Ethnic ingroup friendships in schools: Testing the by-product hypothesis in England, Germany, the Netherlands and Sweden

Sanne Smith [a,b,*], Ineke Maas [a,c], Frank van Tubergen [a,b,d]

[a] Department of Sociology/ICS, Utrecht University, Padualaan 14, 3584 CH Utrecht, The Netherlands
[b] ERCOMER (European Research Centre on Migration and Ethnic Relations)/ICS, Utrecht University, Padualaan 14, 3584 CH Utrecht, The Netherlands
[c] Department of Sociology, VU University Amsterdam, De Boelelaan 1081, 1081 HV Amsterdam, The Netherlands
[d] Department of Sociology & Social Work, King Abdul Aziz University, Abdullah Suleiman Street, Al Jamiaa District 80200, Saudi Arabia

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ABSTRACT

This study set out to examine to what extent ethnic ingroup friendship in secondary school classes are a by-product of cultural and socioeconomic ingroup friendship. Based on homophily theory, we expected similar opinions, leisure activities, religion, risk behaviour and socioeconomic factors to (partly) explain ethnic ingroup preferences. Multilevel p_2 models on 13,272 pupils in 625 secondary school classes in England, Germany, the Netherlands and Sweden showed that adolescents tend to have friends similar in ethnicity, cultural and socioeconomic characteristics. We find no evidence, however, that ethnic homophily is explained by cultural and socioeconomic homophily.

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1. Introduction

Friendships of adolescents are segregated along ethnic boundaries in many countries, as has been shown in the United States (Currarini et al., 2010; Mouw and Entwisle, 2006; Zeng and Xie, 2008), Israel (Eshel and Kurman, 1990), and the Netherlands (Vermeij et al., 2009). Scholars have argued that ethnic segregation in friendships is due to limited opportunities to meet adolescents of a different ethnicity, and, beyond opportunities, also caused by preferences to befriend same ethnic peers, i.e., ethnic homophily (Mouw and Entwisle, 2006; Vermeij et al., 2009).

Such ethnic ingroup preferences are usually explained by the idea that co-ethnic peers have more in common with each other than peers of different ethnic groups (Byrne, 1971; McPherson et al., 2001). Sharing the same ethnicity, so is argued, is related to similar behaviour, resources, attitudes and tastes, which facilitate joint activities and understanding. In order to properly address to what extent adolescents prefer same-ethnic friends over interethnic friends, it is therefore necessary to examine to what extent ethnic homophily is a by-product of homophily with respect to

behaviour, resources, attitudes or tastes. For example, if ethnicity and religion are correlated, choosing friends with the same religion is likely to result in choosing co-ethnic friends, whereas ethnic in-group preferences are not necessarily present.

The idea that ethnic homophily can be explained by homophily on other characteristics – what we will call the 'by-product hypothesis' – has been tested in several studies. Previous research found that ethnic homophily cannot be explained by similarity in terms of age, gender or parental socio-economic status (e.g., Hamm et al., 2005; Mouw and Entwisle, 2006; Shrum et al., 1988). Some studies tested the by-product hypothesis in terms of cultural taste, political orientation and club memberships for US college students (Marmaros and Sacerdote, 2006; Mayer and Puller, 2008). Based on on-line social network data (i.e., Facebook and e-mail traffic), these studies found that social relations between students are partly based on other characteristics than ethnicity, but they explained only little of ethnic ingroup friendship.

Another study focused on music preferences, deviant behaviour, going out and school behaviour (Stark and Flache, 2012). Using data on adolescents in the Dutch city of Arnhem, Stark and Flache (2012) showed evidence for the by-product hypothesis in a selection of the studied classes (i.e., 16%). In these classes, ethnicity is correlated to one of the other characteristics (e.g., deviant behaviour) and similarity on the other characteristics also drives friendship choice.

In this study, we pose the following research question: *to what extent is the overall ethnic homophily tendency among adolescents a*

* Corresponding author at: Department of Sociology/ICS, Utrecht University, Padualaan 14, 3584 CH Utrecht, The Netherlands. Tel.: +31 30 2534075; fax: +31 30 253 4405.
E-mail addresses: s.smith@uu.nl (S. Smith), i.maas@uu.nl (I. Maas), f.vantubergen@uu.nl (F. van Tubergen).

by-product of homophily on other characteristics? We aim to contribute to previous research in three ways.

First, we study many different cultural and socioeconomic characteristics one-by-one that can possibly explain ethnic homophily. Some studies modelled basic demographic characteristics (Hamm et al., 2005; Mouw and Entwisle, 2006; Shrum et al., 1988), included all homophily characteristics simultaneously or in combination with other predictors (Marmaros and Sacerdote, 2006; Mayer and Puller, 2008), or included the strongest correlating type of homophily per school class and modelled different types of homophily as one parameter (e.g., in some class it is similarity in deviant behaviour, in another class it is similarity in music taste) (Stark and Flache, 2012). It is therefore not sufficiently clear from previous research which *specific* characteristic might explain what part of the *overall pattern* of ethnic homophily. For example, did religious homophily or homophily on music taste contribute to the explanation ethnic homophily? In this study, we specifically examine possible mediators and provide a more detailed test of the by-product hypothesis as such.

Second, most leading studies that address the by-product hypothesis were restricted to limited convenience samples of university students and proxy measures of friendship in the US (Marmaros and Sacerdote, 2006; Mayer and Puller, 2008; Wimmer and Lewis, 2010), or to one particular city in the Netherlands (Stark and Flache, 2012). We test the by-product hypothesis for adolescents of all educational levels in a large number of secondary schools with nationally representative data across different countries. As such, our study increases the generalizability of conclusions. We research adolescent ingroup friendships in four European countries: England, Germany, the Netherlands and Sweden.

Third, previous research has studied the by-product hypothesis using logistic models without taking into account that coefficients in those models cannot be readily compared (Marmaros and Sacerdote, 2006; Mayer and Puller, 2008; Stark and Flache, 2012; Wimmer and Lewis, 2010). The size of coefficients in the family of logistic models depends on the total variance explained within models. As a result, coefficients of previously added variables do not only change because of mediation, but also because of rescaling whenever variables are added to the model (Kohler et al., 2011). This could imply that the size of the ethnic homophily coefficient in logistic models goes up when adding variables to the model that affect friendship choice but are uncorrelated with ethnic homophily. Mediation and rescaling effects work in opposite directions (decrease and increase of coefficients, respectively), so that mediation effects become obscured. In this study, we improve on previous research by addressing the rescaling issue by y-standardization.

We use the first wave of the 'Children of Immigrants Longitudinal Study for Four European Countries' project (from hereafter, CILS4EU) to test our hypotheses (Kalter et al., 2013). These data constitute a nationally representative sample of 18,716 pupils (around 15 years old) in England, Germany, the Netherlands and Sweden. The data contain information about native pupils and first and second generation immigrant pupils. We define ethnic groups by pupil's parental birth countries, as is common in European ethnic research (Baerveldt et al., 2004, 2007; Lubbers et al., 2010; Vermeij et al., 2009; Zijlstra et al., 2006).

Because we use cross-sectional data, we examine the structure of friendship networks on a specific moment and we cannot examine the dynamic process that underlies friendship choice. Therefore, we cannot single out actual preferences, as there are many other mechanisms that may have caused a friendship to develop. In this study, we approximate ethnic homophily (i.e., a preference) by examining the relative frequency of ingroup and outgroup friendships taking the opportunities to have such friends into account.

Ethnic homophily thus relates to the tendency to have more ethnic ingroup friends than is expected from the opportunity structure alone.

As we study four countries, we will provide a short description of relevant immigrant groups in these countries in the next section before we discuss our theoretical framework, data, methods, results and conclusions. Our dataset includes children of immigrants of circa 100 countries. All these pupils are included in our analysis, but we only explicitly describe and analyze the largest and most salient immigrant groups in the four countries.

2. Children of immigrants in England, Germany, the Netherlands and Sweden

Although Western-European countries have their own immigration history, they share similarities in the types of immigrants that have settled. Western-European countries at first recruited low educated foreign workers from the European periphery in the 1950s and later from Turkey and Morocco in the 1960s in order to meet demands of production expansion (Castles and Miller, 2003; Rystad, 1992). Because of chain migration (i.e., migration of extended kin and friends long after the first labour immigrants arrived) and marriages with partners from the country of origin, children of Turkish immigrants in Germany, Sweden and the Netherlands, Italian immigrants in Germany, and Moroccan immigrants in the Netherlands account for a large part of the immigrant adolescent population.

Second, there is a considerable group of children of immigrants from post-colonial countries. These include children of Indian, Pakistani and Caribbean immigrants in England and children of Surinamese, Antillean and Aruban immigrants in the Netherlands. In the process of de-colonization by the beginning of the 1950s to the 1970s, a large share of the colonized countries' population chose to immigrate to England and the Netherlands with an economic motivation (Castles and Miller, 2003). Due to chain migration and marriage migration, children of post-colonial immigrants still constitute a considerable share of immigrant children.

Third, refugee immigrants and their children fled from war or conflict in their home country (Castles and Miller, 2003). Examples are Iraqi, Bosnian and Lebanese immigrants in Sweden and Nigerian immigrants in England. These groups are generally relatively new immigrant groups.

Lastly, some immigrant groups originate from neighbouring countries, like Polish immigrants in Germany. Children from Russian immigrants in Germany make up an exceptional group. A considerable share of them are known as 'ethnic Germans' and descent from Germans who emigrated to Russia and repatriated (Castles and Miller, 2003).

Immigrant groups per country vary in their socioeconomic and cultural integration. Immigrants from neighbouring countries are highly similar to the native population and are therefore known to blend relatively easy into the host society. In contradiction, many labour and post-colonial immigrant groups struggle with educational and socioeconomic deprivation (Algan et al., 2010; Rystad, 1992; Van Amersfoort and Van Niekerk, 2006). This is usually explained as a consequence of recruiting low educated immigrant workers for low-cost and unskilled labour. Also, efforts to socioeconomically integrate immigrants have been minor at first as the Dutch and German government expected guest workers to stay temporarily (Algan et al., 2010; Castles and Miller, 2003).

In addition, many large labour and post-colonial immigrant groups also culturally differ from the native population as they adhere to Islam instead of Christianity (i.e., Pakistani, Turks and Moroccans). For these groups, the process of cultural integration has been considered more difficult, which has raised concern

in England, Germany, the Netherlands and Sweden (Castles and Miller, 2003).

3. Theory

3.1. Homophily on multiple characteristics

According to homophily theory, adolescents prefer similar peers over dissimilar peers as their friends with respect to almost any social category (e.g., gender, social class or ethnicity). The core argument behind this statement is that similar adolescents are more likely to share the same cultural characteristics (e.g., norms, values and interests) or socioeconomic characteristics (e.g., parental occupational status), which facilitate agreement, understanding and enjoying the same activities together (Ibarra, 1993; Ingram and Morris, 2007; Kandel, 1966). In the following sections, we theorize about possible cultural and socioeconomic characteristics that may explain ethnic ingroup friendships. There are many selection criteria that adolescents use to befriend, but we focus on those that are likely to intersect with ethnicity. In our study, we focus on multiple immigrant and native groups. Both the strength of ethnic homophily and the extent to which friendships on other characteristics explain can vary across these groups. Therefore, we will distinguish between the largest groups in our analyses. We do not, however, derive group-specific hypotheses as we have no clear theoretical expectations concerning them.

3.1.1. Cultural homophily

First, we consider normative opinions. Having similar normative opinions is likely to increase understanding and decrease disagreement between adolescents, making such friendships attractive (Urberg et al., 1998). Specifically, we examine tolerance towards several issues (i.e., unmarried cohabitation, divorce, homosexuality, abortion). Even though adolescents may not discuss these topics on a daily basis, these opinions reflect a certain worldview that adolescents hold.

Most non-Western immigrant groups in England, Germany, the Netherlands and Sweden are considered to be more conservative than the native population. For example, Turkish, Moroccan, Indian and Pakistani cultures generally disapprove of homosexuality, abortion and divorce (Shah, 1960; Uunk, 2003). Many Western-European countries, however, have become increasingly tolerant towards such issues. This is illustrated by legislation, such as legal abortion in most Western-European countries and same-sex marriage (the Netherlands, Sweden and England) or by an official alternative type of same-sex partnership (Germany). Other immigrant groups are known to be less conservative. For example, immigrants from neighbouring countries are likely to hold more or less similar normative opinions as native adolescents. Because of differences in normative opinions across groups, we hypothesize that ethnic homophily can be partly explained by homophily on normative opinions (H1).

Second, we argue that adolescents are likely to prefer friends who have similar leisure activities as it helps them in the development of their identity and self-esteem (Kelly and Godbey, 1992). Sharing similar leisure activities provides shared matters to talk about and possibilities to engage in the preferred activity. Consequently, adolescents who have similar leisure activities are more likely to become friends with each other.

In this study, we will focus on adolescents being similar in going out to the cinema, parties, concerts and bars; playing computer games; and reading. We expect adolescents to differ on whether or not they do these activities and we think they would enjoy friends similar in these hobbies (going out alone is not very common and it is fun to discuss the books you read and the games you play with

peers). There is little research on ethnically bound leisure activities of European adolescents, but US studies suggest differences in leisure activities (Busser et al., 1996; Stodolska and Yi, 2003). Examining to what extent going out, playing computer games and reading explains ethnic ingroup friendship is in this respect explorative, as it is not clear how ethnic groups differ regarding these activities. Considering the importance of leisure activities for adolescent friendship, we hypothesize that ethnic homophily can be partly explained by homophily on leisure activities (H2).

Third, sharing the same religion increases the likelihood of a friendship (Brashears, 2008; Verbrugge, 1977). It can be argued that adolescents prefer same-religious peers as friends above peers with a different religion because such peers share a similar worldview and comply with accompanying behavioural guidelines. This provides social confirmation of each other's opinions and a common ground to talk about.

Religious beliefs are known to depend upon the dominant religion(s) in the country of origin and parental religious beliefs (Kelley and Graaf, 1997). Hence, the far majority of the Turkish, Moroccan and Pakistani children of immigrants consider themselves Muslim. Children from predominant Christian countries such as Poland or Ireland are likely to be Christian themselves, similar to a large part of natives in Germany and England, but different from a large share of non-religious children in secularized countries as the Netherlands and Sweden. In addition, some countries and corresponding immigrant groups are religiously diverse (e.g., India and Surinam). Considering the close relation between ethnicity and religion, it is possible that the choice for a friend with the same religion simultaneously results in a choice for a same-ethnic friend. Therefore, we hypothesize that ethnic homophily can be partly explained by religious homophily (H3).

Furthermore, it can be expected in line with homophily theory that adolescents choose friends who are similar in terms of smoking, drinking alcohol and delinquency (Knecht et al., 2010; Vries et al., 2006). Adolescence is a period in life during which many young people start exploring such risk behaviour. Diverging in risk behaviours is likely to inhibit friendship, as the activities that peers could undertake together are either not risky enough for the more thrill seeking adolescent or too risky for the adolescent who wishes to avoid trouble. Also, it is difficult to maintain a friendship if peers disapprove of each other's behaviour. Previous research has shown that risk behaviour varies between ethnic groups (Vries et al., 2006; Williams et al., 1999). For example, immigrant children with an Islamic background are not allowed to drink alcohol (Van Tubergen and Poortman, 2010), and the deprived socioeconomic status of some immigrant groups can be related to increased criminal activity (Tonry, 1993). Hence, we hypothesize that ethnic homophily can be partly explained by homophily on risk behaviour (H4).

3.1.2. Socioeconomic homophily

Besides cultural characteristics, we also consider socioeconomic characteristics. Less affluent adolescents may be unable to participate in the activities that more affluent peers undertake or a difference in economic resources, and related issues such as wearing certain brands, may cause adolescents to look down on each other. Therefore, similarity in socioeconomic resources may be an important characteristic for friendship. There are two socioeconomic characteristics we consider, namely parental socioeconomic status and the amount of money adolescents are able to spend freely. In general, previous research has found non-Western immigrant adolescents' parents to have a lower socioeconomic status than native adolescents' parents (Schnepf, 2007). Adolescents also differ in the amount of money they themselves can spend, that is the amount of pocket money and/or income from part-time jobs. This represents another flow of economic resources that is not necessarily related to parental socioeconomic status. Adolescents with less

affluent parents may compensate their parental economic status with taking part-time jobs and adolescents with high socioeconomic status parents do not necessarily receive much pocket money. All in all, we hypothesize that ethnic homophily can be partly explained by homophily on socioeconomic characteristics (H5).

4. Method

4.1. Data

We analyze the first wave data of the Children of Immigrants Longitudinal Study in Four European Countries (CILS4EU) project (Kalter et al., 2013). These data constitute a nationally representative sample of 18,716 pupils (±15 years old) within 958 classes in 480 regular secondary schools and were collected between October 2010 and June 2011 in England, Germany, the Netherlands and Sweden.

The sample is stratified on the proportion of non-Western immigrants (first and second generation) in a school. Within strata, schools were selected with a probability proportional to their size (using the number of pupils in the relevant educational level) and at least two classes were asked to participate per school (simple random sampling).

If a school refused to participate, a similar school in terms of educational level was chosen within the same stratum as a replacement, until such a similar school agreed to participate. The overall response rate of schools is 83.2% after replacement (England = 65.6%, Germany = 98.6%, the Netherlands = 91.7%. Sweden = 76.8%).[1]

Parents had received information about the study in advance and could object to their children participating (England < 0.01%, the Netherlands = 1.19%, and Sweden < 0.01%[2]) or needed to provide a written consent for their children's participation (Germany = 85%). In addition, adolescents themselves could refuse to participate or be absent on the day of interview (England = 19.5%, Germany = 4.16%, the Netherlands = 8.8%, Sweden = 13.9%[3]). The overall response rate for pupils is 85%. Table 1 shows the number of schools, classes and pupils in the complete dataset. Additionally, it shows the number of pupils by national origin.

The questionnaires were carefully tested in advance by a cognitive pre-test and a pilot study. During the actual field work, trained field workers introduced and assisted adolescents with the questionnaires and at least one teacher was present during the process to safeguard order.

4.2. Measurement

4.2.1. Dependent variable (dyad level)

To measure friendship between pupils we used the item 'who are your best friends in class?'. Each student was given a class roster that listed all class members by their name and an assigned number. With the use of this list, students were asked to nominate their best friends in class by writing down the corresponding numbers with a maximum of five nominations. We consider non-reciprocal friendships, meaning that a nomination from ego to alter does not necessarily imply a nomination from alter to ego. Adolescents were allowed to nominate fellow pupils who were absent for

Table 1
N of schools, classes and pupils.

Country		N
England	Schools	107
	Classes	214
	Pupils	4,315
	Native	2,654
	Pakistan	319
	India	185
	Jamaica	91
	Nigeria	62
	Other western country	446
	Other non-western country	551
	Unknown	7
Germany	Schools	144
	Classes	271
	Pupils	5,013
	Native	2,865
	Turkey	726
	Russia	189
	Poland	149
	Italy	129
	Other western	609
	Other non-western	342
	Unknown	5
The Netherlands	Schools	100
	Classes	222
	Pupils	4,363
	Native	3,015
	Turkey	269
	Morocco	248
	Suriname	167
	Dutch Antilles/Aruban	73
	Other western country	349
	Other non western country	242
	Unknown	0
Sweden	Schools	129
	Classes	251
	Pupils	5,025
	Native	2,836
	Ìraq	212
	Bosnia-Herzegovina	125
	Turkish	113
	Lebanon	109
	Other western country	904
	Other non western country	731
	Unknown	0

Source: "Children of Immigrants Longitudinal Survey in 4 European Countries", own calculations.

a short period (due to illness or truancy for example), whose parents did not allow participation or who refused to participate, but we discarded these nominations as all accompanying attribute data of these alters is missing.

4.2.2. Independent variables (dyad level)

The independent variables measure similarity between ego and alter attributes. For categorical variables, adolescents are considered different (0) if ego and alter have a different response and the same (1) if ego and alter have the same response. For continuous variables, we compute the absolute difference between ego and alter's score on a variable. We multiply the absolute difference by −1, so that a higher value (negative, but closer to 0) refers to being more similar and a lower value (increasingly smaller than 0) refers to being less similar.

We define ethnicity by the adolescents' parental birth countries (cf. Stark and Flache, 2012; Vermeij et al., 2009). If both parents are native born in England, Germany, the Netherlands or Sweden, the adolescent is considered to belong to the native group in that particular country. If an adolescent or at least one of the parents is born abroad, we consider the pupil to have an immigrant background (39.51% of the pupils).

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[1] Sweden did not apply a replacement strategy, but had a high school response rate without replacing schools that refused to participate.

[2] Swedish refusal rates include both refusal by parent as by child as they were not registered separately.

[3] It is not possible to distinguish between refusal and absence in England and Germany. The Swedish percentage includes parental refusal (<0.01% of total approached adolescents). In the Netherlands, 0.39% of the pupils refused to participate explicitly.

We distinguish the largest, most salient immigrant groups. A group is considered large enough if we can examine at least 10 classes with more than 1 member of a particular immigrant group. In England, we distinguish between native, Pakistani, Indian, Jamaican, other Western and other non-Western immigrant pupils. In Germany, we do the same for natives, Turkish, Russian, Polish, Italian, other Western and other non-Western immigrants. We examine natives, Turkish, Moroccan, Surinamese, other Western and other non-Western immigrant pupils in the Netherlands. Finally, we study natives, Iraqi, Turkish, Bosnian, Lebanese, other Western and other non-Western immigrant pupils in Sweden.

The broad categories 'other Western immigrants' and 'other non-Western' immigrants are less informative than the specific categories, as ties between pupils of different groups are implied to be ingroup ties. For example, ties between Nigerian and Kenyan pupils are for simplicity modelled as ingroup ties. Due to the relative small size of classrooms, children from these Western and non-Western rest-categories hardly ever meet in-group peers in class, and hence, it is not of specific interest to model their preference for in-group friends explicitly.

We measure normative opinions by four items about tolerance towards several topics. Adolescents indicated if they considered living together as a couple without being married, divorce, abortion and homosexuality as being 'ok', 'often ok', 'sometimes ok' or 'never ok'. A higher score on these items refers to having a more liberal opinion about these issues. From these items, we computed the scale normative opinions (Cronbach's α: 0.70 (England), 0.67 (Germany), 0.68 (the Netherlands), 0.74 (Sweden)), by taking the mean of the four items.

Religion is measured by differentiating between pupils reporting themselves being Christian, Islamic, non-religious and pupils adhering to another religion. In practice, it is difficult to separate religion from ethnicity. For example, 96% of Turkish and Moroccan pupils in the Netherlands consider themselves Muslim, whereas the majority of native Swedish and Dutch report to have no religion. Therefore, we decided to focus on strong religiosity. We categorized pupils to a certain religion only if they reported to practice the religion actively, because we expect that religion is more salient in that case. We assume adolescents to practice their religion actively if they pray more than once a month. We think it is a fair assumption that religious boundaries in friendship are less strong for less religious adolescents and because of this focus on strong religiosity, we acquire sufficient variation in religious denomination within ethnic groups to test our hypothesis. As such, it is reasonable to categorize non-active religious adolescents in the reference group of non-religious adolescents.

We distinguish between four types concerning religion (active Christian, active Muslim, active in a different religion, and not religiously active), but model the dyadic variable of having the same religion with one parameter as we have no differential hypotheses concerning religious ingroup friendships and the mediation of ethnic ingroup friendships. The variable 'same religion' returns to one if ego and alter are within the same religious category (i.e., ego and alter are active Christians) and to zero if they are not (i.e., ego is not religiously active and alter is active Christian, or ego is an active Muslim and alter is an active Christian).

Leisure activities were measured by three variables. First, adolescents indicated on a five-point scale ('every day', 'once or multiple times a week', 'once or multiple times a month', 'less often' or 'never') how often they usually go to the cinema. Also they were asked how often they visited pub/bar/nightclub/party and how often they go to a concert or a dj-event. We took the mean of these three items to reflect going out. Second, adolescents reported on the same five-point scale how often they usually read a book (not for school). Third, adolescents indicated on a five-point scale ('more than 2 h a day', 'about 2 h a day',

'about 1 h a day', 'less than 1 h a day' or 'never') how often they normally play computer games alone. In addition, they were asked how often they play computer games with others. We took the mean of these two items to construct the variable playing computer games. A higher score reflects doing a type of activity more often for all three variables.

Risk behaviour is measured by two variables. Adolescents were asked if they smoked and they were asked if they drank alcohol. If an adolescent answered 'yes' to one of these two questions, we considered the adolescent to smoke and/or drink. Also, they were asked if they deliberately damaged things that were not his/hers the last three months and they were asked if they stole something from a shop/someone else in the last three months. If an adolescent answered 'yes' to one of these two questions, we considered the adolescent to display delinquent behaviour.

Parental socioeconomic status is measured by the International Socio-Economic Index of occupational status (ISEI-08) (Ganzeboom et al., 1992) to classify the biological mother's and father's occupational status. From these two, we included the mean score in the household. Adolescents' economic resources, or 'budget' as we will refer to it from now on, are measured by pocket money and income from a part-time job per month in Euro's.

4.2.3. Control variables (dyad level)

We include a dummy variable for 'same gender'. Also, 'similar popularity' was obtained from the popularity nominations ego and alter received from class peers (i.e., 'who are the 5 most popular in your class?') and measures the percentage of popularity nominations a pupil received in class of the total of popularity nominations in class.

4.2.4. Control variables (individual level)

A dyad level variable can be considered as an interaction variable between characteristics of ego and characteristics of alter (Goodreau et al., 2009). That is, the tendency to form interethnic ties depends on the tendency of the majority group to send and receive ties and the tendency of the minority group to send and receive ties. Hence, we include all accompanying individual level variables (sender and receiver attributes) of dyad level variables as main effects to avoid model misspecification. For example, we include a sender effect of gender, a receiver effect of gender and an effect for same gender.

4.3. Missing data

We reconstructed the outgoing ties of pupils that miss sociometric data by their incoming ties. According to Huisman (2009), this procedure does not lead to large bias in most of the network's structural features when the amount of missing data in a network is small (20–30%). In our case, we only examine classes with less than 20% missing pupils. Second, missing attribute data due to item non-response were imputed using a multiple imputation like procedure. For every variable, we estimated missing values by 20 multivariate imputations separately for the four countries using all other variables in the analysis and additional background variables as independent variables (e.g., parental education, ethnic outgroup attitudes, and number of books at home). From these 20 imputations, we take the mean value to impute missing values. Table 2 shows the descriptive statistics of the complete sample by country after imputing missing values and the percentage of missing values that was imputed. We repeated our analyses without imputed data and the results are in line with the imputed data analyses.

4.4. Multilevel p_2 model

We use multilevel p_2 models to answer our research question (Zijlstra et al., 2006). Focusing on dyads, the multilevel p_2 model is

Table 2
Descriptive statistics after imputation of missing values (percentage of missing values in parentheses).

		England		Germany		The Netherlands		Sweden	
		M	Range	M	Range	M	Range	M	Range
Network									
Friendship nominations		2.97	0–5	3.72	0–5	3.55	0–5	3.44	0–5
	(2%)								
Attributes									
Normative opinions		2.04	0–4	1.67	0–4	2.01	0–4	2.64	0–4
	(4%)								
Going out		1.23	0–4	1.20	0–4	1.22	0–4	0.82	0–4
	(10%)								
Reading		1.44	0–4	1.41	0–4	1.09	0–4	1.58	0–4
	(9%)								
Playing computer games		1.53	0–4	1.37	0–4	1.17	0–4	1.60	0–4
	(12%)								
Smoking and/or alcohol use		0.57	0/1	0.46	0/1	0.55	0/1	0.29	0/1
	(15%)								
Delinquency		0.18	0/1	0.12	0/1	0.14	0/1	0.14	0/1
	(11%)								
Religion									
Active Christian		0.16	0/1	0.21	0/1	0.10	0/1	0.11	0/1
Active Muslim		0.11	0/1	0.15	0/1	0.10	0/1	0.06	0/1
Not religiously active		0.67	0/1	0.63	0/1	0.76	0/1	0.82	0/1
Active other religion		0.06	0/1	0.02	0/1	0.04	0/1	0.01	0/1
	(4%)								
Household ISEI score		51.82	16–89	45.02	16–89	49.64	16–89	50.22	16–89
	(14%)								
Budget		41.19	0–259	41.23	0–411	52.29	0–230	41.60	0–410
	(3%)								
Female		0.49	0/1	0.49	0/1	0.51	0/1	0.51	0/1
	(0%)								
Popularity		9.74	0–100	13.15	0–100	10.83	0–97	7.42	0–88
	(0%)								

Source: "Children of Immigrants Longitudinal Survey in 4 European Countries", own calculations.

an extension of the p_2 model (Van Duijn et al., 2004). It is a multinomial regression model of four possible dyadic outcomes: no tie between pupils A en B, a non-mutual tie from pupil A to pupil B, a non-mutual tie from pupil B to pupil A and a mutual tie between pupils A and B. The dependence between ties from and to the same pupil in a class is taken into account by adding a random component for individual level sender and receiver effects. Furthermore, the p_2 model explicitly models density (the tendency to form ties) and reciprocity (the tendency for ties to be mutual) parameters. The multilevel p_2 model is similar to the p_2 model, with the exception that an extra random component is added on the class level.

In this study, we test our hypotheses by including similarity variables for the ethnic, cultural and socioeconomic homophily characteristics: the estimated parameters reflect to what extent ties between similar peers are more likely than dissimilar peers. In addition, we add a sender and receiver variable for all homophily variables in order to correctly estimate the dyadic coefficients. Furthermore, we add a random effect for the general density variable to capture the variability in ties across school classes. In sum, our models are defined as random effects models with three levels: (1) ties, (2) cross-nested in pupils, (3) nested in school classes.

Our method of analyses required selecting ±85 classes per country because of computational limitations. For each country, we selected classes with at least 10 pupils and with less than 20% pupils absent from class. This selection implies the inclusion of 66% of the English classes, 69% of the German classes, 88% of the Dutch classes and 82% of the Swedish classes. Next, we identified the most ethnically diverse classes as these are of most interest. We computed the inverse Herfindahl index and took the 170 classes with the highest score. In a last step, we applied a split half method: we randomly selected 85 classes of the remaining 170 classes to test our hypotheses and 85 other classes for sensitivity analyses. All educational levels are sufficiently represented in our data after these selections. We ran our analyses separately for the lowest, medium and

highest educational level in Germany and the Netherlands (England and Sweden have comprehensive schools). Since these analyses do not show level specific patterns, we present the results of analyses of all levels combined.

A split half method is not only a necessity due to computational limitations, but it is also an excellent method to examine the robustness of results. Results based on the second random sample do not lead to different conclusions regarding our hypotheses and research question. We note any other notable differences in results between the samples in the result section.

Exponential Random Graph models (ERGMs) can be an alternative method for this cross-sectional study (Lusher et al., 2013). ERGMs have the advantage of being able to explicitly model dependencies beyond the dyad (e.g., transitivity, the tendency that ego's friends will befriend each other as well) and previous research has shown that omitting these dependencies may cause homophily coefficients to be overestimated (Goodreau et al., 2009; Wimmer and Lewis, 2010).

Recent studies that use multilevel p_2 models have preferred it over ERGMs because of an interest in context effects such as the ethnic diversity of a classroom (Tolsma et al., 2013; Vermeij et al., 2009). In our case, we are not interested in class room effects, but we are interested in mediation effects. How to examine mediation in (multilevel) ERGMs is not yet described in any previous literature. As ERGMs are more complex than a simple (multinomial) logistic regression, it is to date unclear how to deal with rescaling effects. Also, applying ERGMs to multiple class rooms entails a two-step procedure where models are estimated by class and summarized by a meta-analysis. Due to bad model fit in some classes, several classes often either need to be excluded (see Lubbers, 2003) or need to be modelled with a different set of parameters than the other classes. This leads to different samples between models or different models, respectively, and makes it impossible to address mediation correctly. As the main interest of this study lies in the

Table 3
Percentage of classes of the total classes with a significant difference ($p < 0.2$) between national origin groups with respect to the other similarity dimensions (ANOVA and Chi[2] tests).

	England ($N_{class} = 85$) %	Germany ($N_{class} = 85$) %	The Netherlands ($N_{class} = 85$) %	Sweden ($N_{class} = 85$) %	Overall ($N_{class} = 340$) %
Normative opinions	43	55	53	45	49
Going out	23	25	15	33	24
Reading	20	24	16	26	22
Playing computer games	16	16	18	19	17
Active religion	52	42	50	42	47
Substance use	44	33	47	32	39
Delinquency	32	21	24	19	24
Parental SES	20	36	31	20	27
Budget	19	30	20	32	25
At least one dimension	94	95	92	93	94

Source: "Children of Immigrants Longitudinal Survey in 4 European Countries", own calculations.

Table 4a
Results multilevel p_2 model England ($n_{class} = 85$; $n_{pupils} = 1753$).

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Similarity effects						
Same ethnicity						
Interethnic	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
$n_{ingroup\ peers\ >\ 0} = 83$						
Both native	0.036***	0.035***	0.033***	0.035***	0.030***	0.033***
$n_{ingroup\ peers\ >\ 0} = 83$		n.s.	n.s.	n.s.	n.s.	n.s.
Both Pakistani	0.121***	0.105***	0.115***	0.108***	0.130***	0.122***
$n_{ingroup\ peers\ >\ 0} = 32$		n.s.	n.s.	n.s.	n.s.	n.s.
Both Indian	0.049	0.029	0.051	0.006	0.030	0.032
$n_{ingroup\ peers\ >\ 0} = 28$						
Both Jamaican	−0.065	−0.026	−0.038	−0.043	−0.019	−0.018
$n_{ingroup\ peers\ >\ 0} = 23$						
Both other western	−0.005	−0.012	−0.002	0.003	−0.004	−0.008
$n_{ingroup\ peers\ >\ 0} = 50$						
Both other non-western	0.022	0.016	0.025	0.018	0.011	0.015
$n_{ingroup\ peers\ >\ 0} = 58$						
Similar normative opinions		0.024***				
Similar leisure activities						
Going out			0.029***			
Reading			0.013***			
Computer games			0.004*			
Same active religion				0.027***		
Same risk behaviour						
Substance use					0.033***	
Delinquency					0.009	
Similar socioeconomic status						
Parental isei						0.001
Personal budget						0.001***
Control effects						
Same gender	0.246***	0.242***	0.229***	0.248***	0.241***	0.215***
Similar popularity	0.006***	0.006***	0.005***	0.006***	0.006***	0.005***
General effects						
Density	−0.879***	−0.865***	−0.816***	−0.889***	−0.885***	−0.761***
Reciprocity	0.773***	0.775***	0.769***	0.781***	0.770***	0.699***
Random effects						
Between classes						
Density variance	0.036	0.037	0.039	0.036	0.037	0.042
Within classes						
Sender variance	0.081	0.082	0.080	0.084	0.080	0.072
Receiver variance	0.096	0.099	0.095	0.102	0.096	0.086
Sender-receiver covariance	−0.079	−0.080	−0.078	−0.082	−0.078	−0.070
Acceptance rate	0.606	0.603	0.610	0.613	0.617	0.623

Source: "Children of Immigrants Longitudinal Survey in 4 European Countries", own calculations.
Note: Significance of fixed effects was determined using a *t*-test. For the random effects no significance is determined. All parameter estimates are y-standardized. All models are controlled for sender and receiver parameters of the attributes included. The change in ethnic similarity parameters compared to the ethnic similarity parameter in Model 1 is tested for significance using a Wald-test and the result is given in italics.

* $p_1 < 0.05$.
** $p_1 < 0.01$.
*** $p_1 < 0.001$.

Table 4b
Results multilevel p_2 model on friendship in Germany ($n_{\text{class}} = 85$; $n_{\text{pupils}} = 1831$).

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Similarity effects						
Same ethnicity						
Interethnic	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Both native	0.070***	0.065***	0.067***	0.067***	0.070***	0.072***
$n_{\text{ingroup peers} > 0} = 83$		n.s.	n.s.	n.s.	n.s.	n.s.
Both Turkish	0.094***	0.096***	0.099***	0.082***	0.097***	0.104***
$n_{\text{ingroup peers} > 0} = 51$		n.s.	n.s.	n.s.	n.s.	n.s.
Both Russian	0.011	0.018	0.020	0.008	0.018	0.016
$n_{\text{ingroup peers} > 0} = 20$						
Both Polish	0.024	0.018	0.032	0.011	0.014	0.024
$n_{\text{ingroup peers} > 0} = 20$						
Both Italian	0.029	0.022	0.004	0.030	0.011	0.019
$n_{\text{ingroup peers} > 0} = 8$						
Both other western	0.032*	0.031	0.032***	0.029***	0.027*	0.023
$n_{\text{ingroup peers} > 0} = 56$		n.s.	n.s.	n.s.	n.s.	n.s.
Both other non-western	0.059***	0.058***	0.061***	0.058***	0.044***	0.045*
$n_{\text{ingroup peers} > 0} = 32$		n.s.	n.s.	n.s.	n.s.	n.s.
Similar normative opinions		0.014***				
Similar leisure activities						
Going out			0.012***			
Reading			0.010***			
Computer games			0.010***			
Same active religion				0.027***		
Same risk behaviour						
Substance use					0.030***	
Delinquency					0.027***	
Similar socioeconomic status						
Parental isei						0.001
Personal budget						0.001***
Control effects						
Same gender	0.243***	0.243***	0.234***	0.247***	0.250***	0.259***
Same popularity	0.004***	0.004***	0.004***	0.004***	0.005***	0.005***
General effects						
Density	−0.506***	−0.494***	−0.497***	−0.568***	−0.635***	−0.641***
Reciprocity	0.512***	0.507***	0.509***	0.529***	0.547***	0.552***
Random effects						
Between classes						
Density variance	0.141	0.142	0.120	0.086	0.058	0.015
Within classes						
Sender variance	0.020	0.020	0.017	0.020	0.021	0.021
Receiver variance	0.056	0.056	0.052	0.055	0.056	0.057
Sender-receiver covariance	−0.028	−0.028	−0.025	−0.028	−0.030	−0.029
Acceptance rate	0.587	0.616	0.610	0.606	0.612	0.400

Source: "Children of Immigrants Longitudinal Survey in 4 European Countries", own calculations.

Note: Significance of fixed effects was determined using a *t*-test. For the random effects no significance is determined. All parameter estimates are y-standardized. All models are controlled for sender and receiver parameters of the attributes included. The change in ethnic similarity parameters compared to the ethnic similarity parameter in Model 1 is tested for significance using a Wald-test and the result is given in italics.

* $p_1 < 0.05$.
** $p_1 < 0.01$.
*** $p_1 < 0.001$.

relative magnitude of ethnic homophily coefficients across models, we choose the multilevel p_2 model over an ERGM. In order to examine robustness of our conclusions for omitting beyond-dyad variables, we also ran ERGMs with and without a transitivity parameter. The results of these sensitivity analyses are in line with our conclusions based on multilevel p_2 models.[4]

4.5. Examining mediation in multilevel p_2 models

In linear models, mediation can be examined by comparing coefficients between a model uncontrolled for particular variables and a model controlled for particular variables. Coefficients in models from the logistic family (as is the multilevel p_2 model) however, differ not only due to confounding, but also due to rescaling of the

error variance implicit in logistic regression models (Mood, 2010; Winship and Mare, 1984). This means that coefficients between models are measured on different scales as the models uncontrolled and controlled for additional variables explain a different amount of residual variation in the dependent variable, and the coefficients depend on the residual variation. The effect of rescaling is that coefficients increase in size whenever significant variables are added to the model, which counters the reducing effect of including mediating variables.

In order to compare coefficients across models, we y-standardize all variables (Winship and Mare, 1984).[5] We divide all coefficients by the standard deviation of the latent variable (sdY*),

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[4] The ERGMs are uncorrected for rescaling issues. A comparison of ERGM results with those of multilevel p_2 models that are not corrected for scaling problems, shows similar results, indicating that whether or not transitivity is modelled is not affecting our conclusions.

[5] Other solutions are calculating marginal effects or using the KHB method (Best and Wolf, 2012; Kohler et al., 2011; Mood, 2010). Y-standardization is a suitable method for correction as we compare models across the same sample (Mood, 2010), with a low chance of success (i.e., friendship is scarce in our networks) and the explained variance is not too high (Best and Wolf, 2012). As Y-standardization is more straightforward to apply to multilevel p_2 model results, we chose this method over more complex methods to account for rescaling.

which is the sum of the standard deviation of the predicted logits and the assumed standard deviation of the error term (which is always fixed to 1.81 in logistic models). Hence, the coefficients shown represent the standard-deviation-unit change in y^* for a one-unit change in an independent variable.

5. Results

In this section, we will discuss descriptive and explanatory results. Theoretically, we assumed that ethnic groups differ on cultural and socioeconomic characteristics. However, variation across classes in such correlations is likely, and in some classes, ethnicity will not relate to cultural and socioeconomic characteristics at all (Stark and Flache, 2012). It is important to examine descriptively to what extent ethnicity is related to cultural and socioeconomic characteristics as this is an important condition for the by-product hypothesis to hold. A second condition for the by-product hypothesis is that adolescents should choose friends based on ethnic, cultural and socioeconomic characteristics. This and our hypotheses are tested in the multilevel p_2 models in the explanatory results section.

5.1. Descriptive results

Table 3 illustrates to what extent ethnicity and cultural and socioeconomic characteristics are correlated within the 340 classes we selected for the multilevel p_2 analyses. We applied ANOVAs in each class separately to test if the mean value of continuous cultural or socioeconomic variables differs between ethnic categories. For nominal variables, we conducted Chi^2 tests. Note that these tests show if there is a difference between any of these ethnic groups and not which groups differ significantly. Due to the small size of classrooms, we considered a p value smaller than 0.2 to signify ethnic differences (cf. Stark and Flache, 2012).

In general, Table 3 shows that all cultural and socioeconomic characteristics are related to ethnicity in a substantial number of classes, but certainly not in all classes. Ethnic groups seem to differ most in religion and normative opinions as we find ethnic differences along these two characteristics in 49% and 47% of the classes, respectively. Playing computer games seems to be least related to ethnicity. We find significant differences between ethnic groups in playing computer games in only 17% of the classes. There are only

Table 4c
Results multilevel p_2 model on friendship in the Netherlands (n_{class} = 85; n_{pupils} = 1766).

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Similarity effects						
Same ethnicity						
Interethnic	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Both native	0.073***	0.070***	0.069***	0.069***	0.074***	0.079***
$n_{ingroup\ peers\ >\ 0}$ = 74		n.s.	n.s.	n.s.	n.s.	n.s.
Both Turkish	0.117***	0.114***	0.118***	0.094***	0.101***	0.109***
$n_{ingroup\ peers\ >\ 0}$ = 25		n.s.	n.s.	n.s.	n.s.	n.s.
Both Moroccan	0.139***	0.144***	0.148***	0.133***	0.128***	0.145***
$n_{ingroup\ peers\ >\ 0}$ = 20		n.s.	n.s.	n.s.	n.s.	n.s.
Both Surinamese	0.065*	0.061	0.060	0.060	0.059	0.077**
$n_{ingroup\ peers\ >\ 0}$ = 14		n.s.	n.s.	n.s.	n.s.	n.s.
Both other western	−0.046	−0.036	−0.042	−0.038	−0.031	−0.039
$n_{ingroup\ peers\ >\ 0}$ = 37						
Both other non-western	0.035	0.025	0.022	0.039	0.031	0.040
$n_{ingroup\ peers\ >\ 0}$ = 32						
Similar normative opinions		0.009***				
Similar leisure activities						
Going out			0.024***			
Reading			0.007***			
Computer games			0.011***			
Same active religion				0.024***		
Same risk behaviour						
Substance use					0.027***	
Delinquency					0.025***	
Similar socioeconomic status						
Parental isei						−0.001
Personal budget						0.001*
Control effects						
Same gender	0.255***	0.251***	0.233***	0.242***	0.233***	0.272***
Same popularity	0.006***	0.006	0.006***	0.006***	0.006***	0.006***
General effects						
Density	−0.730***	−0.717***	−0.655***	−0.697***	−0.647***	−0.704***
Reciprocity	0.621***	0.624***	0.619***	0.633***	0.600***	0.545***
Random effects						
Between classes						
Density variance	0.013	0.014	0.036	0.036	0.078	0.024
Within classes						
Sender variance	0.047	0.047	0.048	0.051	0.046	0.048
Receiver variance	0.086	0.085	0.083	0.089	0.084	0.088
Sender-receiver covariance	−0.057	−0.057	−0.057	−0.061	−0.056	−0.046
Acceptance rate	0.603	0.599	0.649	0.646	0.633	0.624

Source: "Children of Immigrants Longitudinal Survey in 4 European Countries", own calculations.

Note: Significance of fixed effects was determined using a t-test. For the random effects no significance is determined. All parameter estimates are y-standardized. All models are controlled for sender and receiver parameters of the attributes included. The change in ethnic similarity parameters compared to the ethnic similarity parameter in Model 1 is tested for significance using a Wald-test and the result is given in italics.

* p_1 < 0.05.
** p_1 < 0.01.
*** p_1 < 0.001.

Table 4d

Results multilevel p_2 model on friendship in Sweden (n_{class} = 85; n_{pupils} = 1783).

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Similarity effects						
Same ethnicity						
Interethnic	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Both native	0.072***	0.077***	0.066***	0.075***	0.071***	0.073***
$n_{ingroup\ peers\ >\ 0}$ = 79		n.s.	n.s.	n.s.	n.s.	n.s.
Both Iraqi	0.047***	0.050*	0.051*	0.043*	0.054*	0.050**
$n_{ingroup\ peers\ >\ 0}$ = 26		n.s.	n.s.	n.s.	n.s.	n.s.
Both Turkish	0.118***	0.123***	0.121***	0.122***	0.119***	0.118***
$n_{ingroup\ peers\ >\ 0}$ = 14		n.s.	n.s.	n.s.	n.s.	n.s.
Both Bosnian	0.194***	0.201**	0.177**	0.208***	0.178**	0.193**
$n_{ingroup\ peers\ >\ 0}$ = 8		n.s.	n.s.	n.s.	n.s.	n.s.
Both Lebanese	−0.012	−0.008	0.035	−0.030	−0.001	0.001
$n_{ingroup\ peers\ >\ 0}$ = 13						
Both other western	−0.006	−0.008	−0.008	−0.015	−0.007	−0.007
$n_{ingroup\ peers\ >\ 0}$ = 73						
Both other non-western	0.040***	0.035***	0.036***	0.037***	0.034***	0.036***
$n_{ingroup\ peers\ >\ 0}$ = 55		n.s.	n.s.	n.s.	n.s.	n.s.
Similar normative opinions		0.013***				
Similar leisure activities						
Going out			0.038***			
Reading			0.009***			
Computer games			0.005**			
Same active religion				0.021***		
Same risk behaviour						
Substance use					0.035***	
Delinquency					0.023***	
Similar socioeconomic status						
Parental isei						−0.001
Personal budget						0.001***
Control effects						
Same gender	0.256***	0.262***	0.242***	0.251***	0.252***	0.255***
Same popularity	0.007***	0.007***	0.007***	0.006***	0.006***	0.007***
General effects						
Density	−0.593***	−0.660***	−0.477***	−0.535***	−0.591***	−0.611***
Reciprocity	0.563***	0.584***	0.526***	0.532***	0.538***	0.552***
Random effects						
Between classes						
Density variance	0.092	0.050	0.173	0.179	0.126	0.080
Within classes						
Sender variance	0.060	0.060	0.058	0.060	0.057	0.057
Receiver variance	0.077	0.078	0.070	0.074	0.072	0.072
Sender-receiver covariance	−0.059	−0.060	−0.055	−0.056	−0.055	−0.055
Acceptance rate	0.600	0.619	0.675	0.661	0.626	0.625

Source: "Children of Immigrants Longitudinal Survey in 4 European Countries", own calculations.

Note: Significance of fixed effects was determined using a *t*-test. For the random effects no significance is determined. All parameter estimates are y-standardized. All models are controlled for sender and receiver parameters of the attributes included. The change in ethnic similarity parameters compared to the ethnic similarity parameter in Model 1 is tested for significance using a Wald-test and the result is given in italics.

* $p_1 < 0.05$.
** $p_1 < 0.01$.
*** $p_1 < 0.001$.

very few classes in which none of the cultural and socioeconomic characteristics are related to ethnicity (6%).

Homophily on other characteristics can only explain ethnic homophily in the classes in which these are correlated with ethnicity. This implies that we will only find evidence for the by-product hypothesis if the mediation effect present in the classes with such a correlation is strong enough to compensate a lack of mediation in the other classes. When we do not find evidence for our by-product hypotheses, this is either due to (1) a lack of association with ethnicity in too many classes, or (2) a lack of friendship selection on the cultural and socioeconomic characteristics in question.

5.2. Explanatory results

Tables 4a, 4b, 4c and 4d show the multilevel p_2 coefficients on the likelihood of friendship nomination for England, Germany, the Netherlands and Sweden, respectively. In every table, Model

1 shows the effects of ethnic homophily with control variables only. For every group, we also provide the number of classes in which ethnic groups have the possibility to befriend ingroup peers ($N_{ingroup\ peers} > 0$). Subsequently, we add a cultural or a socioeconomic homophily characteristic that is hypothesized to mediate the effect of having the same ethnicity in every additional model.[6] In addition, whenever significant, we report the decrease or increase of significant ethnic homophily coefficients in percentages in every additional model compared to Model 1. We test whether the change in coefficient is significant by applying a Wald test. The Wald test shows whether the reduction in homophily coefficients is significantly larger than the standard error of the baseline homophily coefficient (Model 1). Note that we present averaged effects across

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[6] We also estimated a model including all ethnic, cultural and socioeconomic characteristics simultaneously as it may be the combination of cultural and socioeconomic characteristics that explains ethnic homophily. These models show severe signs of multicollinearity, however, and are therefore not presented.

classes. This implies that a certain effect may not be present in some classes, but that the tendency is present and strong enough in a sufficient number of classes to be significant on average. Models and their results can be accepted if the acceptance rates are roughly between 1/3 and 2/3. All the acceptance rates are sufficient.

In Model 1, we find that ties within some ethnic groups are more likely in comparison to ties between ethnic groups.[7] In England, only the homophily effects of native and Pakistani adolescents are positive and significant. This means that native and Pakistani adolescents tend to choose ingroup peers over outgroup peers on average. Homophily effects for Indian, Jamaican and the rest categories of other Western and other non-Western immigrant adolescents are absent or not strong enough to be significant over all classes. In Germany, ethnic ingroup friendships are found to be more likely than outgroup friendship for natives, Turks, other Western and other non-Western immigrants. In the Netherlands, significant homophily coefficients are found for all groups, except for the rest categories of Western and non-Western immigrants. In Sweden, adolescents significantly have more ethnic ingroup friends compared to outgroup friends, except for Lebanese adolescents and adolescents from the rest category of other Western immigrant groups.

It is possible that insignificant homophily coefficients are caused by the gender composition within classes. Gender segregation is very strong (see Tables 4a–4d), and if there are no same-gender peers of the same-ethnic group in class, adolescents might prefer to cross ethnic boundaries because a same-gender friend is more important than a same-ethnic friend. As such, we ran sensitivity analyses for classes in which ethnic groups have at least two ethnic ingroup boys and two ethnic ingroup girls. These analyses show (results available on request) that the insignificant homophily coefficients in Tables 4a–4d are robust: we also find no significant homophily coefficients when we examine classes in which same-ethnic same-sex friendships are possible.

The subsequent models show also positive and significant main effects of cultural and socioeconomic similarity on the likelihood of friendship. Adolescents who are similar in normative opinions (Model 2), similar in going out, reading and playing computer games (Model 3), practice the same religion actively (Model 4), are the same in substance use and delinquent behaviour (Model 5) and who have a similar budget (Model 6) are more likely to be friends than adolescents who are different. There are two exceptions to this general finding. Parental socioeconomic status homophily coefficients are not significant (Model 6), meaning that we find no evidence in this sample that adolescents choose friends similar in parental socioeconomic status.[8] Also, we find no evidence that adolescents tend to befriend peers that are the same in delinquent behaviour in England, as the delinquency English homophily coefficient is not significant[9] (Model 5, Table 4a).

Besides the two exceptions, our results show that cultural and socioeconomic characteristics are salient homophily dimensions in general. We do not, however, see a significant reduction in ethnic homophily coefficients in any of the models. In every model, ethnic homophily coefficients remain significant and roughly the same size. The reduction of ethnic homophily coefficients after adding another homophily characteristic is never significant. As

such, we find no evidence that homophily on normative opinions (H1), homophily on leisure activities (H2), homophily on religion (H3), homophily on risk behaviour (H4) or that homophily on socio-economic status (H5) explains ethnic homophily.

A contribution of this study to earlier work was to account for a rescaling issue in (multinomial) logistic models by y-standardizing our coefficients. Therefore, we also examined the extent to which rescaling influenced the coefficients, and especially, the extent to which it obscures mediation effects. Unstandardized results also show no significant mediation effects (see the e-component for the results). The substantive conclusions of both sets of analyses are as such the same.

6. Conclusion and discussion

The aim of this study was to examine to what extent ethnic homophily can be explained by cultural and socioeconomic homophily. This so-called 'by-product hypothesis' can be traced back to Blau's work on 'consolidation' (1977, chapter 5) and has often been addressed in previous research, but has not been sufficiently tested for a representative sample of adolescents (Marmaros and Sacerdote, 2006; Mayer and Puller, 2008; Stark and Flache, 2012; Wimmer and Lewis, 2010) or a sufficient number of salient characteristics on which friendships are likely to be chosen (Brown et al., 2008; Mouw and Entwisle, 2006). Also, possible mediation effects may have been obscured in previous studies as rescaling effects in logistic models were not addressed (Mood, 2010; Winship and Mare, 1984). In this study, we tested multiple by-product hypotheses for 13,272 pupils in 625 secondary school classes in England, Germany, the Netherlands and Sweden. We examined characteristics on which adolescents are likely to choose their friends, namely normative opinions, religion, leisure time activities, risk behaviour, parental socioeconomic status and adolescents' personal budget.

Defining ethnic groups by parental country of birth, our study indicates evidence for homophily theory. On average across classes, adolescents in England, Germany, the Netherlands and Sweden are shown to nominate ethnic ingroup peers as friends at the expense of peers of another ethnic background. Not all groups under study, however, show a strong ethnic ingroup preference. The exceptions are children of Indian and Jamaican descent in England, children of Russian, Polish and Italian descent in Germany, and Lebanese descent in Sweden. These findings are in line with previous findings about cultural and socioeconomic integration of immigrant groups: immigrants from nearby countries (e.g., European countries as Russia, Poland and Italy) are known to have integrated more easily than immigrants from most labour and post-colonial immigrant groups (e.g., Turks and Surinamese in the Netherlands) (Castles and Miller, 2003). The refugee groups in Sweden are more difficult to place: Bosnian and Iraqi adolescents are found to befriend within their own ethnic group, whereas we find no evidence that Lebanese adolescents show this tendency. Overall, however, cultural and socioeconomic integration are mirrored in adolescents' social integration.

The main question in this paper is: *to what extent is the overall ethnic homophily tendency among adolescents a by-product of homophily on other characteristics*? First, we showed evidence for homophily theory on cultural and socioeconomic characteristics. Pupils nominate more often culturally and socioeconomic similar pupils as friends than different pupils. Having similar opinions, the same religion, similar leisure activities (going out, reading and playing computer games), the same risk behaviour (smoking, drinking alcohol and delinquency) and a similar personal budget increase the likelihood of friendship nomination. Second, however, we find that ethnic homophily effects remain highly significant after

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[7] Coefficients of the second random sample are in line with the coefficients presented here, although some effects become borderline insignificant (i.e., German other non-Western, Dutch Surinamese, Swedish Iraqi and Swedish Bosnian).

[8] There is a significant homophily effect of socioeconomic status in the second random sample in Germany ($b = 0.001$; $p_1 < 0.05$), the Netherlands ($b = 0.001$; $p_1 < 0.001$) and Sweden ($b = 0.0001$; $p_1 < 0.001$).

[9] The English delinquency homophily effect is significant in the second random sample ($b = 0.016$, $p_1 < 0.01$).

taking cultural and socioeconomic homophily into account and the reduction in ethnic homophily effects never reaches significance. In other words: we find no evidence that ethnic ingroup friendships can be explained by ingroup friendships on the cultural and socioeconomic characteristics we examined.

Stark and Flache (2012) showed that there can be two reasons why another type of homophily does not explain ethnic homophily. On the one hand, it can be due to adolescents not choosing their friends based on the particular characteristics. On the other hand, it can be due to a lack of overlap between ethnicity and the particular characteristic. Our study corroborates their finding that the lack of evidence for the by-product hypothesis is mainly due to the latter explanation: in general, adolescents choose friends that are similar on several cultural and socioeconomic characteristics, but these characteristics do not significantly correlate with ethnicity in a considerable number of classes. In the words of previous literature: in many classes there is no 'consolidation' (Blau, 1977) or 'intersection' (Wimmer and Lewis, 2010) with ethnicity, and as such, cultural and socioeconomic ingroup friendship cannot explain the overall tendency of ethnic homophily.

Another possible explanation for an effect of ethnic homophily on friendship choice above and beyond other correlated similarities could be that there are even more specific types of cultural and socioeconomic characteristics that we were unable to capture. For example, if adolescents both like going to the cinema, do they also like the same genres? This study included salient cultural and socioeconomic characteristics, but future research may even further extend our study by capturing more fine-grained measures of culture and socioeconomic status.

In addition, a possible explanation for the independent effect of ethnic homophily in comparison to cultural and socioeconomic homophily could be that adolescents may not consider multiple characteristics simultaneously as we assumed. Based on stage models in marriage research (Kerckhoff and Davis, 1962; Murstein, 1970), it can be argued that individuals first narrow the market down to their own ethnic group and second, choose friends with desirable status and cultural resources from that confined pool of candidates. Ethnicity can be used as a filter before adolescents seriously consider peers as friends. As the adolescents in this study have shared a class for approximately three years, we can expect that pupils of different ethnic groups were more or less forced to associate with each other, for example through collaborating in class projects or during gym class. Therefore, pupils from different ethnic groups have spent enough time with each other in order to at least consider each other as possible friends. It would be interesting if future research follows this line of thought by examining friendship development when individuals are new to the setting and follow them over time (e.g., the first year of high school or university).

Future research on the by-product may also examine conditions under which other types of ingroup friendship explain ethnic ingroup friendship or dive deeper into the kind of friendship. For example, if parents affect their children's friendship choice, it may also mask evidence for the by-product hypothesis: if parents do not approve of interethnic friendships, boundaries will be more difficult to cross despite common cultural and socioeconomic characteristics (Munniksma et al., 2012; Windzio, 2012). Also, we have focused on friendship ties in this study. Windzio and Bicer (2013) have shown that ethnic boundaries are stronger for relationships that are more costly (e.g., visiting one's home, spending more time together), and as such, it would expand our knowledge to examine if results for the by-product hypothesis hold for different types of friendship (i.e., weaker and stronger friendships, or even romantic relationships).

This study examined a large number of salient cultural and socioeconomic characteristics that were expected to explain the overall ethnic homophily tendency in several countries, and finds no confirmation for this by-product hypothesis. Hence, this study corroborates previous findings that ethnic homophily is not explained by other types of homophily (Marmaros and Sacerdote, 2006; Mayer and Puller, 2008; Wimmer and Lewis, 2010). Also, we found that rescaling issues in (multinomial) logistic regression models did not obscure mediation effects, which means that we find no evidence that rescaling caused the lack of evidence for the by-product hypothesis in previous research.

To conclude: there is something about ethnic ingroup friendship that makes it attractive and valuable to adolescents. This study and previous work show that it is not simply explained by a large collection of possible underlying preferences that happen to relate with ethnicity, not in the least because ethnic groups are often not so different as we expect them to be. In terms of cultural and socioeconomic integration, it seems promising to know that adolescents from different backgrounds are not all that different from each other. In line with Stark and Flache (2012), however, we conclude that policy interventions that try to decrease the social gap between adolescents of different ethnic groups by closing cultural or socioeconomic gaps should carefully consider if the targeted cultural and socioeconomic indicators are actually contributing to ethnic boundaries. There is ample nuance in what makes ethnic groups culturally and socioeconomically distinct in each miniature society that is a classroom.

Appendix A. Supplementary data

Supplementary material related to this article can be found, in the online version, at http://dx.doi.org/10.1016/j.socnet.2014.04.003.

References

Algan, Y., Dustmann, C., Glitz, A., Manning, A., 2010. The economic situation of first and second-generation immigrants in France, Germany and the United Kingdom. Econ. J. 120 (542), F4–F30.

Baerveldt, C., Van Duijn, M.A.J., Vermeij, L., Van Hemert, D.A., 2004. Ethnic boundaries and personal choice. Assessing the influence of individual inclinations to choose intra-ethnic relationships on pupils' networks. Soc. Netw. 26 (1), 55–74.

Baerveldt, C., Zijlstra, B., de Wolf, M., Van Rossem, R., Van Duijn, M.A.J., 2007. Ethnic boundaries in high school students' networks in Flanders and the Netherlands. Int. Soc. 22 (6), 701–720.

Best, H., Wolf, C., 2012. Modellvergleich und ergebnisinterpretation in logit- und probit-regressionen. Kölner Zeitschrift Für Soziologie Und Sozialpsychologie 64 (2), 377–395.

Blau, P., 1977. Inequality and Heterogeneity. A Primitive Theory of Social Structure. Free Press, New York.

Brashears, M.E., 2008. Gender and homophily: differences in male and female association in Blau space. Soc. Sci. Res. 37 (2), 400–415.

Brown, B.B., Herman, M., Hamm, J.V., Heck, D.J., 2008. Ethnicity and image: correlates of crowd affiliation among ethnic minority youth. Child Dev. 79 (3), 529–546.

Busser, J.A., Hyams, A.L., Carruthers, C.P., 1996. Differences in adolescent activity participation by gender, grade and ethnicity. J. Park Recreat. Admin. 14 (4), 1–20.

Byrne, D.E., 1971. The Attraction Paradigm. Academic Press, New York.

Castles, S., Miller, M.J., 2003. The Age of Migration, 3rd ed. The Guilford Press, New York.

Currarini, S., Jackson, M.O., Pin, P., 2010. Identifying the roles of race-based choice and chance in high school friendship network formation. Proc. Natl. Acad. Sci. 107 (11), 4857–4861.

Eshel, Y., Kurman, J., 1990. Ethnic equity and asymmetry in peer acceptance. J. Soc. Psychol. 130 (6), 713–723.

Ganzeboom, H.B.G., De Graaf, P.M., Treiman, D.J., 1992. A standard international socio-economic index of occupational status. Soc. Sci. Res. 21 (1), 1–56.

Goodreau, S.M., Kitts, J.A., Morris, M., 2009. Birds of a feather, or friend of a friend? Using Exponential Random Graph models to investigate adolescent social networks. Demography 46 (1), 103–125.

Hamm, J.V., Brown, B.B., Heck, D.J., 2005. Bridging the ethnic divide: student and school characteristics in African American, Asian-descent, Latino, and White adolescents' cross-ethnic friend nominations. J. Res. Adoles. (Blackwell Publishing Limited) 15 (1), 21–46.

Huisman, M., 2009. Imputation of missing network data: some simple procedures. J. Soc. Struct. 10 (1), 1–29.

Ibarra, H., 1993. Personal networks of women and minorities in management: a conceptual framework. Acad. Manage. Rev. 18 (1), 56–87.

Ingram, P., Morris, M.W., 2007. Do people mix at mixers? Structure, homophily, and the "life of the party". Adm. Sci. Q. 52 (4), 558–585.

Kalter, F., Heath, A.F., Hewstone, M., Jonsson, J.O., Kalmijn, M., Kogan, I., Van Tubergen, F., 2013. Children of Immigrants Longitudinal Survey in Four European Countries (CILS4EU), GESIS Data Archive, Cologne, ZA5353 Data file Version 1.0.0.

Kandel, D.B., 1966. Status homophily, social context, and participation in psychotherapy. Am. J. Sociol. 71 (6), 640–650.

Kelley, J., Graaf, N.D.D., 1997. National context, parental socialization, and religious belief: results from 15 nations. Am. Sociol. Rev. 62 (4), 639–659.

Kelly, J.R., Godbey, G., 1992. The Sociology of Leisure. Venture Pub, State College, PA.

Kerckhoff, A.C., Davis, K.E., 1962. Value consensus and need complementarity in mate selection. Am. Sociol. Rev. 27 (3), 295–303.

Knecht, A., Snijders, T.A.B., Baerveldt, C., Steglich, C.E.G., Raub, W., 2010. Friendship and delinquency: selection and influence processes in early adolescence. Soc. Dev. 19 (3), 494–514.

Kohler, U., Karlson, K.B., Holm, A., 2011. Comparing coefficients of nested nonlinear probability models. Stata J. 11 (3), 420–438.

Lubbers, M.J., 2003. Group composition and network structure in school classes: a multilevel application of the p^{*} model. Soc. Netw. 25 (4), 309–332.

Lubbers, M.J., Snijders, T.A.B., Van Der Werf, M.P.C., 2010. Dynamics of peer relationships across the first two years of junior high as a function of gender and changes in classroom composition. J. Res. Adoles. 21 (2), 488–504.

Lusher, D., Koskinen, J., Robins, G., 2013. Exponential Random Graph Models for Social Networks: Theory, Methods and Applications. Cambridge University Press, New York.

Marmaros, D., Sacerdote, B., 2006. How do friendships form? Quart. J. Econ. 121 (1), 79–119.

Mayer, A., Puller, S.L., 2008. The old boy (and girl) network: social network formation on university campuses. J. Publ. Econ. 92 (1–2), 329–347.

McPherson, M., Smith-Lovin, L., Cook, J.M., 2001. Birds of a feather: homophily in social networks. Ann. Rev. Soc. 27, 415–444.

Mood, C., 2010. Logistic regression: why we cannot do what we think we can do, and what we can do about it. Eur. Sociol. Rev. 26 (1), 67–82.

Mouw, T., Entwisle, B., 2006. Residential segregation and interracial friendship in schools. Am. J. Sociol. 112 (2), 394–441.

Munniksma, A., Flache, A., Verkuyten, M., Veenstra, R., 2012. Parental acceptance of children's intimate ethnic outgroup relations: the role of culture, status, and family reputation. Int. J. Intercult. Relat. 36 (4), 575–585.

Murstein, B.I., 1970. Stimulus. Value. Role: a theory of marital choice. J. Marriage Fam. 32 (3), 465–481.

Rystad, G., 1992. Immigration history and the future of international migration. Int. Migr. Rev. 26 (4), 1168–1199.

Schnepf, S.V., 2007. Immigrants' educational disadvantage: an examination across ten countries and three surveys. J. Popul. Econ. (3), 527–545.

Shah, K., 1960. Attitudes of Pakistani students toward family life. Marriage Fam. Liv. 22 (2), 156–161.

Shrum, W., Cheek Jr., N.H., Hunter, S.M., 1988. Friendship in school: gender and racial homophily. Soc. Educ. 61 (4), 227–239.

Stark, T.H., Flache, A., 2012. The double edge of common interest. Soc. Educ. 85 (2), 179–199.

Stodolska, M., Yi, J., 2003. Impact of immigration on ethnic identity and leisure behavior on adolescent immigrants from Korea, Mexico and Poland. J. Leis. Res. 35 (1), 49.

Tolsma, J., Van Deurzen, I., Stark, T.H., Veenstra, R., 2013. Who is bullying whom in ethnically diverse primary schools? Exploring links between bullying, ethnicity, and ethnic diversity in Dutch primary schools. Soc. Netw. 35 (1), 51–61.

Tonry, M., 1993. Ethnicity, crime and immigration. In: Tonry, M. (Ed.), Ethnicity, Crime, and Immigration: Comparative and Cross-national Perspectives. Crime and Justice. A Review of Research. University of Chicago pres, Chicago, pp. 1–30.

Urberg, K.A., Degirmencioglu, S.M., Tolson, J.M., 1998. Adolescent friendship selection and termination: the role of similarity. J. Soc. Pers. Relat. 15 (5), 703–710.

Uunk, W., 2003. The cultural integration of immigrants in the Netherlands: a description and explanation of modern attitudes of Turks, Moroccans, Surinamese, Antilleans, and the indigenous population. In: Hagendoorn, L., Veenman, J., Vollebergh, W. (Eds.), Integrating Immigrants in the Netherlands: Cultural Versus Socio-economic Integration (Research in Migration and Ethnic Relations). , Aldershot ed. Ashgate, Aldershot, pp. 199–227.

Van Amersfoort, H., Van Niekerk, M., 2006. Immigration as a colonial inheritance: post-colonial immigrants in the Netherlands, 1945–2002. J. Ethnic Migrat. Stud. 32 (3), 323–346.

Van Duijn, M.A.J., Snijders, T.A.B., Zijlstra, B.J.H., 2004. p_2: a random effects model with covariates for directed graphs. Stat. Neerland. 58 (2), 234–254.

Van Tubergen, F., Poortman, A., 2010. Adolescent Alcohol Use in the Netherlands: The Role of Ethnicity, Ethnic Intermarriage, and Ethnic School Composition. Ethn. Health 15 (1), 1–13.

Verbrugge, L.M., 1977. The structure of adult friendship choices. Soc. Forces 56 (2, Special Issue), 576–597.

Vermeij, L., Van Duijn, M.A.J., Baerveldt, C., 2009. Ethnic segregation in context: social discrimination among native Dutch pupils and their ethnic minority classmates. Soc. Netw. 31 (4), 230–239.

Vries, H., Candel, M.d., Engels, R., Mercken, L., 2006. Challenges to the peer influence paradigm: results for 12–13 year olds from six European countries from the European smoking prevention framework approach study. Tob. Control 15 (2), 83–89.

Williams, J.H., Ayers, C.D., Abbott, R.D., Hawkins, J.D., Catalano, R.F., 1999. Racial differences in risk factors for delinquency and substance use among adolescents. Soc. Work Res. 23 (4), 241–256.

Wimmer, A., Lewis, K., 2010. Beyond and below racial homophily: ERG models of a friendship network documented on Facebook. Am. J. Sociol. 116 (2), 583–642.

Windzio, M., 2012. Integration of immigrant children into inter-ethnic friendship networks: the role of 'Intergenerational openness'. Sociology 46 (2), 258–271.

Windzio, M., Bicer, E., 2013. Are we just friends? Immigrant integration into high- and low-cost social networks. Ration. Soc. 25 (2), 123–145.

Winship, C., Mare, R.D., 1984. Regression models with ordinal variables. Am. Sociol. Rev. 49 (4), 512–525.

Zeng, Z., Xie, Y., 2008. A preference-opportunity-choice framework with applications to intergroup friendship. Am. J. Sociol. 114 (3), 615–648.

Zijlstra, B.J.H., Van Duijn, M.A.J., Snijders, T.A.B., 2006. The multilevel p_2 model: a random effects model for the analysis of multiple social networks. Methodol.: Eur. J. Res. Methods Behav. Soc. Sci. 2 (1), 42–47.