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# Optimism trap? Educational aspirations and outcomes among students with immigrant backgrounds in Norway and Spain

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## ABSTRACT

While immigrants and their children display bold educational aspirations, less is known about the relationship between their aspirations and educational outcomes. Using longitudinal survey data on students in upper secondary education in Barcelona, Spain, and Bergen, Norway, coupled with register data from Norway, we ask how the aspirations of students with immigrant backgrounds are connected to their educational outcomes, and in what way this differs between the cities. We find that, compared with their native peers, youth with immigrant backgrounds in Bergen have higher aspirations and those in Barcelona have somewhat lower aspirations. There is a higher mismatch between educational aspirations and outcomes for youth with immigrant backgrounds in both contexts. We argue that such empirical investigations are important, to avoid portraying immigrant aspirations as either a springboard to future success or as a ‘trap’, but rather as a part of pragmatic considerations and adjustments in varying contexts.

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Educational aspirations;  
educational outcomes;  
immigrant inequality; Spain;  
Norway

## Introduction

High educational aspirations among immigrants and their children is a well-established finding across European countries (Reisel et al., 2019, Tjaden & Scharenberg, 2017; Salikutluk, 2016). However, youth with immigrant backgrounds also show moderate absolute levels of schooling (Engzell, 2019), lower test scores and higher rates of non-completion of upper secondary education (Bratsberg et al., 2012; Zinovyeva et al., 2013; Miyar-Busto, 2017). Their strong orientation towards higher education despite some educational disadvantages has been referred to as ‘bold choices’ (Jackson, 2012) or ‘immigrant drive’ (Portes & Rumbaut, 2001). Still, we know less about how aspirations and outcomes are connected over time, – whether high aspirations actually do translate into equally high educational outcomes (Dollmann and Weissman 2020). As youth with misaligned aspirations and educational outcomes have been shown to be more likely to become ‘NEETs’ (not in education, employment or training), such a misalignment (or mismatch) can be unfortunate (Yates et al., 2011).

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By using longitudinal survey data from students in upper secondary education in Barcelona, Spain ( $n = 1,299$ ) and Bergen, Norway ( $n = 1,702$ ) collected in 2014 and 2017, as well as register data from Norway, we can address this understudied connection between educational aspirations and educational outcomes among students of immigrant origin in two different contexts. Moreover, by selecting Bergen and Barcelona as settings with different educational systems and labour market characteristics, this study provides a much-needed empirical contribution to the literature. More precisely, we ask the following questions: (1) What are the differences in educational aspirations between students with native origin and those with immigrant origin, and in what way does this differ between Barcelona and Bergen? And (2) What are the differences in mismatch between aspirations and attainment among students of native origin and those of immigrant origin, and in what way does this differ between Barcelona and Bergen?

## Background and previous research

Immigrants often migrate with the hope of pursuing socioeconomic upwards mobility (Salikutluk, 2016). While high aspirations and preference for academic tracks among children of immigrants are often viewed as a sign of successful integration, scholars warn that high aspirations might represent an ‘optimism trap’ (Tjaden & Hunkler, 2017; Birkelund, 2020). If youth with immigrant backgrounds are unable to fulfil their aspirations, this can lead to higher non-completion rates and future disadvantage (Dollmann et al., 2023).

### *Educational aspirations and achievements among immigrant populations*

Numerous studies show that people with immigrant and native majority backgrounds have substantial differences in educational aspirations and choices (Tjaden & Hunkler, 2017). Students with immigrant backgrounds are often found to have higher educational aspirations than peers with a native majority background (Heath & Brinbaum, 2014; Dollmann et al., 2023), but lower test scores and higher rates of non-completion of upper secondary education (Bratsberg et al., 2012; Zinovyeva et al., 2013; Miyar-Busto, 2017). Students with immigrant backgrounds also tend to choose academic upper secondary options, even when they are low performing (Dorsett & Lucchino, 2014; Achatz, Jahn, and Schels 2022). Among those who enrol in vocational programmes, non-completion is high (Dollmann et al., 2023).

This tendency for immigrant background students to show bold educational aspirations yet low educational performance has been found across European countries (Dollmann et al., 2023; Engzell, 2019). However, there are important contextual factors to be considered. In Norway, students with immigrant backgrounds spend more time on homework, have a strong preference for academic (rather than vocational) tracks, have low GPAs and have higher continuation rates into tertiary education compared with their native peers (Reisel et al., 2019; Hermansen, 2016). For those who start vocational upper secondary programmes, non-completion remains a problem (Bratsberg et al., 2012; Bratholmen & Ekren, 2020). In Spain, results have been somewhat mixed. Some studies have found that students with immigrant backgrounds, especially those of Latin American origin, have higher educational aspirations compared with students of Spanish origin (Gil-Hernández & Gracia, 2018). Others have found that youth of immigrant origin have the same (Cebolla-Boado et al., 2021) or lower aspirations than their native peers (Portes et al., 2016).

The literature on educational achievement points to the role of educational aspiration as an important factor leading to educational attainment (Portes et al., 2010; Strømme, 2021). However, while aspirations can be important in reducing educational achievement gaps between those with majority and immigrant backgrounds (Dollmann et al., 2023), some argue that these optimistic

choices might result in a failure to obtain the desired qualifications (Birkelund, 2020; Tjaden & Hunkler, 2017; Dollmann & Weißmann, 2020).

### ***The association between aspirations and achievements***

What directs members of the immigrant population towards their educational aspirations and outcomes is a matter of theoretical dispute. One disagreement revolves around the role of ‘immigrant culture’ and whether cultural preservation promotes positive school behaviour (Kindt, 2022).

In explaining the educational behaviour of children of immigrants, some point to the importance of an immigrant cultural ethos of obligation, hard work and superior expectations (Friberg, 2019; Portes & Rumbaut, 2001; Zhou & Bankston, 1998). Critics argue that this is inattentive to who immigrants were before they migrated (Feliciano & Lanuza, 2017); and, moreover, that immigrants’ status in their countries of origin and the geographical and historical contexts in which this status was attained (i.e., contextual attainment) is crucial to consider when assessing the educational progress of children of immigrants (Feliciano & Lanuza, 2017; Feliciano, 2020). In line with this, others point to immigrants’ subjective social status within their countries of origin as relevant, as it informs how parents support their children’s schooling. While an immigrant may hold a low-income job in their host country, they may nevertheless see themselves as having a higher-class origin and therefore engage in parenting styles associated with the middle class (Kindt, 2022).

This literature discusses the mechanisms promoting *either* high educational aspirations *or* high educational outcomes, rarely addressing the association between aspirations and achievement. Engzell (2019) shows that, while immigrant selectivity implies strong parental expectations that lead to high educational aspirations among children, immigrant selection cannot explain the children’s educational outcomes. He argues that schooling in countries from which non-European immigrants often migrate is characterised by less expansive educational systems. These tend to be marked by uneven access and strong inheritance, limiting the potential for skill transmission. Thus, immigrants with a high relative level of education might expect their children to reproduce what they understand as their high social status; at the same time, they may be less equipped to support their children’s schooling in comparison with majority parents with higher absolute levels of education. That immigrants often lack relevant information about the educational system might amplify this pattern (Tjaden & Hunkler, 2017).

The apparent asymmetry between low performance and high aspirations within immigrant populations raises concerns. Some scholars suggest that low performing students with immigrant backgrounds might benefit more in the labour market from pursuing vocational, rather than general upper secondary, programmes (Tjaden & Hunkler, 2017). However, whether the educational achievements of students with immigrant backgrounds would increase if they were to be encouraged towards alternative routes than those to which they aspire is an empirical question. In a newer study, Dollmann et al. (2023) found that the completion gap between students with majority and immigrant backgrounds is not likely to be much reduced by steering children of immigrants into more ‘realistic’ educational paths. That students with immigrant backgrounds are disadvantaged in vocational secondary programmes, especially in access to apprenticeships, is confirmed (Tjaden, 2017; Bratholmen & Ekren, 2020). But whether this disadvantage is due to immigrant background students’ own preferences or discrimination is a matter of disagreement (Tjaden, 2017; Tobback et al., 2020).

While our data do not allow us to draw solid conclusions about the mechanisms promoting educational aspirations and achievements, they do allow us to explore the understudied and somewhat conflicted relationship between the two. We argue that it is important to establish the empirical connection between educational aspirations and outcomes before portraying high educational aspirations as *either* a springboard to structural integration (Dollmann et al., 2023), *or* as a ‘trap’ (Birkelund, 2020; Tjaden & Hunkler, 2017; Dollmann & Weißmann, 2020). In this paper, we

provide evidence to support this argument from two different cases: Barcelona in Spain and Bergen in Norway.

## Barcelona and Bergen as different cases

The two cities vary along several dimensions that are discussed in comparative literature on educational systems and youth transitions. Although national context variables are unavailable for this study, an outline of some important features helps to locate the two cities within larger typologies and research fields. After a brief account of the relevant immigrant populations, we describe how the cities' educational systems are structured, then turn to recent developments in their labour markets.

Immigration in Spain has increased rapidly, not least from Latin America (Cebolla-Boado et al., 2021): i.e., people with a linguistic advantage, but often from poor schooling backgrounds (Zinovyeva et al., 2013; Portes et al., 2016). Immigration in Norway has been slower, with a wave of labour immigration from Eastern Europe following the 2004 expansion of the European Economic Area. The immigrant populations are heterogeneous in both cities. In any case, we may expect variation in parents' reasons for migration, education, occupations, social class pre- and post-migration and expectations for their children. Furthermore, educational and labour market structures also vary within and across the two cases.

In Walther's (2006) typology of youth transitions, the two countries reflect different clusters of structural characteristics and rationales. Norway, together with other Northern countries, is understood as a *universalistic* transition regime, with a comprehensive school system and national frameworks that allow for individual educational plans. Second chance options emphasise reopening access rather than cooling down aspirations. Furthermore, students in vocational tracks in Norway can choose a supplementary year that qualifies them for university admission, making the initial choice (at age 16) more open and flexible (Reisel et al., 2019). Nevertheless, completing vocational training in Norway can offer prospects of acquiring a job in a relevant field and even a relatively high wage.

Spain, as in other southern European countries, is classified within a *sub-protective* transition regime, characterised by un-protective living conditions in which the family plays a crucial role. Vocational training is weakly developed and known for its low status compared with the academic tracks (Walther, 2006; Merino & García Gracia, 2022; Termes, 2022). Though enrolment in vocational training has increased significantly in Barcelona over the last decade, the stratification and segmentation between academic and vocational tracks have been consolidated (Termes, 2022).

According to typologies of schooling system characteristics, both Norway and Spain have a comprehensive school organisation and a common curriculum until the age of 16. However, Norway exemplifies an *individualised integration* model (Mons, 2002), with individualised lessons, the automatic promotion of students, a teaching process comprising all students and low non-completion rates. Spain's model, by contrast, is one of *uniform integration*, with high repetition rates, remedial classes for some students and high non-completion rates (Janmaat & Mons, 2011). In Barcelona, unofficial tracking by means of internal ability grouping in schools is relatively common at the lower secondary level (Pàmies & Castejón, 2015) and even earlier (Carrasco et al., 2011). The most vulnerable groups, including students of immigrant families, are largely oriented towards less academic tracks, resulting in an unequal distribution of opportunities (Pàmies & Castejón, 2015; Elias et al., 2020). Despite comprehensive initiatives, both failure of completion and inequality in educational opportunities have increased (Merino et al., 2017). Another difference between the two cities is the cost of higher education. Catalonia is the most expensive region in Spain in this respect, whereas in Norway most colleges and universities require no tuition.

While the association between early tracking and inequality of educational outcomes is well documented (Horn, 2009; Van de Werfhorst & Mijs, 2010), the impact of tracking on aspirations is not properly understood. However, it might be that late tracking and second chance opportunities positively shape aspirations; it may also be that 'immigrant optimism' is better explained by the impact of significant others' and parents' expectations (Nygård, 2017).

Concerning labour market characteristics, Norway is generally known for its egalitarian composition with a compressed wage structure and large public sector. Economic inequality is substantially lower in Norway than in Spain (O'Reilly et al., 2015). A segmented labour market in Spain contributes to very high rates of youth unemployment, but also to over-qualification (Walther, 2006; Garcia, 2011). In Spain, the dramatic increase in immigration can be attributed to the combination of a high demand for unskilled and semi-skilled labour and a low supply of native workers (Portes et al., 2016). More recently, over three million jobs in Spain were eradicated in the aftermath of the economic recession (Miyar-Busto, 2017), affecting low-skilled young people, in particular (Dolado et al., 2013); Norway, by comparison, was hardly affected (Salvanes, 2017). In 2013, youth unemployment rates were 54.6 in Spain and 8.7 in Norway (O'Reilly et al., 2015), just before the first round of this survey was carried out. In Spain, the participation rate for those under 30 decreased from 67% in 2005 to 57% in 2015, while the occupancy rate decreased from 58% to 35%, partly because many who were educated and ready to work became inactive (Cebrián & Moreno, 2018). On the whole, the international literature confirms the economic prediction that young people will opt for education in times of economic depression and unemployment (von Simson 2016). Across countries, unemployment rates among immigrant youth are much higher than among the native populations (Lancee, 2016), and a perceived risk of unemployment may strengthen aspirations for higher education.

In sum, due to unofficial tracking into pathways leading away from academic careers, and tuition for tertiary education and a strong division in the labour market based on education and higher unemployment rates, there seems to be a greater divide between groups depending on background in terms of educational decisions in Barcelona than in Bergen. It might be that this is also the case for educational aspirations.

## Data and analytic strategy

The data were collected as part of the 'International Study of City Youth' project, in which surveys were administered in several cities around the world, from 2014 onwards. The present study uses the data from the surveys conducted in Barcelona and Bergen. Of the 2,030 tenth graders who participated in the first round of the survey in Barcelona, and 2,141 in Bergen – after excluding those with missing relevant information in year 12 – we were left with 1,299 in Barcelona and 1,702 in Bergen. The sample in Barcelona is from both public and publicly funded private schools and is considered a representative sample of these. In Bergen, all the tenth graders in public schools who were present on the day of the survey participated. Previous research shows little social segregation between public and private schools in Norway (Berge & Hyggen, 2011). Leaving private schools in Bergen out of the study is thus not expected to notably affect the analyses. The students were followed up by register data in Bergen in year 12, and by a survey in Barcelona. In the schools that were asked to participate in the first round, approximately 80.2% of the students in Bergen and 91.6% in Barcelona replied to the survey. As the data are collected solely from two relatively large cities in the two countries, the study is not considered to be representative of the countries – although we sometimes use the names of the countries rather than the cities.

## Variables

### Dependent variables

The variable measuring aspirations is based on a question asking tenth graders which occupation they think they would have or would want to have when they were 30 years old.<sup>1</sup> The variable has

<sup>1</sup>This question was formulated somewhat differently in the two countries. In Norway, the students were asked what they thought they would be doing at the age of 30, whereas in Spain they were asked what they would like to be doing when they were 30. In the literature, aspirations are defined as abstract statements about or hopes for what the future might bring (Gottfredson,



been coded into four categories, based on the level of education required for that occupation. The first category includes occupations that require higher education; the second category those that require vocational education in upper secondary school; the third category those that require no particular form of education; and the fourth includes answers of uncertainty as to future occupation. The lowest possible educational level needed for the stated occupation was chosen. The variable measuring educational outcomes in Bergen is based on register data about the programmes the students were attending in the second year of upper secondary school; in Barcelona, it is based on the third round of the survey, which asked students to state what programme and year they were studying; also, in the last year of upper secondary school. Since the last year of upper secondary school in Spain corresponds to the second-to-last year in Norway, we use the twelfth year of schooling in both countries to facilitate comparison. Those who were in a vocational track at this point, or who dropped out or were delayed, were coded as 0, and those who were in an academic track were coded as 1. This variable was created to give an indication of whether the students were likely to proceed to higher education, as this is often regarded as constituting 'high' aspirations, or whether the students were not likely to do so. A variable measuring mismatch was created to depict whether students aspired towards an occupation demanding higher education, but started a vocational track, were delayed or dropped out.

### *Independent variables*

The main independent variable is immigrant background. This variable is based on the respondents' answers to questions about their country of birth, that of their mother and father, and languages spoken at home, as well as on register data about students' mother tongue from their application to upper secondary school. If their mother and father were born in Eastern Europe, Africa, Asia or Latin America, the student is regarded as having an immigrant background. Where parents' countries of origin differ or are missing, the student is classified as being of immigrant origin insofar as the languages spoken at home include the language of the foreign-born parent or a relevant mother tongue in the register data. As is common in much of the literature on education and labour market prospects among immigrants, immigrants from Western European countries and North America are included in the majority category, because research shows that labour market disadvantages primarily affect immigrants from other countries (e.g., Drange & Helland, 2019).

Spanish-speaking students from South and Central America in Barcelona have been classified as having an immigrant background. However, we have conducted alternative analyses (available in the appendix), in which these students are singled out as one category in Barcelona, and Eastern European students are singled out as one category in Bergen. Unfortunately, numbers hinder our ability to distinguish further between students of different geographical origins. Students originating from Africa, Latin America and Asia comprise 7% of the Bergen sample and 26% of the Barcelona sample. How this simplification might affect our analyses is further discussed below, when we detail the limitations of the study.

Because of the low numbers, it is also difficult to distinguish between immigrants and descendants of immigrants. Thus, the dichotomous variable of immigrant versus native origin is a simplification. However, the educational behaviour of descendants is known to be quite different from that of immigrants, in Norway as well as in Spain. We report the results of separate analyses for descendants and immigrants in the appendix and comment on these in the discussion. Students who immigrated before the age of six are counted as descendants. We control for parents' education, measured at three levels: lower secondary, upper secondary and university. By using a dominance approach, the parent with the highest level of education is used. We control for grades based on a question

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1981; Beal & Crockett, 2010; Andres et al., 1999; Khatib, 2015). This definition is arguably closer to the way the question was formulated in the Spanish survey. However, as the students were 16 years old when they were asked the question, it may be rather abstract in both cases. Moreover, while the question requires that students project themselves into the future, any differences found can also be related to the students' capacity to do this. As such, the variable should not be thought to simply measure aspirations.

in the first round of the survey, where the students were asked what grades they expected to get. As this is the year before they enter upper secondary school, these grades are instructive for their future options. These have been standardised within countries to aid with comparability. We also include a control based on the item ‘my parents want me to go to university’ to assess whether parent expectation is what is driving their aspirations and/or outcomes and the match or mismatch between these. Finally, we control for gender, as we know there are important gender differences in these questions (Feliziano and Rubault 2005). The variables are listed in [table 1](#).

The analyses were conducted using logistic binomial regression models calculated into average marginal effects, to avoid well-known issues connected to comparing across models using logistic regression (Mood, 2010). The results are visualised with plots showing the relative differences between coefficients for immigrants and native majority students with and without controls and additionally shown as full models. Standard errors are clustered on schools in all analyses, as the between-school variation in Barcelona proved relatively high. We have included attrition weights for the Barcelona sample, as the attrition between the first and second round of data collection was not assumed to be random, and many predictors were correlated with attrition when tested (Baulch & Quisumbing, 2011). As the first round of data from Bergen was followed up with register data on all the individuals in the second round, attrition weights were not necessary in the models from Bergen.

## Results

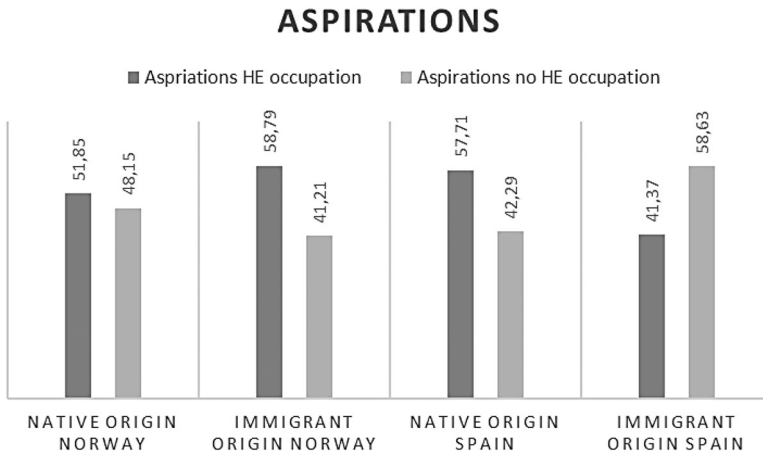
To present the results, we provide figures showing descriptive statistics and then examine the statistical analysis from logistic regressions calculated into average marginal effects. [Figures 1–3](#) show descriptive statistics for the dependent variables, to visualise the differences in percentages. [Figure 1](#) shows that most students in both countries tend to have aspirations towards occupations demanding higher education. However, whereas a somewhat higher share of youth of immigrant origin in Norway have such tendencies, the pattern in Spain is the opposite: a lower share of youth of immigrant origin have such ‘high’ aspirations.

[Figure 2](#) shows the percentage in different groups that are on time in an academic track in year 12, versus those who have dropped out, are delayed or in a vocational track. In Norway, larger

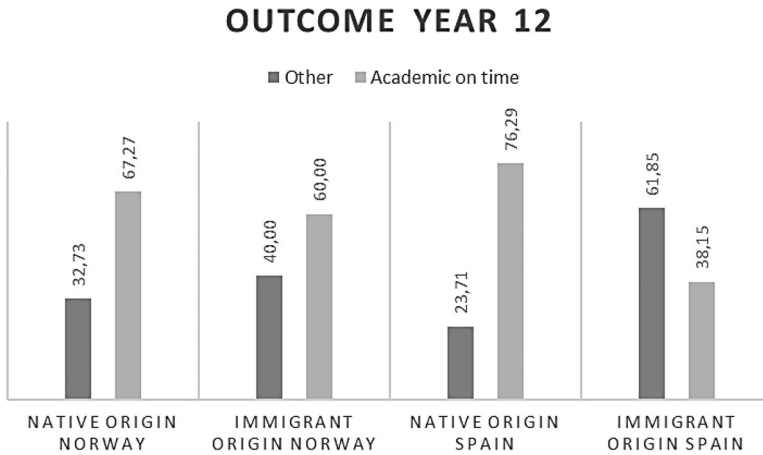
**Table 1.** Descriptive statistics.

Variables	Mean/Per cent	SD	Min/Max	N
<i>Barcelona:</i>				
Aspirations HE	54.58		0/1	709
Academic year 12	68.98		0/1	896
Mismatch aspirations outcomes	11.78		0/1	153
Female	49.96		0/1	875
Immigrant	19.17		0/1	249
Parents’ compulsory level or less	14.93		0/1	194
Parents’ post-compulsory level	38.95		0/1	506
Parents’ university level	46.11		0/1	599
Expected grades	2.836663	0.7112898	0/4	1,702
My parents want me to go to university	3.141598	0.8471951	1/4	1,702
<i>Bergen:</i>				
Aspirations HE	52.53		0/1	894
Academic year 12	66.57		0/1	1,133
Mismatch aspirations outcomes	10.22		0/1	174
Female	51.41		0/1	875
Immigrant	9.69		0/1	165
Parents’ compulsory level or less	5.11		0/1	87
Parents’ post-compulsory level	43.01		0/1	732
Parents’ university level	51.88		0/1	883
Expected grades	2.668976	0.932903	0/4	1,299
My parents want me to go to university	3.582756	0.670679	1/4	1,299





**Figure 1.** Percentage with aspirations towards an occupation demanding higher education versus other aspirations in both countries in school year 10, according to immigrant background.



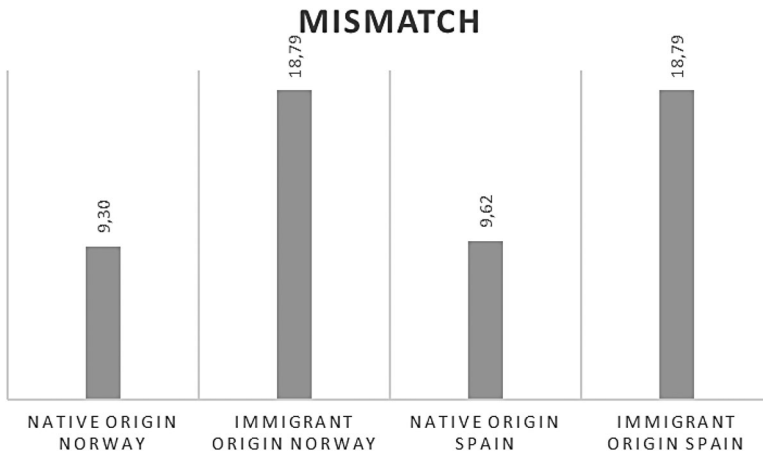
**Figure 2.** Percentage on time in an academic track in year 12 in both countries, according to immigrant background.

shares of both native and immigrant origin students are in an academic track at this point, whereas a larger share of the immigrant origin students in Spain are in the other category, likely related to the high repetition rate. A larger share of the native students than those of immigrant origin are also in an academic track in Norway, even if the difference between descendants of immigrants and natives is minimal (not shown).

Finally, [figure 3](#) shows the share of different groups in tenth grade that have aspirations towards an occupation demanding a higher education, but that are not on time in an academic track in year 12. In both countries, the share of those with immigrant backgrounds experiencing such a mismatch is larger than among their native peers.

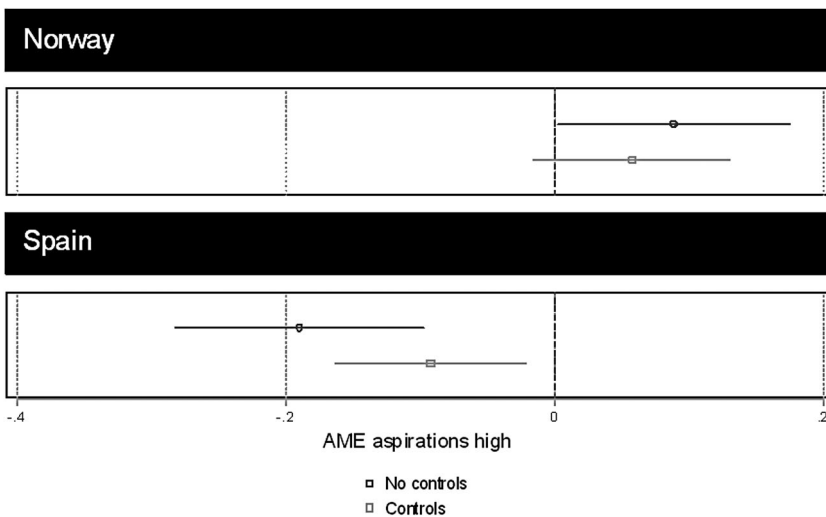
### Aspirations

Turning to the statistical analyses, [figure 4](#) depicts the plotted coefficients from logistic models shown as average marginal effects for having aspirations towards an occupation demanding higher



**Figure 3.** Percentage with aspirations towards occupations demanding higher education, but not on time in an academic track in year 12 in both countries, according to immigrant background.

education for immigrants relative to natives, with and without controls for gender, parents' education level, students' own expected grades and the item 'my parents want me to go to university'. In Norway, students with immigrant backgrounds have relatively higher aspirations than their native origin peers, whereas in Spain, the pattern is the opposite – and the differences are larger. In Spain, the average change in probability of having aspirations towards an occupation requiring higher education decreases by almost 20% between those with native origins and those with immigrant origins. The differences between immigrant and native origin students weakens when controls are included, as the probabilities for such aspirations increase for the group of immigrant origin. The results shown in tables 1, 2 and 7 in the appendix confirm that those with immigrant backgrounds have significantly higher aspirations than the native majority in Bergen, but lower in Barcelona, and that there is a significant difference between youth with immigrant backgrounds in



**Figure 4.** Plotted coefficients from logistic models shown as average marginal effects for having aspirations towards occupations demanding higher education. With and without control for parents' education level, gender, own grades, and the item 'my parents want me to go to university'. Immigrant background versus native background. Baseline: aspirations towards an occupation not demanding any education/native background.

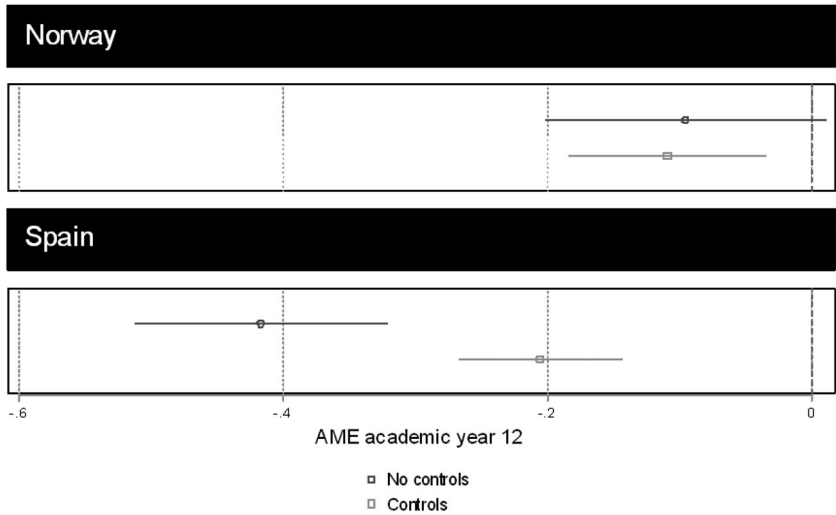
Barcelona and Bergen in this respect. Tables 1 and 2 also show that, whereas parents' expectations are driving these results in Bergen, this is not the case in Barcelona.

**Outcomes**

Figure 5 depicts plotted coefficients from a logistic model shown as average marginal effects for being on time in the academic track in year 12 for the students with immigrant backgrounds relative to their native peers. In Norway, the association is somewhat lower for the students with immigrant backgrounds relative to the rest, but the differences are only significantly different from the majority with controls. The negative correlations are driven by the immigrants, not the descendants (see figures in appendix). In Spain, the average change in probability for the students with immigrant backgrounds is substantially lower relative to the native students, as well as when controls are included. Here, robustness checks also confirm that there are significant differences between immigrants in the two cities, even if being in the academic track in general is more common in Barcelona than in Bergen.

**Mismatch**

Finally, figure 6 depicts the coefficients from the marginal effect for the mismatch between having aspirations towards a profession requiring higher education and being in a vocational track, having dropped out or being delayed in the last year of upper secondary school. The analyses are with and without controls for parents' education level, gender, students' own expected grades and the item 'my parents want me to go to university'. The analyses show that, in both countries, such a mismatch is more common among the students with immigrant backgrounds than among the native origin students. Again, this is mostly driven by young people with immigrant backgrounds in Norway, rather than the descendants (see figures in the appendix). Including controls reduces the coefficients in Barcelona, but not in Bergen, implying that parents' university level accounts for a significant share of the average change in the probability of experiencing such a mismatch in Barcelona. The sensitivity checks in the appendix also suggest that the Eastern European immigrants



**Figure 5.** Plotted coefficients from logistic models shown as average marginal effects on being in an academic track in year 12. With and without controls for gender, parents' education level, own grades, the item 'my parents want me to go to university' and own aspirations. Difference between immigrant background and native background. Baseline: not on track/native background.

are important in driving the results concerning aspirations and mismatch in Norway, but due to the small numbers, we are careful with such interpretations.

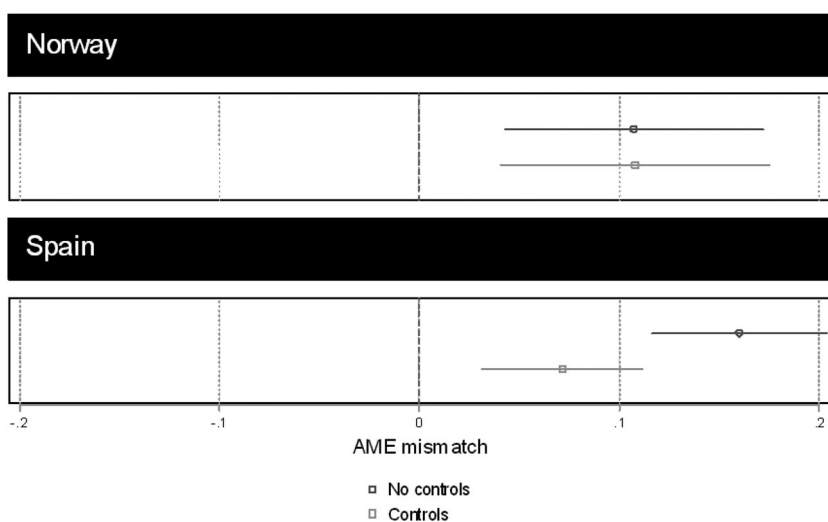
Tables 1–6 in the appendix show in more detail how the independent variable influences the different outcomes. Importantly, we have included a control measuring students' perceptions of parents' expectations. This is significantly related to aspirations and outcomes (but not mismatch) in both cities but does not impact the correlation between immigrant origin and aspirations in Barcelona: only in Bergen.

To sum up, our analysis shows that, in Bergen, youth with immigrant backgrounds have relatively higher educational aspirations, lower educational outcomes and a higher probability of mismatch compared with their peers with a native background. In Barcelona, our findings suggest that youth with immigrant backgrounds have somewhat lower educational aspirations, lower educational outcomes and a higher probability of a mismatch compared with their peers with a native background. In the following section, we discuss these findings.

## Concluding discussion

The overall positive trend regarding the educational aspirations of youth of immigrant origin has generated optimism for future socioeconomic integration and is regularly described as a success story (Crul et al., 2012; Heath et al., 2008; Dollmann and Weissman 2020; Tjaden & Scharenberg, 2017; Salikutluk, 2016). However, the success of this trend towards educational mobility depends on the level of fit between immigrant origin youths' educational aspirations and outcomes. If they aspire to more than they achieve, and this gap is significantly larger among immigrant origin youth compared with their native peers, the immigrant drive is not solely a story about success.

Researchers disagree about whether high educational aspirations in immigrant communities should be seen as a positive springboard to structural integration (Dollmann et al., 2023) or as an 'optimism trap' (Tjaden & Hunkler, 2017). We argue that, before establishing aspirations as *either* amplifying *or* diminishing the possibilities in the educational system for students with immigrant backgrounds, research needs to establish the empirical connection *between* educational aspirations and outcomes.



**Figure 6.** Plotted coefficients from logistic models shown as average marginal effects on mismatch. With and without control for parents' education level, gender, own grades and the item 'my parents want me to go to university'. Difference between immigrant background and native background. Baseline: native origin/no mismatch.

We find that the educational aspirations of youth with immigrant backgrounds are lower in Spain than in Bergen, compared with their native majority peers. We also show that high aspirations, even if positively related to outcomes, also risk a mismatch. We find that the mismatch between aspirations and outcomes is higher among youth with immigrant backgrounds compared with their native peers, in both Norway and Spain. While our data do not allow us to draw solid conclusions about the mechanisms explaining youths' educational aspirations, outcomes and the association between them, the youth of immigrant origin likely establish dreams and hopes for their future – not only as 'immigrants' but related to what they see as possible within the context where they shape their wishes.

In this paper, we point to differences in the immigrant populations, educational systems and labour markets as factors that are likely to affect the educational aspirations and outcomes of youth with immigrant backgrounds. Informal early tracking, dependence on family for economic support, a segmented labour market and tuition in higher education seem to place immigrant origin youth in Barcelona at greater risk when opting for higher education, in comparison with immigrant youth in Bergen. This can also be important for the difference between immigrant and native youths' aspirations and choices at each branching point, as the response to risk that often follows such divides may depend on social origin (Boudon, 1974; Cebolla-Boado & Finotelli, 2015; Elias et al., 2020).

Concerning the mismatch between educational outcomes and aspirations, the higher mismatch in Norway must be understood as related to the higher aspirations among those youth. However, the mismatch in Norway might be related to the parallel pathways to higher education. As described in the methods section, the variable measuring mismatch is created to depict whether students aspired towards an occupation demanding higher education, but started a vocational track, were delayed or dropped out. As students in vocational tracks in Norway can 'switch' to the academic track by taking a supplementary year, their aspirations towards higher education might still be reachable. However, as shown earlier, we know that there exist ethnic differences in access to apprenticeships in upper secondary vocational education. In Norway, it has been suggested that this might help explain both why so few students with immigrant backgrounds aspire for vocational programmes (Ljunggren & Orupabo, 2020) – and, further, why so many who enter vocational programmes drop out (Bratholmen & Ekren, 2020). If these barriers are real, students with immigrant backgrounds will not necessarily benefit from 'lowering' their educational aspirations towards vocational upper secondary programmes, as has been suggested (Tjaden & Hunkler, 2017).

Although youth with immigrant backgrounds show a higher mismatch between their aspirations and outcomes compared with their native peers, the youth in Spain also show this mismatch, though their aspirations were initially quite low. This builds on our point made above: lowering immigrants' educational aspirations might not necessarily lead to a smaller mismatch between educational aspirations and outcomes. As we control for perceived parent expectations, we can also rule out that the mismatch is due to adjustments from trying to meet parent expectations and thus having 'too high' aspirations.

There are some important limitations to this study. First, our results permit no causal claims. The rationale behind our findings may well be more complex and unobservable than our speculations about contextual factors. As the data for this study are limited in terms of numbers, we had to construct a dichotomous classification of 'immigrant background' versus 'native background', thereby omitting differences among different immigrant groups, and among immigrants versus their children. Research with a larger sample size could address these differences in a more nuanced way. Moreover, future research should investigate the relationship between aspirations and outcomes over a longer period, to learn more about the long-term consequences of mismatch within immigrant populations. Another limitation is that, while we controlled for grades, this is self-reported from the students and may be biased; as grades are considered an important barrier, especially in Barcelona, a better measurement could have improved the accuracy of our results. We

also acknowledge that we use the category for occupations requiring higher education as a proxy for 'high' aspirations, although these are not necessarily more ambitious than other occupations. Further, this could mean different things in the two contexts: male-dominated upper secondary vocational education, for example, can lead to relatively well-paid jobs in Norway, compared with female-dominated higher education of short duration. A final point is that, although we argue that context is important when studying youths' educational aspirations and outcomes, we have not had the opportunity to measure the contexts before and after important events, such as the financial crisis.

Our contribution is not to conclude which mechanisms promote educational aspirations and outcomes. Rather, we contribute to the literature by addressing the empirical connection between educational aspirations and outcomes: our results suggest that immigrant youth adjust their aspirations relative to what is possible in their context, but that barriers may exist across contexts, leading to a higher mismatch between aspirations and outcomes for this group compared with the native population in two very different settings. We argue that research needs to do such empirical work before portraying educational aspirations as *either* a springboard for structural integration (Dollmann et al., 2023) *or* as a 'trap' (Birkelund, 2020; Tjaden & Hunkler, 2017; Dollmann & Weißmann, 2020). Further, we cannot conclude that immigrant aspirations are too high and therefore constitute an 'optimism trap'. As discussed above, it might be that the mismatch is related to barriers in the educational institutions or the labour market. The higher mismatch among immigrant youth may in fact be a sign of pragmatic adjustment to their perceived reality. If this is the case, the barriers need to be removed, instead of encouraging youth with immigrant backgrounds to adjust their aspirations. Future research should investigate whether and in what regard these potential barriers contribute to unfulfilled educational aspirations among immigrant populations.

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## Ethics statement

Participation was voluntary, and consent was given through the completion of the survey. Letters of information and data collection procedures were assessed by Sikt (Norwegian Agency for Shared Services in Education and Research) to ensure compliance with the General Data Protection Regulation (GDPR) (reference number 35902). Similarly, all the necessary approvals have been given by parents and government in Barcelona.

## References

- Achatz, J., Kerstin, J., & Brigitte, S. (2022). On the non-standard routes: Vocational training measures in the school-to-work transitions of lower-qualified youth in Germany. *Journal of Vocational Education & Training*, 74(2), 289–310. <https://doi.org/10.1080/13636820.2020.1760335>



- Andres, L., Anisef, P., Krahn, H., Looker, D., & Thiessen, V. (1999). The persistence of social structure: Cohort, class and gender effects on the occupational aspirations and expectations of Canadian youth. *Journal of Youth Studies*, 2(3), 261–282. <https://doi.org/10.1080/13676261.1999.10593042>
- Baulch, B., & Quisumbing, A. (2011). *Testing and adjusting for attrition in household panel data* (CPRC Toolkit Note). Chronic Poverty Research Centre.
- Beal, S. J., & Crockett, L. J. (2010). Adolescents' occupational and educational aspirations and expectations: Links to high school activities and adult educational attainment. *Developmental Psychology*, 46(1), 258. <https://doi.org/10.1037/a0017416>
- Berge, Ø., & Hyggen, C. (2011). *Privatskoler i Norden. Omfang, utvikling og den politiske debatten (Fafo-notat. 2011)*. Fafo.
- Birkelund, J. F. (2020). Aiming high and missing the mark? Educational choice, dropout risk, and achievement in upper secondary education among children of immigrants in Denmark. *European Sociological Review*, 36(3), 395–412. <https://doi.org/10.1093/esr/jcz064>
- Boudon, R. (1974). *Education, opportunity and social inequality: Changing prospects in Western society*. Wiley.
- Bratholmen, N. V. L., & Ekren, R. (2020). *Hvordan går det med elever som ikke får læreplass?. Gjennomføring i videregående opplæring og tilknytning til arbeidsmarkedet*. Statistics Norway.
- Bratsberg, B., Raaum, O., & Røed, K. (2012). Educating children of immigrants: Closing the gap in Norwegian schools. *Nordic Economic Policy Review*, 1(2012), 211–253.
- Carrasco, S., Pàmies, J., Ponferrada, M., Ballestín, B., & Bertràn, M. (2011). Segregación escolar e inmigración en Cataluña: Aproximaciones etnográficas. In F. J. García Castano, & S. Carrasco (Eds.), *Investigaciones en Inmigración y Educación en España. Homenaje a Eduardo Terrén Lalana* (pp. 1–26). CIDE-Ministerio de Educación.
- Cebolla-Boado, H., Ferrer, A. G., & Soysal, Y. N. (2021). It is all about “Hope”: Evidence on the immigrant optimism paradox. *Ethnic and Racial Studies*, 44(2), 252–271. <https://doi.org/10.1080/01419870.2020.1745254>
- Cebolla-Boado, H., & Finotelli, C. (2015). Is there a North–South divide in integration outcomes? A comparison of the integration outcomes of immigrants in Southern and Northern Europe. *European Journal of Population*, 31, 77–102. <https://doi.org/10.1007/s10680-014-9327-8>
- Cebrián, I., & Moreno, G. (2018). Youth employment in Spain: Flows in and out during the great recession and employment stability. In MÁ Malo, & A. M. Mínguez (Eds.), *European youth labour markets: Problems and policies* (pp. 95–107). Springer.
- Crul, M., Schneider, J., & Lelie, F. (2012). *The European second generation compared: Does the integration context matter?* Amsterdam University Press.
- Dolado, J. J., Jansen, M., Felgueroso, F., Fuentes, A., & Wölfl, A. (2013). *Youth labour market performance in Spain and its determinants (Economics Department Working Paper)*. OECD. <https://doi.org/10.1787/18151973>
- Dollmann, J., Jonsson, J. O., Mood, C., & Rudolphi, F. (2023). Is ‘immigrant optimism’ in educational choice a problem? Ethnic gaps in Swedish upper secondary school completion. *European Sociological Review*, 39(3), 384–399. <https://doi.org/10.1093/esr/jcad023>
- Dollmann, J., & Weißmann, M. (2020). The story after immigrants' ambitious educational choices: Real improvement or back to square one? *European Sociological Review*, 36(1), 32–47.
- Dorsett, R., & Lucchino, P. (2014). Explaining patterns in the school-to-work transition: An analysis using optimal matching. *Advances in Life Course Research*, 22, 1–14. <https://doi.org/10.1016/j.alcr.2014.07.002>
- Drange, I., & Helland, H. (2019). The sheltering effect of occupational closure? Consequences for ethnic minorities' earnings. *Work and Occupations*, 46(1), 45–89. <https://doi.org/10.1177/0730888418780970>
- Elias, M., Merino Pareja, R., & Sánchez-Gelabert, A. (2020). Aspiraciones ocupacionales y expectativas y elecciones educativas de los jóvenes en un contexto de crisis. *Revista Española De Sociología*, 29(3 - Sup2), 27–46. <https://doi.org/10.22325/fes/res.2020.73>
- Engzell, P. (2019). Aspiration squeeze: The struggle of children to positively selected immigrants. *Sociology of Education*, 92(1), 83–103. <https://doi.org/10.1177/0038040718822573>
- Feliciano, C. (2020). Immigrant selectivity effects on health, labor market, and educational outcomes. *Annual Review of Sociology*, 46(2020), 315–334. <https://doi.org/10.1146/annurev-soc-121919-054639>
- Feliciano, C., & Lanuza, Y. R. (2017). An immigrant paradox? Contextual attainment and intergenerational educational mobility. *American Sociological Review*, 82(1), 211–241. <https://doi.org/10.1177/0003122416684777>
- Feliciano, C., & Rumbaut, R. G. (2005). Gendered paths: Educational and occupational expectations and outcomes among adult children of immigrants. *Ethnic and Racial Studies*, 28(6), 1087–1118.
- Friberg, J. H. (2019). Does selective acculturation work? Cultural orientations, educational aspirations and school effort among children of immigrants in Norway. *Journal of Ethnic and Migration Studies*, 45(15), 2844–2863. <https://doi.org/10.1080/1369183X.2019.1602471>
- García, R. J. (2011). *Youth unemployment in Spain: Causes and solutions (11/30 Documentos de Trabajo)*. BBVA Research.
- Gil-Hernández, C., & Gracia, P. (2018). Adolescents' educational aspirations and ethnic background: The case of students of African and Latin American migrant origins in Spain. *Demographic Research*, 38, 577–618. <https://doi.org/10.4054/DemRes.2018.38.23>

- Gottfredson, L. S. (1981). Circumscription and compromise: A developmental theory of occupational aspirations. *Journal of Counselling Psychology*, 28(6), 545–579. <https://doi.org/10.1037/0022-0167.28.6.545>
- Heath, A. F., & Brinbaum, Y. (eds.). (2014). *Unequal attainments: Ethnic educational inequalities in ten Western countries* (Vol. 196). Oxford University Press.
- Heath, A. F., Rothon, C., & Kilpi, E. (2008). The second generation in Western Europe: Education, unemployment, and occupational attainment. *Annual Review of Sociology*, 34(1), 211–235. <https://doi.org/10.1146/annurev.soc.34.040507.134728>
- Hermansen, A. S. (2016). Moving up or falling behind? Intergenerational socioeconomic transmission among children of immigrants in Norway. *European Sociological Review*, 32(5), 675–689. <https://doi.org/10.1093/esr/jcw024>
- Horn, D. (2009). Age of selection counts: A cross country analysis of educational institutions. *Educational Research and Evaluation*, 15(4), 343–346. <https://doi.org/10.1080/13803610903087011>
- Jackson, M. (2012). Bold choices: How ethnic inequalities in educational attainment are suppressed. *Oxford Review of Education*, 38(2), 189–208. <https://doi.org/10.1080/03054985.2012.676249>
- Janmaat, J. G., & Mons, N. (2011). Promoting ethnic tolerance and patriotism: The role of education systems characteristics. *Comparative Education Review*, 55(1), 56–81. <https://doi.org/10.1086/657105>
- Khatab, N. (2015). Students' aspirations, expectations and school achievement: What really matters? *British Educational Research Journal*, 41(5), 731–748. <https://doi.org/10.1002/berj.3171>
- Kindt, M.T. (2022). How do children of immigrants experience parental involvement in their education? *Nordic Journal of Migration Research*, 12(2), 190–205.
- Lancee, B. (2016). The negative side effects of vocational education: A cross-national analysis of the relative unemployment risk of young non-Western immigrants in Europe. *American Behavioural Scientist*, 60(5), 659–679. <https://doi.org/10.1177/0002764216632835>
- Ljunggren, J., & Orupabo, J. (2020). Moving beyond: Narratives of higher educational aspirations among descendants of immigrants in vocational training. *British Journal of Sociology of Education*, 41(5), 701–716. <https://doi.org/10.1080/01425692.2020.1776593>
- Merino, R., García, M., Torrent, D., & Valls, O. (2017). Separación del alumnado por niveles en 4<sup>o</sup> de ESO y complejidad social de los centros. Límites y posibilidades del currículum comprensivo. *Revista Tempora*, 19(2016–2017), 181–198.
- Merino, R., & García Gracia, M. (2022). Vías e itinerarios de formación profesional: la persistencia de la asociación entre bajo rendimiento y opción profesional. *Estudios sobre Educación*, 43, 157–176. <https://doi.org/10.15581/004.43.008>
- Miyar-Busto, M. (2017). Immigrant-origin youth engagement in education in Spain during the great recession. *Revista Española de investigaciones Sociológicas*, 157, 123–140. <https://doi.org/10.5477/cis/reis.157.123>
- Mons, N. (2002). *De l'école unifiée aux écoles plurielles: Evaluation internationale des politiques de différenciation et de diversification de l'offre éducative* (PhD thesis), IREDU-Université de Bourgogne.
- Mood, C. (2010). Logistic regression: Why we cannot do what we think we can do, and what we can do about it. *European Sociological Review*, 26(1), 67–82. <https://doi.org/10.1093/esr/jcp006>
- Nygård, O. (2017). Early tracking and immigrant optimism: A comparative study of educational aspirations among students in disadvantaged schools in Sweden and the Netherlands. *Comparative Migration Studies*, 5(20), <https://doi.org/10.1186/s40878-017-0063-1>
- O'Reilly, J., Eichhorst, W., Gábos, A., Hadjivassiliou, K., Lain, D., Leschke, J., McGuinness, S., Kureková, L. M., Nazio, T., Ortlieb, R., Russell, H., & Villa, P. (2015). Five characteristics of youth unemployment in Europe: Flexibility, education, migration, family legacies, and EU policy. *SAGE Open*, 5(1), <https://doi.org/10.1177/2158244015574962>
- Pàmies, J., & Castejón, A. (2015). Distribuyendo oportunidades: el impacto de los agrupamientos escolares en la experiencia de los estudiantes. *Revista de la Asociación de Sociología de la Educación*, 8(3), 335–348.
- Portes, A., Aparicio, R., & Haller, W. (2016). *Spanish legacies: The coming of age of the second generation*. University of California Press.
- Portes, A., Aparicio, R., Haller, W., & Vickstrom, E. (2010). Moving ahead in Madrid: Aspirations and expectations in the Spanish second generation. *International Migration Review*, 44(4), 767–801. <https://doi.org/10.1111/j.1747-7379.2010.00825.x>
- Portes, A., & Rumbaut, R. G. (2001). *Legacies: The story of the immigrant second generation*. University of California Press.
- Reisel, L., Hermansen, A. S., & Kindt, M. T. (2019). Norway: Ethnic (In)equality in a social-democratic welfare state. In P. Stevens, A. Dworkin, P. Stevens, & A. Dworkin (Eds.), *The Palgrave handbook of race and ethnic inequalities in education* (pp. 843–884). Palgrave Macmillan.
- Salikutluk, Z. (2016). Why do immigrant students aim high? Explaining the aspiration–achievement paradox of immigrants in Germany. *European Sociological Review*, 32(5), 581–592. <https://doi.org/10.1093/esr/jcw004>
- Salvanes, K. G. (2017). *Omstillingsevnen i norsk økonomi under finanskrisen. Bakgrunnsnotat for Perspektivmeldingen (Arbeidsnotat 2017, 7)*. Finansdepartementet.

- Strømme, T. (2021). Educational aspirations and decisions in Barcelona, Spain and Bergen, Norway: the significance of class and class fractions. *Journal of Youth Studies*, 24(3), 404–425.
- Termes, A. (2022). Transitions to post-compulsory education in Barcelona: Distinct paths, unequal itineraries. *Revista Española de Investigaciones Sociológicas*, 178, 143–164. <https://doi.org/10.5477/cis/reis.178.143>
- Tjaden, J. D. (2017). Migrant background and access to vocational education in Germany: self-selection, discrimination, or both? *Zeitschrift für Soziologie*, 46(2), 107–123. <https://doi.org/10.1515/zfsoz-2017-1007>
- Tjaden, J. D., & Hunkler, C. (2017). The optimism trap: Migrants' educational choices in stratified education systems. *Social Science Research*, 67, 213–228. <https://doi.org/10.1016/j.ssresearch.2017.04.004>
- Tjaden, J. D., & Scharenberg, K. (2017). Ethnic choice effects at the transition into upper-secondary education in Switzerland. *Acta Sociologica*, 60(4), 309–324. <https://doi.org/10.1177/0001699316679491>
- Tobback, I., Verhaest, D., & Baert, S. (2020). Student access to apprenticeships: Evidence from a vignette experiment. *Industrial Relations: A Journal of Economy and Society*, 59(3), 435–465. <https://doi.org/10.1111/irel.12258>
- Van de Werfhorst, H., & Mijs, J. J. B. (2010). Achievement inequality and the institutional structure of educational systems: A comparative perspective. *Annual Review of Sociology*, 36(1), 407–428. <https://doi.org/10.1146/annurev.soc.012809.102538>
- von Simson, K. (2016). Frafall I yrkesfag blant jenter og gutter: Arbeidsmarkedets betydning. In K. Reegård, & J. Rogstad (Eds.), *De frafalne. Om frafall i videregående opplæring*. Gyldendal Akademisk.
- Walther, A. (2006). Regimes of youth transitions: Choice, flexibility and security in young people's experiences across different European contexts. *Young. Nordic Journal of Youth Research*, 14(2), 119–139.
- Yates, S., Harris, A., Sebates, R., & Staff, J. (2011). Early occupational aspirations and fractured transitions: A study of entry into 'NEET' status in the U.K. *Journal of Social Policy*, 40(3), 513–534. <https://doi.org/10.1017/S0047279410000656>
- Zhou, M., & Bankston, C. (1998). *Growing up American: How Vietnamese children adapt to life in the United States*. Russell Sage Foundation.
- Zinovyeva, N., Felgueroso, F., & Vazquez, P. (2013). Immigration and student achievement in Spain: Evidence from PISA. *Journal of the Spanish Economic Association SERIEs*, 5, 25–60. <https://doi.org/10.1007/s13209-013-0101-7>