placement into municipalities may correlate with how the refugees were treated, and therefore also with the outcomes of the second generation. For example, if some municipalities systematically placed the refugees in areas with fewer social problems, this would most likely imply that the children of those refugees would attend schools of higher quality, which may affect their educational outcomes. If the likelihood of placing refugees in neigh-

[15] Treatment is technically at the source-country level, but too few clusters may decrease standard errors (Angrist and Pischke, 2009). My results are robust to using a wild bootstrap procedure to obtain standard errors clustered at the source-country level.

[16] This assumption would be violated if, for example, source-country culture was correlated with in-utero factors that affect opposite-sex foetuses differently. Following Figlio et al. (2019), I address this assumption by assessing whether cultural gender norms can predict neonatal characteristics, such as birth weight. Reassuringly, Appendix Table A1 shows that there is only a weak and negligible relationship between cultural gender norms and the gender gap in birth weight.

bourhoods of "higher quality" correlates with municipality FLFP, this would bias my results, as I would be comparing boys and girls attending different types of schools and living in different types of neighbourhoods. By including sibling-pair fixed effects, I increase the likelihood that my model identifies only the mitigation effect of neighbourhood gender equality, rather than the effect of some unobserved municipality characteristic that correlates with placement, as siblings are placed in the same neighbourhood, school and house, and therefore experience the same special treatment (if such treatment exists). Again, the sibling fixed effect absorbs everything that affects both siblings equally, and I estimate the effect of the *gender-specific* component of municipality characteristics. I estimate the following equation:

$$\begin{aligned} MathScore_{ij} &= \alpha Girl_{ij} + \beta Girl_{ij} \times Norms_j \\ &+ \delta Girl_{ij} \times MunicipalityFLFP_{ij} + \lambda Girl_{ij} \times Norms_j \times MunicipalityFLFP_j \\ &+ \gamma Birthorder_{ij} + Cohort_{ij} + \eta_j + \epsilon_{ij} \quad (4) \end{aligned}$$

where i refers to individuals and j to sibling pairs. α captures the baseline math gender gap between brothers and sisters, and β captures how this gender gap varies with mothers' cultural gender norms. The coefficient of interest is λ, which measures how the effect of cultural norms on the gender gap in math varies with the gender equality of the mothers' assigned municipality. In other words, λ captures the relative effect for girls growing up with more traditional mothers who were assigned to more gender-equal municipalities, compared to girls whose traditional mothers were assigned to less gender-equal municipalities. The baseline cultural norm and municipality characteristic effects will be absorbed by the sibling-pair fixed effect η_j. I cluster standard errors at assigned municipality times year of immigration.[17]

Another threat to identification is the possibility that asylum seekers were systematically placed in gender-equal municipalities based on the country they migrated from, which would cause correlation between municipality FLFP and the mothers' cultural gender norms. To investigate this, I test whether mothers' cultural gender norms can predict municipality gender equality. Table 3 presents the results of this balance test.[18] The top panel shows the correlation between asylum-

[17]My results are robust to clustering the standard errors at source country times assigned municipality times year of immigration level.

[18]Column (1) presents the raw correlation between cultural gender norms and municipality

seeking mothers' cultural gender norms and the FLFP of the assigned municipality. Reassuringly, the correlation is very small and statistically insignificant, which indicates that the allocation of asylum-seeking future mothers were random with respect to cultural gender norms. The share of municipality residents from the same source country as the refugee (cultural density) and family size predicts municipality FLFP; this is expected as these are characteristics that influenced placement decisions. However, these correlations are not problematic, as all of these differences will be controlled for by the sibling fixed effects.

The middle panel illustrates the relationship when I allow selection, i.e. the correlation between asylum-seeking mothers' cultural gender norms and the FLFP of the municipality they live in when their child is in ninth grade. Similarly, the bottom panel shows the correlation between mothers' cultural gender norms and FLFP of the ninth grade municipality for the full sample of all second-generation immigrants. The correlations shown in the middle and bottom panel are positive and statistically significant, which indicates that families select into municipalities partly based on gender norms and gender equality. If this selection is related to the relative educational outcomes of boys and girls, this would bias my results. Thus, these results highlight the importance of using the refugee placement policy in order to obtain exogenous variation in municipality characteristics.

As previously stated, refugees were not required to stay in their assigned municipality. Following initial assignment, there were no restrictions on moving to a different location, and refugees could move to another municipality if they found housing on their own. For this reason, I am only able to estimate the intention-to-treat effect of the assigned municipality characteristics. However, 56% of the asylum-seeking mothers still lived in their assigned municipality at the time when their children graduated from ninth grade.[19]

gender equality. When municipalities could choose which asylum seekers were allocated to them, priority was given to the more highly educated and those who spoke the language of some of the resident immigrant stock. In addition, family size determined housing availability. Column (2) controls for these relevant placement characteristics, and column (3) adds immigration year fixed effects. Cultural density is calculated as the share of municipality residents with the same nationality. Immigration year fixed effects should be included as the number of participating municipalities increased over time. Finally, column (4) adds the cohort of the mother.

[19]As expected, younger and more highly educated individuals are more likely to change municipality. Some measurement error may exist if individuals move within the first year of assignment, as I observe municipality of residence in the end of the year. This issue is investigated thoroughly by Edin et al. (2003), who use a weighting scheme based on the aggregate data on municipality reception of refugees. The weighting does not change their estimates significantly, which suggests that measurement error is not a substantial concern.

5. Results

5.1. Do cultural gender norms affect the math gender gap?

Figure 3 illustrates the descriptive correlation between mothers' cultural gender norms and the average gender gap in math performance of the second generation. The fitted relationship is negative, indicating that the gender gap in math increases as cultural gender norms become more traditional.

Table 4 shows the results for the first research question: the effect of mothers' cultural gender norms on the gender gap in math. All columns control for birth order and cohort fixed effects. Column (2) adds an indicator of whether both parents are immigrants, as well as source-country and municipality of residence fixed effects. Column (3) adds controls for family size, household income, education level and cohort of the mothers. Column (4) contains the preferred model specification, which includes sibling-pair fixed effects.

Table 4 demonstrates that girls score lower on the math tests compared to boys; the baseline math score sibling gender gap is about 7% of a standard deviation.[20] The estimates in column (1) show that both boys' and girls' math performance decrease as mothers' gender norms become more traditional, but more so for the girls' than for the boys'. The interaction effect of the girl indicator and the cultural gender norms measure shows that the gender gap in math increases with mothers' cultural gender norms, such that girls whose mothers have more traditional gender norms fall behind their brothers by an additional 4% of a standard deviation. Compared to the baseline sibling gender gap, a one-standard-deviation increase in cultural gender norms (about 0.24, which corresponds to going from Norway to Italy, or from Greece to Somalia) increases the gender gap in math by 56%.

Figure 4 graphically illustrates the interaction effect from the preferred specification, with mothers' cultural gender norms on the x-axis and the sibling math gender gap on the y-axis. The distribution of the gender norms proxy is plotted in the background. The interaction effect is negative; going from the most gender-equal source country to the least gender-equal source country corresponds to an increase in the math gender gap of about 15% of a standard deviation.

Compared to previous literature, my estimates are of the same sign, but smaller in magnitude. Nollenberger et al. (2016) and Rodríguez-Planas and Nollenberger

[20] The girl indicator captures the gender gap in math for siblings whose mothers' gender norm proxy takes the value zero (i.e. complete gender equality). However, the mean gender gap in math for the entire sample is very similar, at about 7%.

(2018) find that a one-standard-deviation increase in the source-country World Economic Forum Gender Gap Index is associated with a reduction in the math gender gap, and an increase in the reading and science gender gap, of about 30% of a standard deviation of the aggregate gender gaps. After being recalculated to match their definition, my effect sizes correspond to an effect of 7.6% of the standard deviation of the aggregate math score gender gap.[21] A smaller effect size is in line with the results of Finseraas and Kotsadam (2017), who find that the effect of cultural gender norms on the gender gap in employment among second-generation immigrants in Norway is about 50% of the size of corresponding US estimates.

5.2. Is the effect mitigated by municipality gender equality?

Table 5 presents the results for the second research question: whether municipality gender equality can mitigate the negative effect of cultural gender norms. Column (1) replicates the preferred specification of the first research question, and estimates the effect of gender norms on the sibling gender gap in math for the subset of children whose mothers were asylum seekers under the placement policy. Column (2) presents the mitigation effect, controlling only for birth order and cohort fixed effects. Column (3) adds an indicator of whether both parents are immigrants, source-country fixed effects, and assigned municipality times immigration year linear trends. Column (4) adds controls for predetermined maternal characteristics that may have influenced placement. Finally, column (5) contains the preferred specification, which controls for birth order, cohort and sibling-pair fixed effects.

Similar to the results for the first research question, the baseline gender gap in math is about 7% of a standard deviation. Mothers' cultural gender norms have a negative effect, such that more traditional gender norms increase the sibling gender gap in math in favour of boys. Most importantly for the second research question, the mitigation effect of municipality gender equality is both positive and statistically significant. This result suggests that while girls who have more traditional mothers do relatively worse in math, this negative effect is mitigated for those girls whose mothers were assigned to more gender-equal municipalities. Increasing the assigned municipality FLFP by one standard deviation (0.07) leads to a mitigation effect of about 5% of a standard deviation of the math score, which corresponds to 82% of the negative cultural norm effect. Thus, municipality gender equality can almost completely mitigate the negative effect of mothers' traditional gender norms.

[21] Following Rodríguez-Planas and Nollenberger (2018), I calculate effect size as $\frac{NormSD \times \beta}{MathSD} = \frac{0.24 \times 0.041}{0.13} = 0.076$.

Figure 5 illustrates the graphical representation of the mitigation effect, with municipality gender equality ($FLFP$) on the x-axis and the effect of more gender-traditional mothers on the y-axis. The distribution of assigned municipality $FLFP$ is plotted in the background. Going from the least gender-equal municipality to the most gender-equal municipality completely mitigates the negative effect of mothers' traditional gender norms.

My estimates are comparable to those of Chetty and Hendren (2018), who estimate the effects of neighbourhood exposure on children's outcomes. The authors find that the outcomes of children who move to a new neighbourhood converge to the outcomes of the residents of the new neighbourhood at a rate of 4% per year of exposure. Extrapolating this result implies that children who move to a new neighbourhood at birth and stay there until they are 20 years old would pick up about 80% of the difference in residents' outcomes between their origin and destination neighbourhood. My estimates correspond to an assimilation of mothers' cultural norms to the neighbourhood setting, from before the birth of the child to the age of 16, and are of a similar magnitude to the extrapolated estimates of Chetty and Hendren (2018).

5.3. Heterogeneity

Both the effect of cultural gender norms and the mitigation effect may differ depending on the characteristics of the mother and of the assigned municipality. The assimilation of a mother's cultural values to the neighbourhood setting could be influenced by her education level — for example, because learning Swedish and finding employment may be easier for the more highly educated — or by how long it has been since she migrated to Sweden. The effects could also be influenced by municipality characteristics, such as cultural density (i.e. fraction of residents of the same ethnicity) or by the type of labour market she encounters upon immigration.

Furthermore, the relative math performance of girls may be influenced by the number of siblings she has. As my sample consists of girls that are matched to all their opposite-sex siblings, more weight is given to those girls who have many brothers. Hence, there is a risk of over-estimating the effect of culture if mothers with more traditional cultural gender norms tend to have more children, and if girls in larger families tend to perform worse in math due to, for example, increased responsibilities at home.

Figure 6 presents the heterogeneous effects of mothers' cultural gender norms for the RQ1 sample. The effect appears stronger for less educated mothers, although the estimates do not differ significantly from each other. Likewise, I find no heterogeneous effects by family size, cultural density, or time since the mother's immigration.

Figure 7 presents the heterogeneous mitigation effects for the RQ2 sample. The figure shows that the mitigation effect is stronger for siblings with mothers who were assigned to municipalities in which the health sector is responsible for an above-median share of the total municipality employment.[22] Likewise, the mitigation effect is stronger for siblings with mothers who were assigned to municipalities with an above-median share of same-ethnicity residents. Although the estimates are not statistically different from each other, which may be an issue of power, these results are in line with the results of Åslund and Rooth (2007), who find that initial labour market exposure has lasting effects for arriving refugees, and Edin et al. (2003), who show that living in an ethnic enclave improves labour market outcomes. I find no heterogeneous effects by mothers' education level or family size.

Finally, the effects may be heterogeneous over the math performance distribution. It is reasonable to believe that high-achieving students are not affected in the same way as struggling students are. However, as math performance is an outcome of gender norms, and because the sibling gender gap mechanically depends on the siblings' absolute performance, this is a difficult issue to investigate. As an example, I allocate the siblings into quintiles depending on their mean math performance, and allow the effect of cultural gender norms and the mitigation effect to differ depending on where on the performance distribution the siblings are located. Appendix Figure A1 shows that the results appear to be driven by students in the lower and middle part of the performance distribution. However, these heterogeneous effects may also be mechanically driven by the amount of variation in the sibling gender gap in each quintile, and should therefore be interpreted with caution.

5.4. Alternative outcomes: final marks

Rodríguez-Planas and Nollenberger (2018) show that the effect of parents' cultural gender norms affect not only the gender gap in math, but also the gender gaps in reading and science. This result implies that the cultural norms affecting girls' educational outcomes are not only math-specific, but rather reflect general stereotypes about gender and educational outcomes. To investigate whether this is also true for

[22] Almost 20% of the working population of previously asylum-seeking mothers are working within the health sector; hence, the relative size of this sector may be important for future labour market outcomes and assimilation.

my setting, I estimate the effect of mothers' cultural gender norms on the sibling gender gap in final marks in Swedish, English, math and the total ninth grade mark.

Table 6 presents the effect of mothers' cultural gender norms on the sibling gender gaps in these final marks. Sisters outperform their brothers in all subjects, and they get a higher total ninth grade mark.[23] The effect of mothers' cultural gender norms is negative for all outcomes, such that girls with more traditional mothers perform worse relative to their brothers. These results confirm the findings of Rodríguez-Planas and Nollenberger (2018), and show that cultural gender norms affect not only girls' test scores in math, but also their relative school performance more generally. Thus, the norms at play are not math-specific, but rather gender stereotypes about education in general.

Table 7 shows the mitigation effect of assigned municipality gender equality for the final subject and total marks. The mitigation effect is positive for math, Swedish and the total ninth grade mark, but is only statistically significant for math. However, given the small sample size and lack of variation in outcomes (subject marks can only take the values 0, 10, 15 and 20) the model may not have enough power to estimate coefficients with precision.

6. Robustness checks

The aim of my model is to isolate any gender-specific components of culture, i.e. gender norms. By construction, anything that is not gender-specific will not vary across siblings and will therefore be absorbed by the sibling-pair fixed effect, such that only the gender-specific component remains. However, one possible concern is that cultural gender norms could vary systematically with other, unobserved source-country characteristics that could affect boys and girls in different ways. If that were true, I may not be estimating the effect of gender norms, but rather the effect of some other unobserved and source-country-specific characteristic. To mitigate this concern, I estimate a model in which I investigate the relative sibling impact of source-country placebo norms. I construct an index of desired child characteristics from the World Values Survey that I expect to relate to math performance but that do not necessarily have a gender-specific impact.[24] Table 8 presents the results from

[23]Interestingly, even though girls score lower on the national standardised tests in math, they still seem to get a slightly higher final mark.

[24]The index consists of country-level agreement regarding the various characteristics that parents wish to foster in their children. The characteristics are independence, responsibility and hard work, which are chosen based on their intuitive, and empirically proven, positive impact on math

this placebo test. The placebo norm is positively related to math performance, but has no gender-specific impact on girls relative to boys. This result demonstrates that not all source-country norms have a gender-specific component that differs between boys and girls; accordingly, this supports the argument that my main model identifies the effect of gender norms rather than some other unobservable characteristic that varies by source-country.

Likewise, to test the assumption that my model for the second research question picks up only the effect of neighbourhood gender equality, rather than some other unobserved factor that varies systematically by municipality, I investigate whether the parental norm effect is mitigated by other municipality characteristics, such as average population income. Living in municipalities with higher average income could have a positive effect on children's educational performance, as (for example) high-income municipalities may be able to provide schools of higher quality. However, municipality income may not have a gender-specific component such that it can mitigate the cultural gender norm effect. Table 9 shows that municipality income does not mitigate the effect of mothers' gender norms. This result supports the argument that my main model captures the effect of surrounding gender equality, and not some other unobserved municipality characteristic.

My results are not sensitive to relaxing the opposite-sex sibling restriction, which keeps also families without one child of each gender in the sample. Table 10 (11) show the results for the first (second) research question, without restricting the sample to only opposite-sex siblings.[25] For both research questions, the sample size triples, but the results remain of similar magnitude. Neither are the results sensitive to measuring source-country norms at time of immigration. For a subsample of the data, I have information on gender-specific labour force participation rates from earlier than 1990, and I define a mother's cultural gender norms as the source country $1 - FLFP$ during the decade in which the she migrated to Sweden. Table 12 shows that the effects of mothers' cultural gender norms on the sibling gender gap in math remain of similar sign and magnitude.[26]

Table 13 and 14 show the results for a battery of robustness checks. Column (1) shows that my results are robust to dropping the countries contributing to the largest immigrant flows (Finland and Yugoslavia) and to dropping the largest

performance.

[25]In this setup mother fixed effects are included in the last columns instead of sibling-pair fixed effects, which implies that girls are compared to the average of all their brothers' test scores.

[26]For the second research question, norms are already measured around the time of migration, as all the asylum-seeking mothers arrived during 1987–1991.

and most urban municipalities in Sweden (Stockholm, Gothenburg and Malmö). Column (2) shows that the results are similar when I estimate my model on a sample of children whose parents are both immigrants. To increase the likelihood of the siblings being exposed to the same family environment, I also restrict my sample to siblings who are at most five years apart in age. Column (3) shows that the results are robust to this specification.

I also replicate my main results using alternative measures of both cultural gender norms and municipality gender equality. The first alternative measure of cultural gender norms is source-country level of agreement with the statement *"A university education is more important for a boy than for a girl."* derived from the World Values Survey. The second alternative measure of source-country gender norms is the World Economic Forum's Gender Gap Index.[27] The alternative municipality gender equality measure is average female-to-male wage ratio, measured within the assigned municipality in the immigration year. As before, the measure of cultural norms increases with gender-traditional norms, while the municipality measure increases with gender equality. Columns (4) and (5) show that both the results for the cultural norm effect and the municipality mitigation are robust to using these alternative definitions of gender norms and gender equality.

Figlio et al. (2019) find that boys from families with lower socio-economic status perform worse relative to their sisters. If family disadvantage correlates with cultural gender norms, there is a risk that my study may capture a relative effect of family disadvantage for boys rather than a relative effect of gender norms for girls. In column (6), I estimate my main model with controls for a gender-specific effect of mothers' socio-economic status; reassuringly, it does not affect my estimates.[28] I address the concern of selective migration by controlling for a gender-specific effect of geographical distance between mothers' source-country and Sweden, which, as column (7) shows, also does not alter my estimates.[29]

[27]The WEF GGI is used by Nollenberger et al. (2016), Rodríguez-Planas and Nollenberger (2018) and Rodríguez-Planas and Sanz-de Galdeano (2019). I define parents' cultural gender norms as 1 - GGI.

[28]I measure socio-economic status using the mothers' education levels.

[29]Migrating parents may be disproportionally drawn from the lower or upper part of the source country distribution for preferences regarding girls' relative educational achievement. If this selection varies systematically with the relative female labour force participation of the source country, it could bias my estimates. Belot and Hatton (2012) study the selection of migration among OECD countries and show that the selection on skills is more negative in proximate source countries. If the selection process on preferences against girls' educational achievements is similar, this would lead me to overstate the effect of cultural gender norms. Furthermore, Appendix Figure A2 addresses the concern that migrants might leave their source country precisely because they do not agree with the gender norms there; however, such selection would lead me to understate

The norms a child is exposed to at home could depend on the cultural values of both parents. To investigate whether the effects differ depending on the source country of the father, I estimate the gender norm and mitigation effect using a norm measure that combines the cultural gender norms of both parents. Appendix Tables A2 and A3 show that the results using the average parental norm are very similar to my main results.

Finally, I create a sample of second-generation immigrants defined by having a foreign-born, or asylum-seeking, father instead of mother. Appendix Table A4 shows that the gender norm effect is very similar for fathers' cultural norms, compared to the results using mothers. However, Appendix Table A6 reveals that municipality gender equality does not mitigate the effect of fathers' traditional gender norms. It seems intuitive that municipality gender equality has a stronger relative impact on women then on men. However, the mitigation results for fathers should be interpreted with caution, as Appendix Table A5 shows that fathers' cultural gender norms are correlated with the gender equality of the assigned municipality. This correlation indicates that fathers were not randomly allocated to municipalities with respect to gender norms.[30]

7. Conclusion

This paper estimates the effect of cultural gender norms on the gender gap in math, and explores whether this effect is mitigated by municipality gender equality. To separate the effect of cultural norms from formal institutions, I estimate the effect of maternal source-country gender norms on the gender gap in math test performance for second-generation immigrants. By comparing the outcomes of opposite-sex siblings, I am able to control for everything that correlates with source-country but that is unrelated to gender. By construction, the remaining variation is the aspect of culture that affects opposite-sex siblings in different ways, i.e. gender norms. I show that cultural gender norms have a negative and sizeable impact on girls' relative performance, such that the sibling gender gap in math increases with the

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the effect of cultural gender norms and is therefore not a threat to my study. Appendix Figure A2 shows that the correlation between source country $1 - FLFP$ and the $1 - FLFP$ of the first generation in Sweden is positive.

[30]I expect this non-random placement to lead to an upward bias in the baseline effect of municipality gender equality on the gender gap in math, as fathers' gender norms become more equal when municipality gender equality increases. For the same reason, I expect a downward bias in the mitigation effect; this is because an increase in municipality gender equality implies an automatic decrease in fathers' gender-traditional norms, which will bias the three-way interaction estimate downwards. The results in Appendix Table A6 are in line with this expected bias.

gender-traditional nature of the norms adhered to by the mother. Furthermore, I find similar effects for the gender gaps in final marks in math, Swedish, and the total ninth grade mark. This result implies that the effect is not math-specific, and thus that cultural gender norms have an effect on girls' relative school performance more generally.

To investigate the mitigation effect of municipality gender equality, I exploit a refugee placement policy to obtain random variation in municipality characteristics. Again, I compare the outcomes of opposite-sex siblings, allowing me to control for any differential treatment by municipalities that is unrelated to the gender of the child. I show that municipality gender equality can almost completely mitigate the negative effect of cultural gender norms, which means that even though the sibling gender gap in math increases as mothers' gender norms become more traditional, this increase is smaller for siblings whose mothers were placed in gender-equal municipalities.

I contribute to the literature by providing causal evidence regarding the link between cultural gender norms and the gender gap in math, as well as by being the first to investigate how this effect interacts with neighbourhood gender equality. Accordingly, one novel contribution of this paper is that it merges the literature on cultural norms and neighbourhood exposure. I show that while cultural gender norms play an important role for the gender gap in math, they are not immune to the influence of surrounding characteristics. This result is important from a policy perspective. It would most likely be difficult to influence the norms transmitted to children by their parents; however, the understanding that these norms are affected by surrounding characteristics, which can be influenced, provides policy-makers with opportunities to affect change.

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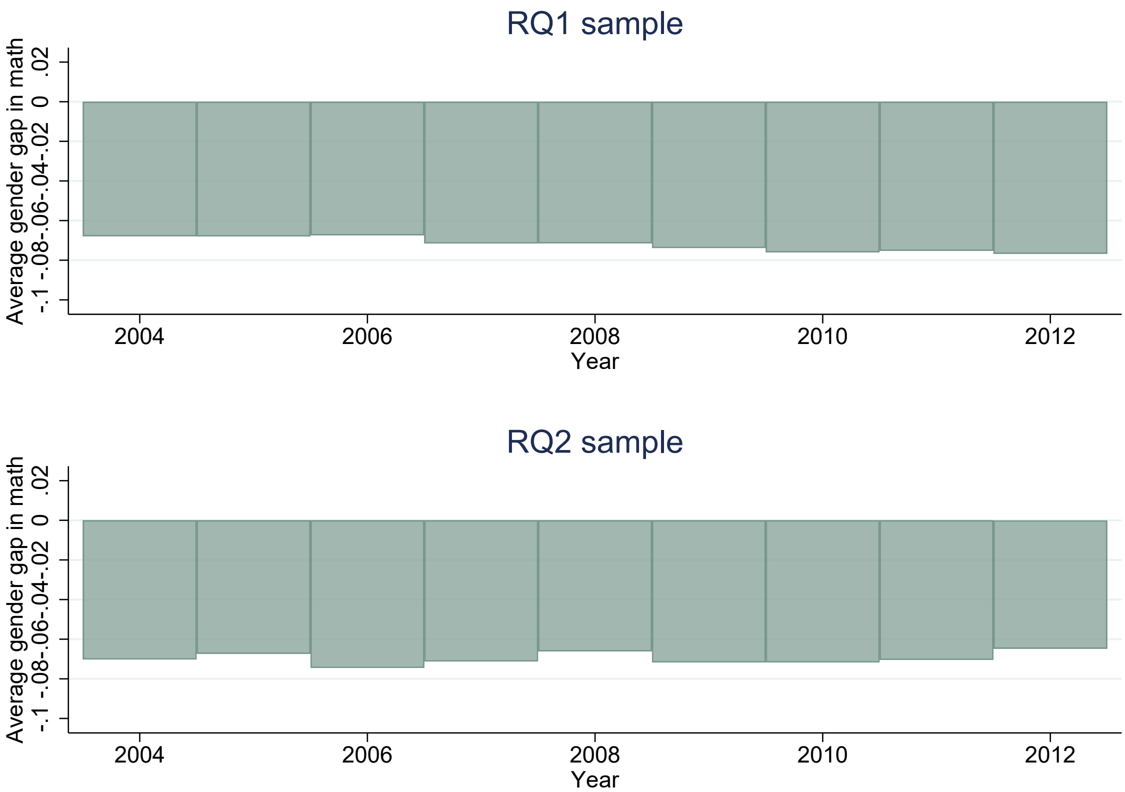
Table 1
Summary statistics

	Full sample	RQ1 sample	RQ2 sample
2nd generation	0.23		
	(0.42)		
Girl	0.49	0.50	0.50
	(0.50)	(0.50)	(0.50)
Cohort	1991.76	1992.11	1992.51
	(2.43)	(2.40)	(2.19)
9th grade total mark	212.01	205.35	199.92
	(59.24)	(61.12)	(60.26)
Math test score	36.20	33.03	29.84
	(15.65)	(15.54)	(14.93)
Math gender gap (std)	-0.01	-0.07	-0.07
	(0.00)	(0.01)	(0.01)
Family size	1.77	2.46	2.46
	(0.72)	(0.70)	(0.64)
HH income > median	0.50	0.32	0.17
	(0.50)	(0.47)	(0.38)
Mothers: post-secondary ed.	0.40	0.29	0.19
	(0.49)	(0.45)	(0.39)
Fathers: post-secondary ed.	0.32	0.27	0.22
	(0.47)	(0.44)	(0.41)
Mother's age	44.82	44.31	43.63
	(5.04)	(4.95)	(4.85)
Father's age	47.76	48.19	48.75
	(6.01)	(6.08)	(6.40)
Mother's norms (1-FLFP)	0.16	0.38	0.56
	(0.13)	(0.24)	(0.24)
Father's norms (1-FLFP)	0.17	0.35	0.56
	(0.14)	(0.27)	(0.25)
Municipality FLFP	0.91	0.92	0.93
	(0.05)	(0.05)	(0.07)
Observations	885,745	24,632	3,926

Notes: The table reports means and standard deviations of the main variables of my study. Column (1) includes all ninth grade students taking the national standardised tests between 2004–2012. Column (2) includes siblings whose mothers are immigrants, and column (3) includes siblings whose mothers were subjected to the refugee placement policy.

Figure 1

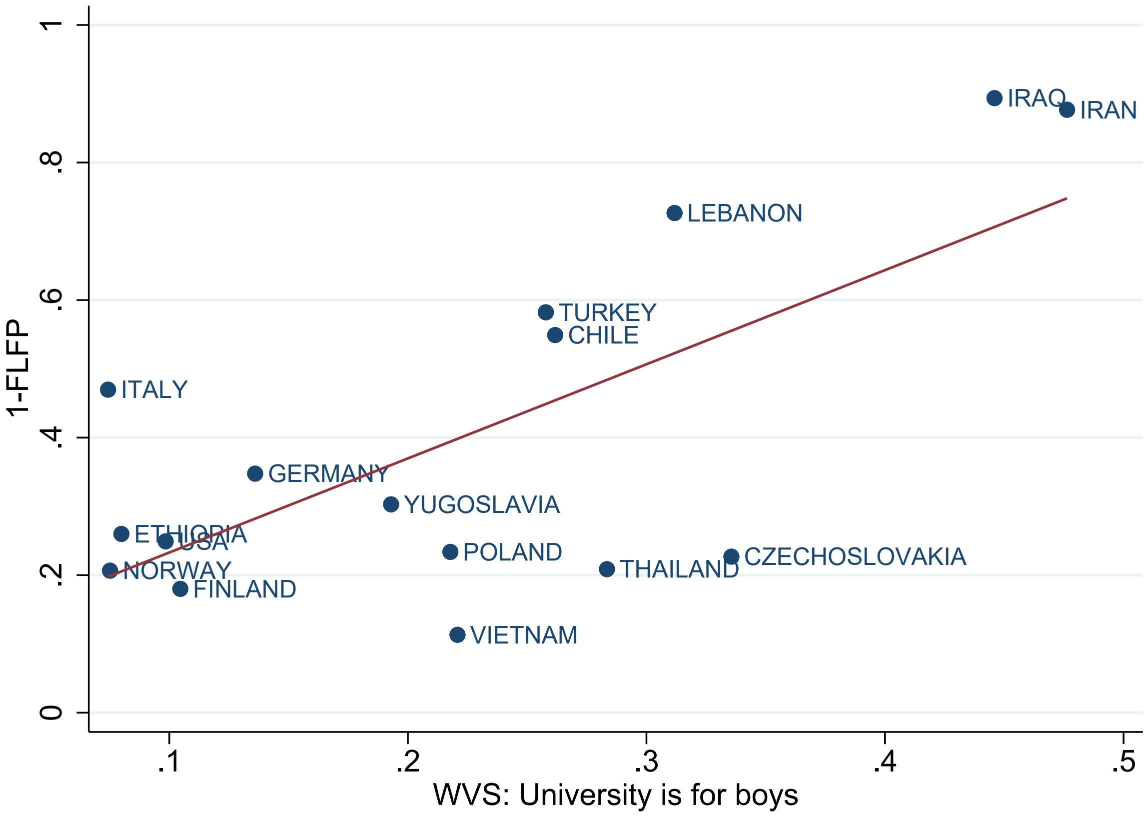
Average gender gap in math over time



Notes: The figure plots the average gender gap between boys and girls for each year between 2004 - 2012. The average gender gap is defined as (girls' average scores - boys' average scores).

Figure 2

Correlation between 1-FLFP and WVS statement



Notes: The figure plots the correlation between source-country 1-FLFP and level of agreement with the statement *"A university education is more important for a boy than for a girl."* from the World Values Survey.

Table 2

Included countries: frequency and norm values

Source country	1 - FLFP	WVS	1 - GGI	RQ1	RQ2
CHILE	0.55	0.26	0.30	990	312
CZECHOSLOVAKIA	0.23	0.34	0.31	144	
DENMARK	0.16		0.22	918	
ETHIOPIA	0.26	0.08	0.39	976	420
FINLAND	0.18	0.11	0.16	6,718	
GERMANY	0.35	0.14	0.24	500	
GREECE	0.47		0.31	142	
IRAN	0.88	0.48	0.41	838	382
IRAQ	0.89	0.45		814	248
ITALY	0.47	0.07	0.32	90	
LEBANON	0.73	0.31	0.4	2,464	886
NORWAY	0.21	0.08	0.16	1,370	
POLAND	0.23	0.22	0.3	1,186	314
SOMALIA	0.71			774	218
THAILAND	0.21	0.28	0.31	408	
THE SOVIET UNION	0.23		0.3	88	
TURKEY	0.58	0.26	0.41	2,586	668
USA	0.25	0.1	0.26	360	
VIETNAM	0.11	0.22	0.33	388	156
YUGOSLAVIA	0.30	0.19	0.3	2,878	322
Observations	24,632	22,710	23,044	24,632	3,926

Notes: The table reports the source-country levels of 1-FLFP and 1-GGI, as well as the country level of agreement with the statement *"A university education is more important for a boy than for a girl."* from the World Values Survey. Columns (4) and (5) report frequencies of children with mothers from each source country for both sample definitions.

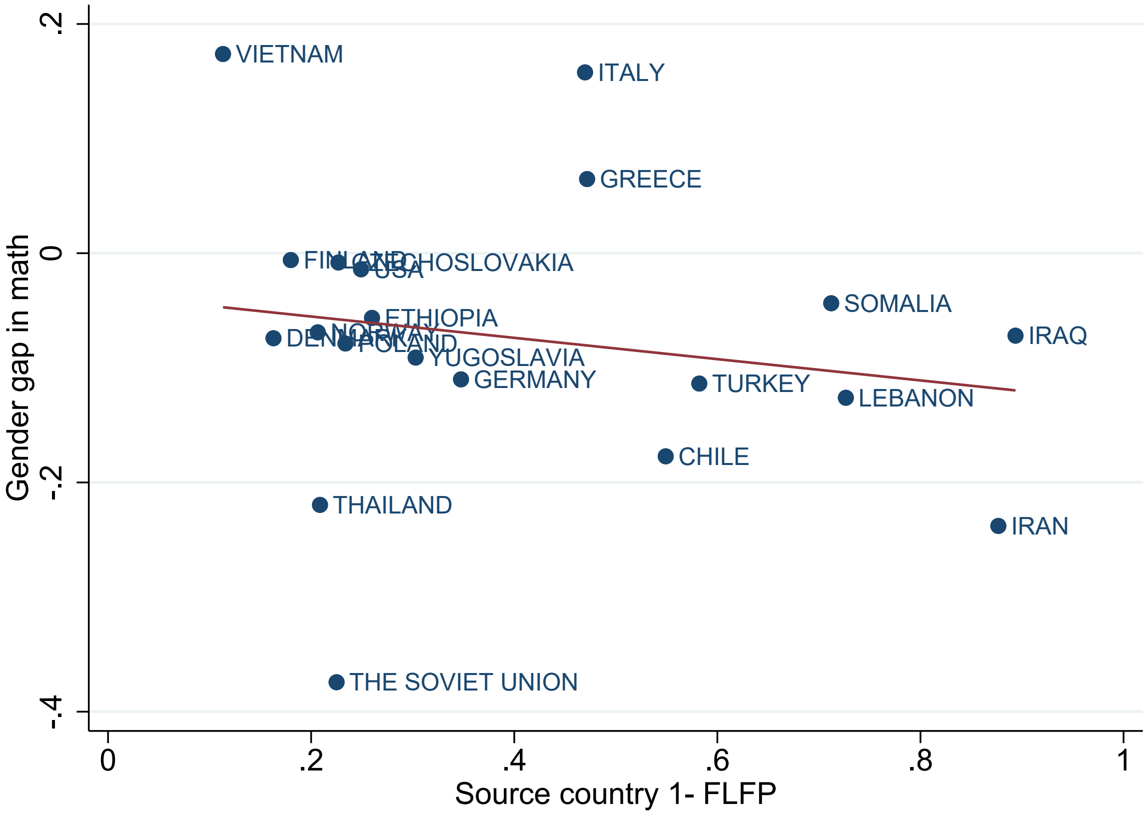
Table 3

Balance test for refugee placement policy

	(1)	(2)	(3)	(4)
	Outcome: assigned mun FLFP (RQ2 sample)			
Mother's norms	-0.014	-0.001	-0.000	0.000
	(0.030)	(0.030)	(0.029)	(0.029)
Cultural density		0.122***	0.124***	0.126***
		(0.035)	(0.035)	(0.035)
Mother's education		-0.008	-0.006	-0.010
		(0.013)	(0.014)	(0.015)
Family size		-0.128***	-0.122***	-0.133***
		(0.034)	(0.035)	(0.036)
Mother's cohort				-0.007
				(0.008)
R-squared	0.00	0.03	0.04	0.05
Observations	3,926	3,926	3,926	3,926
	Outcome: current mun FLFP (RQ2 sample)			
Mother's norms	0.079***	0.075**	0.072**	0.073**
	(0.030)	(0.031)	(0.030)	(0.030)
Cultural density		-0.100**	-0.106***	-0.105***
		(0.040)	(0.039)	(0.039)
Mother's education		-0.002	-0.006	-0.007
		(0.014)	(0.014)	(0.015)
Family size		-0.030	-0.023	-0.025
		(0.029)	(0.029)	(0.032)
Mother's cohort				-0.002
				(0.006)
R-squared	0.01	0.02	0.02	0.02
Observations	3,926	3,926	3,926	3,926
	Outcome: current mun FLFP (RQ1 sample)			
Mother's norms	0.163***	0.183***	0.184***	0.196***
	(0.015)	(0.014)	(0.013)	(0.013)
Cultural density		0.028	0.028	0.028
		(0.032)	(0.032)	(0.032)
Mother's education		0.033***	0.033***	0.025***
		(0.005)	(0.005)	(0.005)
Family size		-0.077***	-0.077***	-0.080***
		(0.015)	(0.015)	(0.015)
Mother's cohort				-0.020***
				(0.002)
R-squared	0.03	0.03	0.05	0.06
Observations	24,544	24,544	24,544	24,544
	Indicators			
Immigration year FE	No	No	Yes	Yes

Notes: The table reports the correlation between municipality FLFP and mothers' source-country gender norms and individual characteristics. The dependent variable in the top panel is the FLFP of the assigned municipality. The dependent variable in the second and third panel is the FLFP of the municipality the family lives in when the child graduates ninth grade. All parental characteristics (for the RQ2 sample) are measured at the time of immigration. Cultural density is the share of municipality residents from the same source country as the mother who is being placed there. Standard errors are clustered at assigned municipality $\times$ immigration year level. * p<0.1, ** p<0.05, *** p<0.01.

Figure 3
Correlation between 1-FLFP and average gender gap in math



Notes: The figure plots the correlation between parents' source-country 1-FLFP and average gender gap in math (girls' average scores - boys' average scores) for second-generation immigrants.

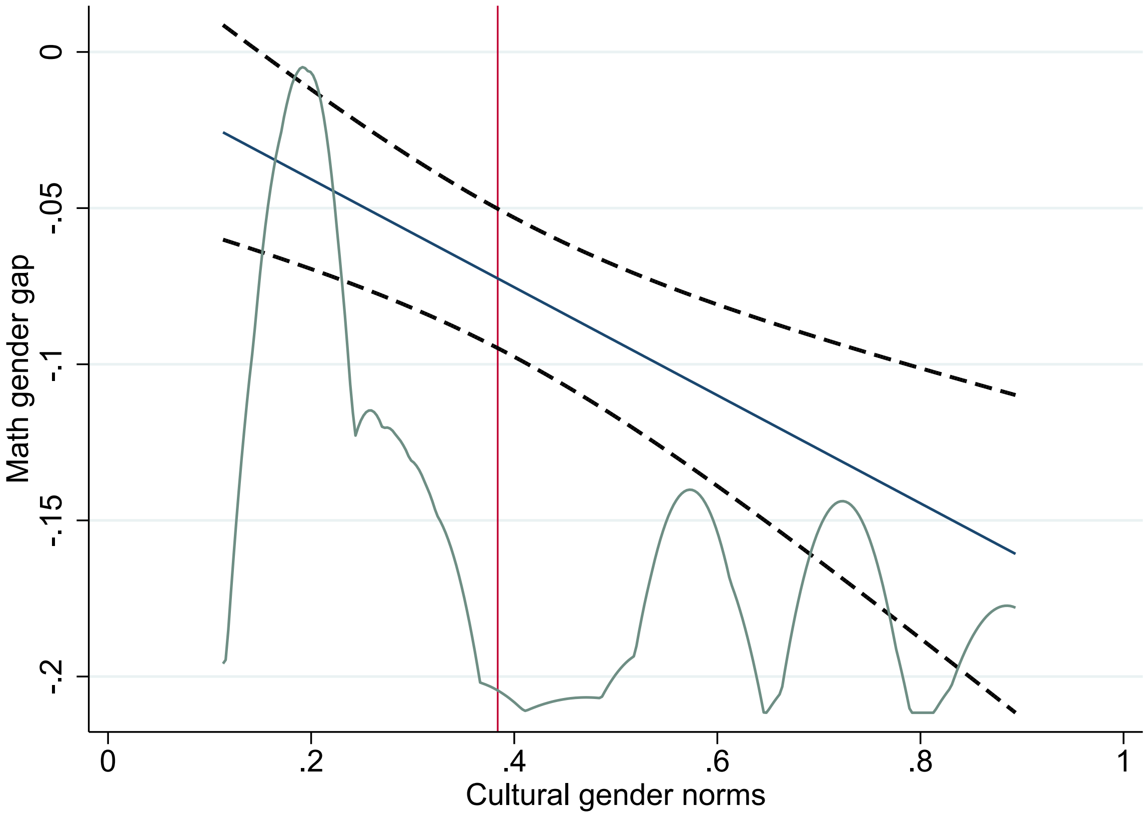
Table 4
Effect of mothers' gender norms on the math gender gap

	(1)	(2)	(3)	(4)
Girl	-0.073***	-0.073***	-0.073***	-0.073***
	(0.014)	(0.013)	(0.013)	(0.011)
Mother's norms	-0.147***			
	(0.020)			
Girl × mother's norms	-0.042***	-0.041***	-0.042***	-0.041***
	(0.014)	(0.013)	(0.013)	(0.011)
R-squared	0.03	0.12	0.18	0.71
Observations	24,632	24,632	24,632	24,632
	Indicators			
Birth order	Yes	Yes	Yes	Yes
Cohort FE	Yes	Yes	Yes	Yes
Source country & mun FE	No	Yes	Yes	No
Mother characteristics	No	No	Yes	No
Sibling FE	No	No	No	Yes

Notes: The dependent variable is the student's test score on the national standardised test in math, standardised to have a mean of 0 and standard deviation of 1. The effects are estimated for a one-standard-deviation increase in mothers' cultural gender norms (0.24). Mothers' characteristics are cohort, education level, household income and family size. Standard errors in parentheses are clustered at the source-country × cohort level. * $p<0.1$, ** $p<0.05$, *** $p<0.01$.

Figure 4

Effect of mothers' gender norms on the math gender gap



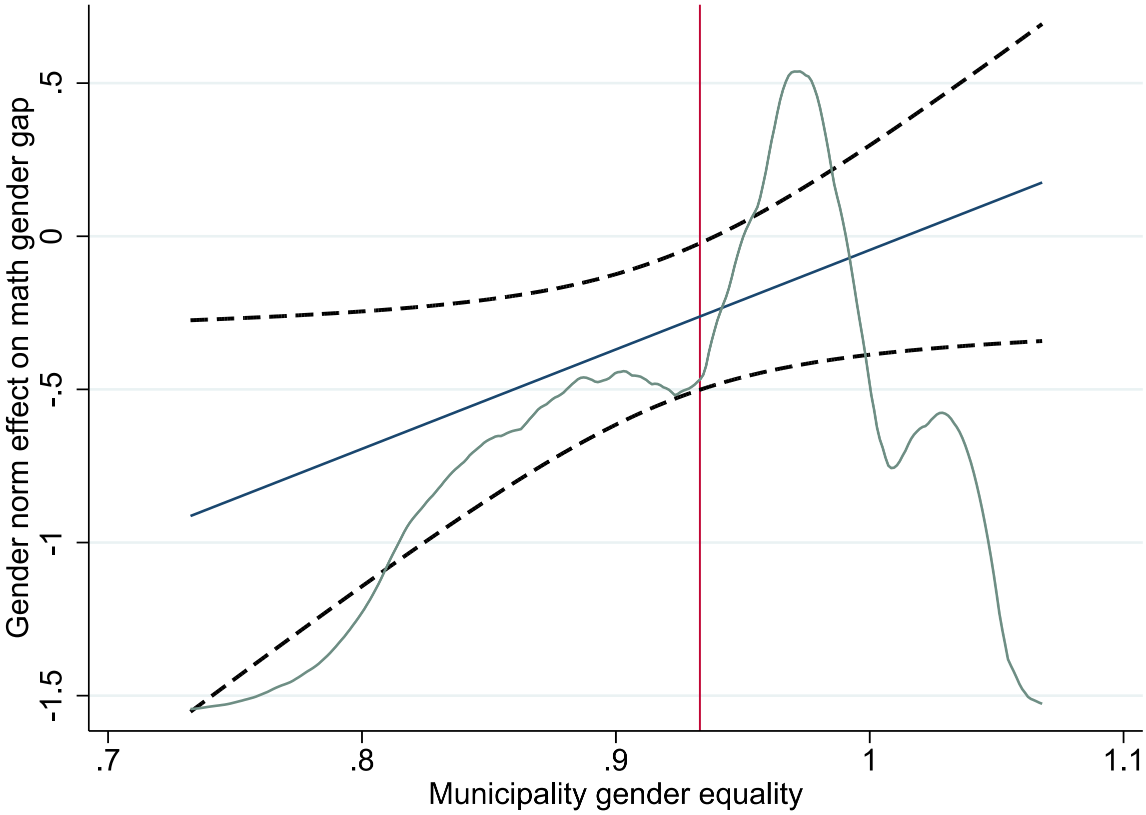
Notes: The figure plots the relative effect of mothers' more traditional cultural gender norms (girl × source-country 1-FLFP) on the gender gap in math. The dotted lines depict the 95% confidence interval. The kernel density distribution of the source-country 1-FLFP is plotted in the background. The vertical line indicates the mean of 1-FLFP.

Table 5
Municipality mitigation effect

	(1)	(2)	(3)	(4)	(5)
Girl	-0.074***	-0.071***	-0.070***	-0.070***	-0.073***
	(0.026)	(0.027)	(0.027)	(0.027)	(0.027)
Girl × mother's norms	-0.064**	-0.063**	-0.064**	-0.064**	-0.062**
	(0.029)	(0.029)	(0.029)	(0.029)	(0.029)
Girl × mun FLFP		-0.039	-0.042	-0.041	-0.040
		(0.027)	(0.027)	(0.027)	(0.026)
Girl × mother's norms × mun FLFP		0.051**	0.049*	0.050*	0.051**
		(0.026)	(0.026)	(0.026)	(0.025)
R-squared	0.71	0.02	0.32	0.33	0.71
Observations	3,926	3,926	3,926	3,926	3,926
	Indicators				
Birth order	Yes	Yes	Yes	Yes	Yes
Cohort FE	Yes	Yes	Yes	Yes	Yes
Source country FE	No	No	Yes	Yes	No
Mun. × Im.Year FE	No	No	Yes	Yes	No
Mother characteristics	No	No	No	Yes	No
Sibling FE	Yes	No	No	No	Yes

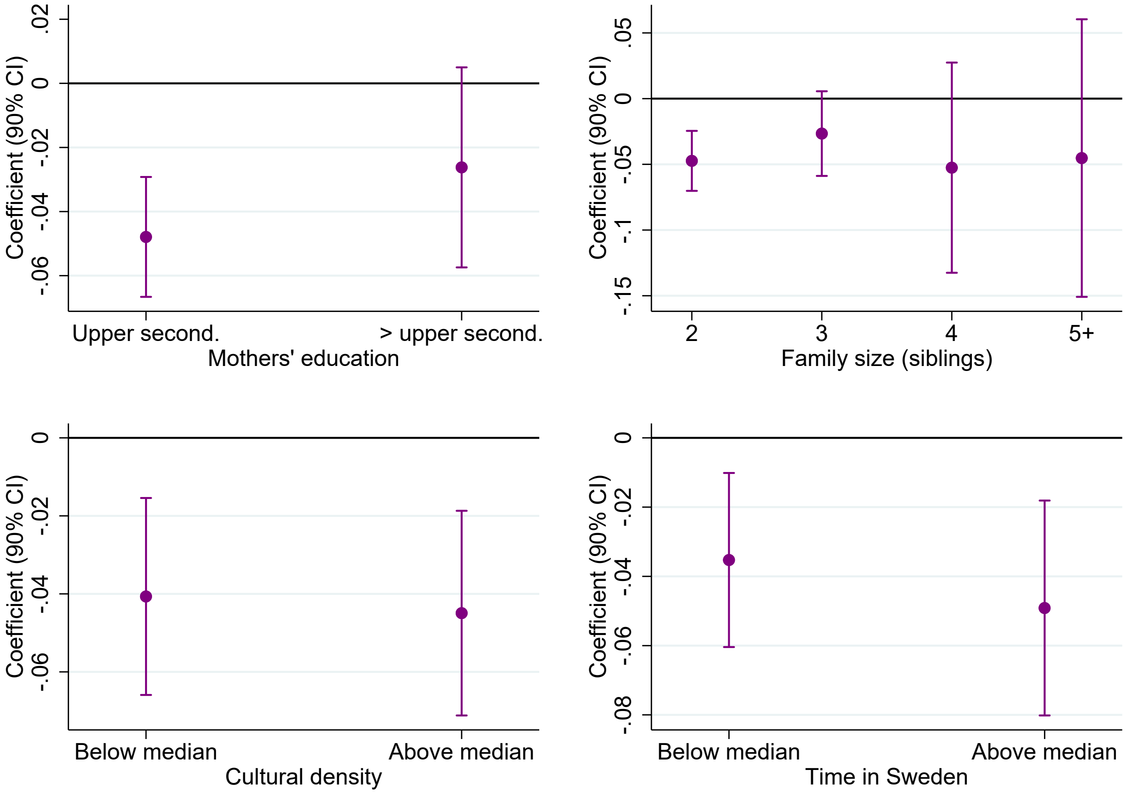
Notes: The dependent variable is the student's test score on the national standardised test in math, standardised to have a mean of 0 and standard deviation of 1. Municipality FLFP is measured at the assigned municipality, in the year in which the mother immigrated to Sweden. The effects are estimated for a one-standard-deviation increase in mothers' cultural gender norms (0.24), and a one standard deviation increase in municipality FLFP (0.07). Mothers' characteristics are cohort, education level, family size and cultural density of assigned municipality, all of which are measured at time of immigration. Standard errors are clustered at the assigned municipality × immigration year level. * $p<0.1$, ** $p<0.05$, *** $p<0.01$.

Figure 5
Municipality mitigation effect



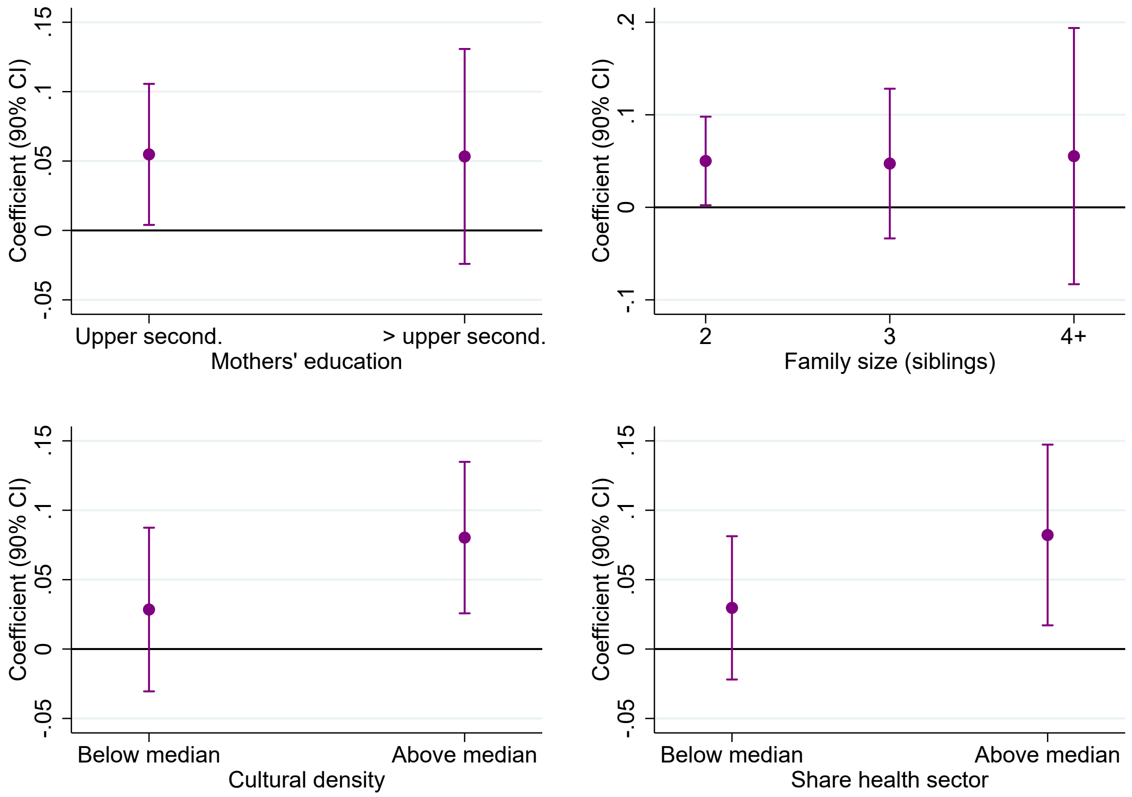
Notes: The figure plots the mitigation effect (girl × source-country 1-FLFP × municipality FLFP) on the gender gap in math. The dotted lines depict the 95% confidence interval. The kernel density distribution of the municipality-level FLFP is plotted in the background, and the vertical line indicates the mean municipality FLFP. Municipality FLFP is measured at the assigned municipality, in the year in which the mother immigrated to Sweden.

Figure 6
Heterogeneity in mothers' gender norm effect



Notes: The figure plots the effect of mothers' gender norms on the gender gap in math, when the effect is allowed to differ by mothers' education level (attended up to, or more, than upper secondary education), family size (measured as the number of siblings a girl has), cultural density of the municipality of residence (measured by share of same-ethnicity residents, below or above the median share), and how long it has been since the mother immigrated to Sweden (below or above the median number of years (22)).The figure plots 90% confidence intervals. The dependent variable is the student's test score on the national standardised test in math, standardised to have a mean of 0 and standard deviation of 1.

Figure 7
Heterogeneity in mitigation effect



Notes: The figure plots the mitigation effect of municipality gender equality, when the effect is allowed to differ by mothers' education level (attended up to, or more, than upper secondary education), family size (measured as the number of siblings a girl has), cultural density of the assigned municipality (measured by share of same-ethnicity residents, below or above median share), or relative share of the health care sector as compared to total industry composition in the assigned municipality. The figure plots 90% confidence intervals. The dependent variable is the student's test score on the national standardised test in math, standardised to have a mean of 0 and standard deviation of 1.

Table 6

Effect of mothers' gender norms on gender gap in final marks

	(Math)	(Eng)	(Swe)	(Total)
Girl	0.021*	0.170***	0.524***	0.332***
	(0.011)	(0.010)	(0.014)	(0.009)
Girl × mother's norms	-0.034***	-0.007	-0.089***	-0.026***
	(0.011)	(0.009)	(0.016)	(0.010)
R-squared	0.68	0.70	0.68	0.73
Observations	24,443	24,443	19,725	24,632
	Indicators			
Birth order	Yes	Yes	Yes	Yes
Cohort FE	Yes	Yes	Yes	Yes
Sibling FE	Yes	Yes	Yes	Yes

Notes: The dependent variables are the student's mark on the national standardised tests in math (1), English (2), Swedish (3) and the total final ninth grade mark (4). All outcomes are standardised to have a mean of 0 and standard deviation of 1. The effects are estimated for a one-standard-deviation increase in mothers' cultural gender norms (0.24). All regressions are controlling for birth order, and sibling-pair and cohort fixed effects. Standard errors in parentheses are clustered at the source country × cohort level. * $p<0.1$, ** $p<0.05$, *** $p<0.01$.

Table 7

Municipality mitigation effect on gender gap in final marks

	(Math)	(Eng)	(Swe)	(Total)
Girl	-0.002	0.190***	0.469***	0.331***
	(0.029)	(0.029)	(0.039)	(0.028)
Girl × mother's norms	-0.038	-0.015	-0.027	-0.017
	(0.028)	(0.025)	(0.036)	(0.025)
Girl × mun FLFP	-0.031	-0.009	-0.010	-0.017
	(0.028)	(0.025)	(0.039)	(0.026)
Girl × mother's norms × mun FLFP	0.049*	-0.002	0.006	0.013
	(0.026)	(0.024)	(0.033)	(0.024)
R-squared	0.68	0.72	0.67	0.73
Observations	3,909	3,909	2,499	3,926
	Indicators			
Birth order	Yes	Yes	Yes	Yes
Cohort FE	Yes	Yes	Yes	Yes
Sibling FE	Yes	Yes	Yes	Yes

Notes: The dependent variables are the student's mark on the national standardised tests in math (1), English (2), Swedish (3) and the total final ninth grade mark (4). All outcomes are standardised to have a mean of 0 and standard deviation of 1. Municipality FLFP is measured at the assigned municipality, in the year in which the mother immigrated to Sweden. The effects are estimated for a one-standard-deviation increase in mothers' cultural gender norms (0.24), and a one-standard-deviation increase in municipality FLFP (0.07). All regressions are controlling for birth order, as well as sibling-pair and cohort fixed effects. Standard errors in parentheses are clustered at the assigned municipality × immigration year level. * $p<0.1$, ** $p<0.05$, *** $p<0.01$.

Table 8

Placebo: effect of other source-country norms

	(1)	(2)	(3)	(4)
Girl	-0.074***	-0.073***	-0.074***	-0.073***
	(0.016)	(0.015)	(0.015)	(0.015)
Mother's placebo norms	0.092***			
	(0.026)			
Girl × mother's placebo norms	0.015	0.015	0.015	0.015
	(0.016)	(0.016)	(0.015)	(0.012)
R-squared	0.01	0.13	0.18	0.71
Observations	22,710	22,710	22,710	22,710
	Indicators			
Birth order	Yes	Yes	Yes	Yes
Cohort FE	Yes	Yes	Yes	Yes
Source country & mun FE	No	Yes	Yes	No
Mother characteristics	No	No	Yes	No
Sibling FE	No	No	No	Yes

Notes: The dependent variable is the student's tests score on the national standardised test in math, standardised to have a mean of 0 and standard deviation of 1. The placebo norm is constructed as an index of various desired child characteristics, derived using source-country level of agreement with traits one would like children to learn from the World Values Survey. The characteristics are *Responsibility*, *Independence* and *Hard work*. These characteristics are chosen because they are intuitively, and empirically, positively related to math performance. The effects are estimated for a one-standard-deviation increase in the placebo norm index (0.07). Mothers' characteristics are cohort, education level, household income and family size. Standard errors are clustered at the source-country × cohort level. * p<0.1, ** p<0.05, *** p<0.01.

Table 9

Placebo: mitigation effect of other municipality characteristics

	(1)	(2)	(3)	(4)
Girl	-0.072***	-0.071***	-0.071***	-0.074***
	(0.027)	(0.027)	(0.027)	(0.026)
Mun income	0.012			
	(0.025)			
Girl × mother's norms	-0.066**	-0.067**	-0.067**	-0.065**
	(0.029)	(0.029)	(0.029)	(0.029)
Girls × mun income	-0.016	-0.018	-0.018	-0.018
	(0.023)	(0.023)	(0.023)	(0.023)
Girl × mother's norms × mun income	-0.004	-0.003	-0.003	-0.003
	(0.028)	(0.028)	(0.028)	(0.028)
R-squared	0.02	0.32	0.33	0.71
Observations	3,926	3,926	3,926	3,926
	Indicators			
Birth order	Yes	Yes	Yes	Yes
Cohort FE	Yes	Yes	Yes	Yes
Source country FE	No	Yes	Yes	No
Mun. × Im.Year FE	No	Yes	Yes	No
Mother characteristics	No	No	Yes	No
Sibling FE	No	No	No	Yes

Notes: The dependent variable is the student's test score on the national standardised tests in math, standardised to have a mean of 0 and standard deviation of 1. Municipality income is measured as average labour income of the assigned municipality, in the year in which the mother immigrated to Sweden. The effects are estimated for a one-standard-deviation increase in mothers' cultural gender norms (0.24), and a one-standard-deviation increase in municipality average income (SEK 15,097). Mothers' characteristics are cohort, education level, household income, family size and cultural density of assigned municipality. Standard errors are clustered at the assigned municipality × immigration year level. * p<0.1, ** p<0.05, *** p<0.01.

Table 10
Mothers' gender norm effect: without opposite-sex sibling restriction

	(1)	(2)	(3)	(4)
Girl	-0.069***	-0.064***	-0.061***	-0.068***
	(0.008)	(0.007)	(0.007)	(0.011)
Mother's norms	-0.100***			
	(0.021)			
Girl × mother's norms	-0.031***	-0.030***	-0.032***	-0.043***
	(0.008)	(0.008)	(0.007)	(0.012)
R-squared	0.01	0.09	0.16	0.70
Observations	79,264	79,264	79,264	79,264
	Indicators			
Birth order	Yes	Yes	Yes	Yes
Cohort FE	Yes	Yes	Yes	No
Source country & mun FE	No	Yes	Yes	No
Mother characteristics	No	No	Yes	No
Mother FE	No	No	No	Yes

Notes: The dependent variable is the student's test score on the national standardised tests in math, standardised to have a mean of 0 and standard deviation of 1. The sample consists of second-generation immigrants with a foreign-born mother, but without restricting the sample to families with at least one child of each gender. The effects are estimated for a one-standard-deviation increase in mothers' cultural gender norms (0.24). Mothers' characteristics are cohort, education level, household income and family size. Standard errors in parentheses are clustered at the source country × cohort level. * $p<0.1$, ** $p<0.05$, *** $p<0.01$.

Table 11

Mitigation effect: without opposite-sex sibling restriction

	(1)	(2)	(3)	(4)	(5)
Girl	-0.075***	-0.067***	-0.053***	-0.053***	-0.072***
	(0.024)	(0.018)	(0.017)	(0.017)	(0.024)
Girl × mother's norms	-0.066**	-0.039*	-0.034*	-0.034*	-0.066**
	(0.028)	(0.020)	(0.021)	(0.020)	(0.029)
Girl × mun FLFP		-0.041**	-0.048***	-0.048***	-0.040
		(0.017)	(0.017)	(0.017)	(0.025)
Girl × mother's norms × mun FLFP		0.034*	0.053**	0.050**	0.055**
		(0.020)	(0.022)	(0.021)	(0.026)
R-squared	0.69	0.01	0.17	0.19	0.69
Observations	12,303	12,303	12,303	12,303	12,303
			Indicators		
Birth order	Yes	Yes	Yes	Yes	Yes
Cohort FE	No	Yes	Yes	Yes	No
Source country FE	No	No	Yes	Yes	No
Mun. × Im.Year FE	No	No	Yes	Yes	No
Mother characteristics	No	No	No	Yes	No
Mother FE	Yes	No	No	No	Yes

Notes: The dependent variable is the student's test score on the national standardised tests in math, standardised to have a mean of 0 and standard deviation of 1. The sample consists of second-generation immigrants with an asylum-seeking mother who had been affected by the refugee placement policy, but without restricting the sample to families with at least one child of each gender. Municipality FLFP is measured at the assigned municipality, in the year in which the mother immigrated to Sweden. The effects are estimated for a one-standard-deviation increase in mothers' cultural gender norms (0.24), and a one-standard-deviation increase in municipality FLFP (0.07). Mothers' characteristics are cohort, education level, family size and cultural density of assigned municipality, which are all measured at time of immigration. Standard errors are clustered at the assigned municipality × immigration year level. * $p<0.1$, ** $p<0.05$, *** $p<0.01$.

Table 12

Effect of source-country norm measured at time of immigration

	(1)	(2)	(3)	(4)
Girl	-0.080***	-0.079***	-0.080***	-0.079***
	(0.015)	(0.015)	(0.015)	(0.015)
Mother's norms	-0.087	-0.125**	-0.051	
	(0.059)	(0.054)	(0.044)	
Girl × mother's norms	-0.029**	-0.028**	-0.028*	-0.029**
	(0.014)	(0.014)	(0.014)	(0.014)
R-squared	0.01	0.12	0.18	0.71
Observations	16,548	16,548	16,548	16,548
	Indicators			
Birth order	Yes	Yes	Yes	Yes
Cohort FE	Yes	Yes	Yes	Yes
Source country & mun FE	No	Yes	Yes	No
Mother characteristics	No	No	Yes	No
Sibling FE	No	No	No	Yes

Notes: The dependent variable is the student's test score on the national standardised test in math, standardised to have a mean of 0 and standard deviation of 1. Source-country norm is measured as 1-FLFP of the decade in which the mother immigrated to Sweden. For Somalia, labour force participation data from this period is not available; moreover, for Czechoslovakia and Lebanon I observe very few mothers with a migration date. Thus, these three source countries are excluded from the regressions. The effects are estimated for a one-standard-deviation increase in mothers' cultural gender norms (0.37). Mothers' characteristics are cohort, education level, household income and family size. Standard errors in parentheses are clustered at the source country × immigration decade level. * $p<0.1$, ** $p<0.05$, *** $p<0.01$.

Table 13

Other robustness checks: mothers' gender norm effect

	Drop FI + YU	Both immigrants	Max 5 years	WVS Uni	GGI norm	SES	Distance
Girl	-0.085***	-0.092***	-0.073***	-0.073***	-0.074***	-0.088***	-0.073***
	(0.014)	(0.016)	(0.011)	(0.011)	(0.011)	(0.020)	(0.011)
Girl × mother's norms	-0.030**	-0.025*	-0.041***			-0.039***	-0.038***
	(0.013)	(0.014)	(0.011)			(0.011)	(0.012)
Girl × mother's WVS norms				-0.047***			
				(0.011)			
Girl × mother's GGI norms					-0.043***		
					(0.011)		
Girl × mother's SES						0.004	
						(0.005)	
Girl × distance							-0.008
							(0.011)
R-squared	0.72	0.70	0.71	0.71	0.71	0.71	0.71
Observations	15,036	15,326	23,759	22,710	23,044	24,632	24,632
	Indicators						
Birth order	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cohort FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sibling FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: The dependent variable is the student's test score on the national standardised test in math, standardised to have a mean of 0 and standard deviation of 1. The effects are estimated for a one-standard-deviation increase in mothers' cultural gender norms (0.24). Column (1) drops Finland and Yugoslavia, the countries contributing to the largest immigrant inflow. Column (2) estimates the effect for only students' whose parents are both immigrants. Column (3) includes only siblings born a maximum of five years apart. Column (4) uses the source-country level of agreement with the statement *"A university education is more important for a boy than for a girl."* derived from the World Values Survey as an alternative measure of cultural gender norms, while column (5) uses the World Economic Forum's Gender Gap Index as a second alternative measure (the norm measure is defined as 1-GGI). Column (6) controls for a potential gender gap effect of mothers' socio-economic status (measured by education level), while column (7) controls for a potential gender gap effect of geographical distance between source-countries and Stockholm, Sweden. All regressions are controlling for birth order, sibling-pair and cohort fixed effects. Standard errors in parentheses are clustered at the source country × cohort level. * p<0.1, ** p<0.05, *** p<0.01.

Table 14

Other robustness checks: mitigation effect

	Drop big mun	Both immigrants	Max 5 years	WVS Uni	Wage ratio	SES	Distance
Girl	-0.084***	-0.077***	-0.073***	-0.068**	-0.072***	-0.069	-0.073***
	(0.032)	(0.028)	(0.026)	(0.028)	(0.026)	(0.055)	(0.027)
Girl × mother's norms	-0.023	-0.052*	-0.061**		-0.061**	-0.063**	-0.063**
	(0.037)	(0.030)	(0.030)		(0.029)	(0.029)	(0.029)
Girl × mother's norms × mun FLFP	0.083**	0.039	0.052*			0.052**	0.051**
	(0.035)	(0.027)	(0.027)			(0.025)	(0.025)
Girl × mother's WVS norms				-0.058**			
				(0.029)			
Girl × mother's WVS norms × mun FLFP				0.053*			
				(0.028)			
Girl × mother's norms × mun wage ratio					0.058**		
					(0.025)		
Girl × mother's SES						-0.001	
						(0.015)	
Girl × mother's SES × mun FLFP						-0.016	
						(0.014)	
Girl × distance							-0.013
							(0.029)
Girl × distance × mun FLFP							0.008
							(0.024)
R-squared	0.71	0.70	0.71	0.70	0.71	0.71	0.71
Observations	2,904	3,656	3,816	3,708	3,926	3,926	3,926
	Indicators						
Birth order	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cohort FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sibling FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: The dependent variable is the student's test score on the national standardised test in math, standardised to have a mean of 0 and standard deviation of 1. The effects are estimated for a one-standard-deviation increase in mothers' cultural gender norms (0.24), and a one-standard-deviation increase in municipality FLFP (0.07). Column (1) drops Stockholm, Gothenburg and MalmÃű. Column (2) estimates the effect for only students' whose parents are both immigrants. Column (3) includes only siblings born a maximum of five years apart. Column (4) uses source-country level of agreement with the statement *"A university education is more important for a boy than for a girl."* derived from the World Values Survey as an alternative measure of gender norms. Column (5) estimates the mitigation effect with an alternative measure of municipality gender equality: the average female-to-male wage ratio. Column (5) controls for a potential gender gap effect of mothers' socio-economic status (measured by education level), while column (7) controls for a potential gender gap effect of geographical distance between source countries and Stockholm, Sweden. Standard errors in parentheses are clustered at the assigned municipality × immigration year level. * p<0.1, ** p<0.05, *** p<0.01.

Appendix

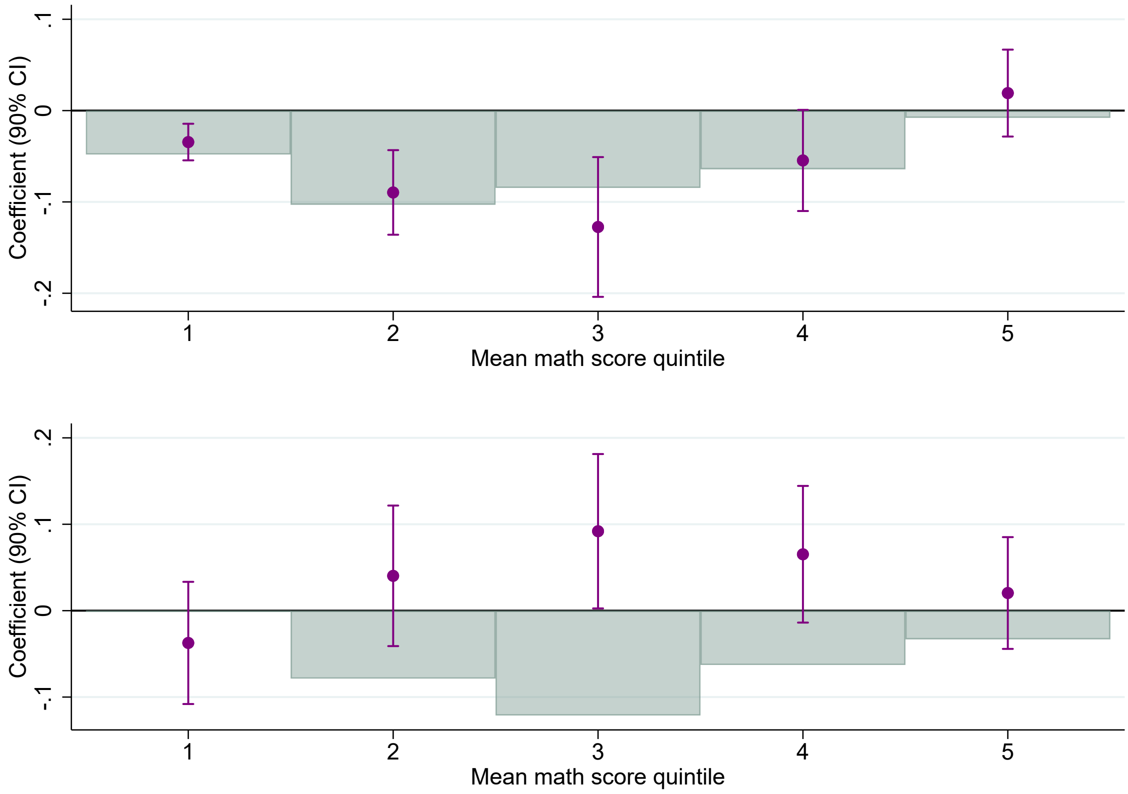
Table A1
Effect of mothers' gender norms on the gender gap in birth weight

	(1)	(2)	(3)	(4)
Girl	-136.462***	-136.284***	-135.764***	-134.678***
	(7.696)	(7.615)	(7.506)	(4.729)
Mother's norms	-40.294***			
	(7.045)			
Girl × mother's norms	-8.203	-8.095	-8.107	-8.576*
	(8.165)	(8.157)	(8.037)	(4.901)
R-squared	0.03	0.06	0.07	0.75
Observations	24,135	24,135	24,135	24,135
	Indicators			
Birth order	Yes	Yes	Yes	Yes
Cohort FE	Yes	Yes	Yes	Yes
Source country & mun FE	No	Yes	Yes	No
Mother characteristics	No	No	Yes	No
Sibling FE	No	No	No	Yes

Notes: The dependent variable is birth weight, measured in grams. The effects are estimated for a one-standard-deviation increase in mothers' cultural gender norms (0.24). Mothers' characteristics are cohort, education level, household income and family size. Standard errors in parentheses are clustered at the source-country × cohort level. * p<0.1, ** p<0.05, *** p<0.01.

Figure A1

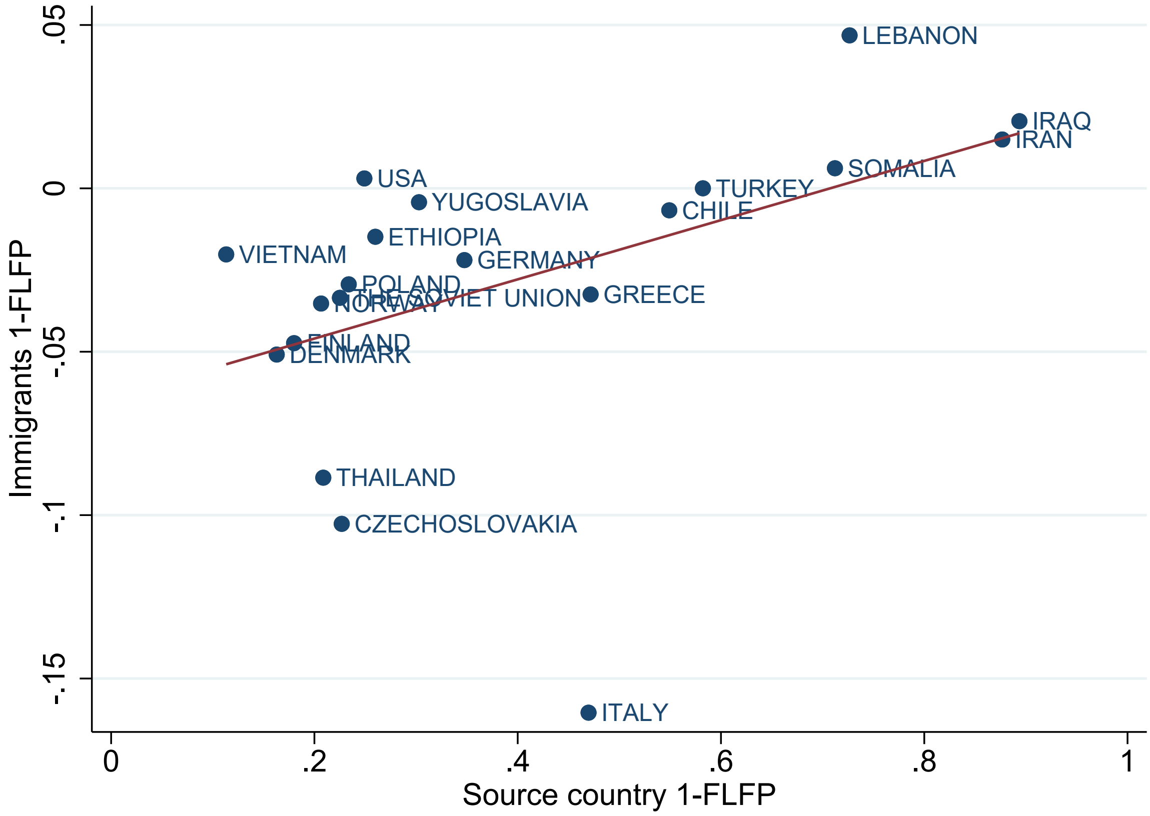
Heterogeneity: gender norm effect by math performance



Notes: The top panel plots the effect of mothers' cultural gender norms on the gender gap in math, when the effect is allowed to differ by the average math performance quintile of the siblings. The bottom panel plots the municipality mitigation effect over the same average math performance quintiles. The figure plots 90% confidence intervals. The dependent variable is the student's test score on the national standardised test in math, standardised to have a mean of 0 and standard deviation of 1. The bars indicate the average gender gap in math scores per quintile.

Figure A2

Correlation: source-country and immigrant 1-FLFP rates



Notes: The figure plots the correlation between source-country 1-FLFP rates and the average current 1-FLFP rate of the first generation. The correlation coefficient is 0.57.

Table A2

Effect of parents' average gender norms on the math gender gap

	(1)	(2)	(3)	(4)
Girl	-0.068***	-0.068***	-0.068***	-0.068***
	(0.013)	(0.013)	(0.013)	(0.012)
Avg. norms	-0.157***	-0.066*	-0.029	
	(0.021)	(0.036)	(0.034)	
Girl × avg. norms	-0.044***	-0.043***	-0.044***	-0.044***
	(0.013)	(0.013)	(0.013)	(0.011)
R-squared	0.04	0.12	0.18	0.71
Observations	23,418	23,418	23,418	23,418
	Indicators			
Birth order	Yes	Yes	Yes	Yes
Cohort FE	Yes	Yes	Yes	Yes
Source country & mun FE	No	Yes	Yes	No
Parent characteristics	No	No	Yes	No
Sibling FE	No	No	No	Yes

Notes: The dependent variable is the student's test score on the national standardised test in math, standardised to have a mean of 0 and standard deviation of 1. The sample consists of second-generation immigrants defined by a foreign-born mother. The effects are estimated for a one-standard-deviation increase in parents' average cultural gender norms ((mothers' 1-FLFP + fathers' 1-FLFP)/2). Parents' characteristics are cohort, education level, household income and family size. Standard errors in parentheses are clustered at the mother's source country × father's source country level. * $p<0.1$, ** $p<0.05$, *** $p<0.01$.

Table A3

Parents' average gender norms: municipality mitigation effect

	(1)	(2)	(3)	(4)	(5)
Girl	-0.078***	-0.073***	-0.073***	-0.073***	-0.077***
	(0.027)	(0.027)	(0.027)	(0.027)	(0.027)
Girl × avg. norms	-0.063**	-0.060**	-0.061**	-0.061**	-0.060**
	(0.029)	(0.030)	(0.029)	(0.030)	(0.029)
Girl × mun FLFP		-0.038	-0.041	-0.041	-0.040
		(0.026)	(0.026)	(0.026)	(0.026)
Girl × avg. norms × mun FLFP		0.045*	0.043	0.044*	0.044*
		(0.027)	(0.027)	(0.027)	(0.026)
R-squared	0.70	0.02	0.33	0.34	0.70
Observations	3,696	3,696	3,696	3,696	3,696
			Indicators		
Birth order	Yes	Yes	Yes	Yes	Yes
Cohort FE	Yes	Yes	Yes	Yes	Yes
Source country FE	No	No	Yes	Yes	No
Mun. × Im.Year FE	No	No	Yes	Yes	No
Parent characteristics	No	No	No	Yes	No
Sibling FE	Yes	No	No	No	Yes

Notes: The dependent variable is the student's test score on the national standardised test in math, standardised to have a mean of 0 and standard deviation of 1. Municipality FLFP is measured at the assigned municipality, in the year in which the mother immigrated to Sweden. The sample consists of second generation immigrants defined by an asylum-seeking mother affected by the refugee placement policy. The effects are estimated for a one-standard-deviation increase in parents' average cultural gender norms ((mothers' 1-FLFP + fathers' 1-FLFP)/2), and a one-standard-deviation increase in municipality FLFP (0.07). Parents' characteristics are cohort, education level, family size and cultural density of assigned municipality, all of which are measured at time of immigration. Standard errors are clustered at assigned municipality × immigration year level. * $p<0.1$, ** $p<0.05$, *** $p<0.01$.

Table A4

Effect of fathers' gender norms on the math gender gap

	(1)	(2)	(3)	(4)
Girl	-0.063***	-0.063***	-0.064***	-0.063***
	(0.013)	(0.012)	(0.012)	(0.010)
Father's norms	-0.166***			
	(0.022)			
Girl × father's norms	-0.041***	-0.040***	-0.040***	-0.042***
	(0.012)	(0.012)	(0.011)	(0.009)
R-squared	0.04	0.12	0.18	0.72
Observations	27,740	27,740	27,740	27,740
	Indicators			
Birth order	Yes	Yes	Yes	Yes
Cohort FE	Yes	Yes	Yes	Yes
Source country & mun FE	No	Yes	Yes	No
Father characteristics	No	No	Yes	No
Sibling FE	No	No	No	Yes

Notes: The dependent variable is the student's test score on the national standardised test in math, standardised to have a mean of 0 and standard deviation of 1. The effects are estimated for a one-standard-deviation increase in fathers' cultural gender norms (0.25). Fathers' characteristics are cohort, education level, household income and family size. Standard errors in parentheses are clustered at the source-country × cohort level. * $p<0.1$, ** $p<0.05$, *** $p<0.01$.

Table A5

Balance test for refugee placement policy: fathers

	(1)	(2)	(3)	(4)
	Outcome: assigned mun FLFP			
Father's norms	-0.090**	-0.063*	-0.062*	-0.062*
	(0.037)	(0.037)	(0.036)	(0.037)
Cultural density		0.189***	0.193***	0.193***
		(0.036)	(0.036)	(0.035)
Father's education		0.000	0.004	0.004
		(0.014)	(0.014)	(0.014)
Family size		-0.056**	-0.053**	-0.055*
		(0.025)	(0.026)	(0.029)
Father's cohort				-0.001
				(0.006)
R-squared	0.01	0.05	0.06	0.06
Observations	3,368	3,368	3,368	3,368
	Indicators			
Immigration year FE	No	No	Yes	Yes

Notes: The table reports the correlation between municipality FLFP and fathers' source-country gender norms and individual characteristics. The dependent variable is the FLFP of the assigned municipality. All fathers' characteristics are measured at the time of immigration. Standard errors are clustered at the assigned municipality × immigration year level. * $p<0.1$, ** $p<0.05$, *** $p<0.01$.

Table A6
Municipality mitigation effect: fathers

	(1)	(2)	(3)	(4)	(5)
Girl	-0.082***	-0.085***	-0.085***	-0.083***	-0.085***
	(0.028)	(0.028)	(0.028)	(0.028)	(0.028)
Girl × father's norms	-0.023	-0.025	-0.025	-0.023	-0.024
	(0.029)	(0.030)	(0.029)	(0.029)	(0.029)
Girl × mun FLFP		0.016	0.014	0.014	0.009
		(0.026)	(0.026)	(0.026)	(0.026)
Girl × father's norms × mun FLFP		-0.027	-0.027	-0.026	-0.026
		(0.029)	(0.029)	(0.029)	(0.029)
R-squared	0.71	0.01	0.33	0.34	0.71
Observations	3,368	3,368	3,368	3,368	3,368
			Indicators		
Birth order	Yes	Yes	Yes	Yes	Yes
Cohort FE	Yes	Yes	Yes	Yes	Yes
Source country FE	No	No	Yes	Yes	No
Mun. × Im.Year FE	No	No	Yes	Yes	No
Father characteristics	No	No	No	Yes	No
Sibling FE	Yes	No	No	No	Yes

Notes: The dependent variable is the student's test score on the national standardised test in math, standardised to have a mean of 0 and standard deviation of 1. Municipality FLFP is measured at the assigned municipality, in the year in which the father immigrated to Sweden. The effects are estimated for a one-standard-deviation increase in fathers' cultural gender norms (0.25), and a one-standard-deviation increase in municipality FLFP (0.07). Fathers' characteristics are cohort, education level, family size and cultural density of assigned municipality, all of which are measured at time of immigration. Standard errors are clustered at the assigned municipality × immigration year level. * p<0.1, ** p<0.05, *** p<0.01.