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# Undermatching and Noncognitive Development during the First Year of College: A Longitudinal Study of College Students in the Netherlands

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## Abstract

The study focuses on the phenomenon of “undermatching” in relation to the development of noncognitive attributes during the first year of college. Particular attention is paid to examining the role of first-generation college student status in moderating these relationships. The analyses utilize longitudinal data from the Netherlands (N = 14,540), to test whether undermatching is associated with noncognitive development, based on measures of academic motivation, college satisfaction, and academic self-efficacy. Results indicate among first-generation students, undermatching predicts positive development of satisfaction with college and academic self-efficacy, net of other social status, demographic, and educational measures. Alternatively, among continuing-generation students, undermatching does not affect noncognitive development. The results were found to be robust to model selection. The discussion and conclusion suggest that undermatching may, in fact, promote positive development of noncognitive attributes for socially mobile students (i.e., students from families with less educational attainment).

**Keywords** Undermatch · Noncognitive development · College students · Netherlands

## Introduction

Throughout Europe and the United States, higher education systems have strived and often struggled to achieve equal and fair access to higher education for all students, regardless of social backgrounds (Goodchild and Wechsler 1997; Hippe et al. 2016). This goal centers on the clear social and economic advantages tied to attaining advanced education, which is a fundamental basis for social mobility. For example, across national contexts, a four-year

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college degree accompanies substantial positive returns for students in both monetary and non-monetary terms, including labor market earnings, likelihood of employment, as well as health, well-being, and civic engagement (Grossman 2006; Kamhöfer et al. 2019; Mayhew et al. 2016; McMahon 2009), and the economic returns associated with higher education attainment are widely viewed as a result of the cognitive and noncognitive attributes students develop as a result of attending college (Heckman and Kautz 2012, 2013).

Within the larger context of equal and fair access to higher education are specific concerns regarding the accessibility of elite or selective colleges. Research has shown that attending a more selective institution increases one's likelihood of graduating and improves subsequent success in the labor market (Bowen et al. 2009; Long 2008, 2010; Titus 2004), and attending a more selective institution among students from lower socioeconomic backgrounds plays a distinctly valuable role in social mobility (Alon and Tienda 2005). Yet, despite efforts to make the most selective tracks in higher education accessible for all students, those with lower socioeconomic status (SES) remain less likely to enter or attain degrees from the most selective tracks, even after taking into account prior academic achievement (Smith et al. 2013).

The phenomenon of undermatching – when a student attends an institution that is less selective than their academic achievement would enable – has become a notable concern among researchers and is where we focus our attention. The large majority of prior research on academic undermatch has examined college enrollment as the primary outcome, seeking to uncover factors that influence one's likelihood of undermatching (Bastedo and Flaster 2014; Ovink et al. 2017). From this work, evidence points to students from lower socioeconomic backgrounds as being more likely to undermatch (Bowen et al. 2009; Roderick et al. 2011; Dillon and Smith 2017; Roksa and Deutschlander 2018; Smith et al. 2013), raising concerns about undermatching in relation to equality of educational opportunity and, more broadly, social mobility.

The pervasive assumption throughout much of the literature is that undermatching is a negative outcome and that students who undermatch will fail to maximize their potential (note the title of Belasco and Trivette's 2015 article that begins with the phrase "Aiming low"). The evidence to date does not fully support this assumption, or deficit-oriented approaches to examining undermatch. The small number of studies that have sought to empirically demonstrate outcomes associated with undermatching have indeed presented evidence to suggest that undermatching may have negative long-term consequences (Muskens et al. 2019, 2020; Ovink et al. 2017), while other studies have indicated that undermatched students may experience some positive outcomes relative to their matched peers (Fostnacht 2015; Kurlaender and Grodksy 2013). Ultimately, the existing evidence on the effects of undermatching is not entirely conclusive, and no prior study has examined academic undermatching from a developmental perspective. In other words, no previous study has examined the extent to which undermatched students change (or develop) during college, relative to comparable students who did not undermatch. With the present study we begin to fill this gap by presenting new evidence on the effects of undermatching on student development.

## Study Aims

This study aims to contribute new evidence on academic undermatching in relation to college student development during the first year of higher education, specifically examining development within the domain of students' noncognitive characteristics. These

characteristics can be defined as “patterns of thought, feelings, and behaviors” (Borghans et al. 2008), comprising personality attributes, attitudes, and motivations that may be developed throughout lifetime (Heckman and Kautz 2012). Noncognitive characteristics are known to have significant predictive value for important life outcomes such as schooling, wages, and longevity (Borghans et al. 2008). Among college students, noncognitive attributes have been found to be positively associated, either directly or indirectly, with achieved grade point average, commitment to one’s institution, and first-to-second year retention (Bowman et al. 2019).

With the present study we focus specifically on students’ academic motivation (Linnenbrink and Pintrich 2002), academic self-efficacy (Bandura 1993; Valentine et al. 2004) and satisfaction with college (Aljohani 2016) at the beginning and ending of their first year of college. In addition, we examine if the influence of undermatching is moderated by (i.e., conditional on) first-generation status, above and beyond the influence of other socioeconomic characteristics including parents’ employment and relative earnings. Sedlacek’s (2017) work has suggested that while noncognitive variables are valuable for all students, they may be particularly beneficial for underrepresented or nontraditional students.

Whereas previous research has concentrated on the factors that influence undermatching (Belasco and Trivette 2015; Bowen et al. 2009; Roderick et al. 2011; Roksa and Deutschlander 2018; Smith et al. 2013), or its longer-term effects (Muskens et al. 2020; Dillon and Smith 2020; Muskens et al. 2019; Ovink et al. 2017), we examine undermatching in relation to a distinctive definition of student success based on the extent to which students positively change over the course of their first year in college. Drawing on data that follows a large, national sample of students into and through their first year of college, we have designed this study to ultimately gain understanding of the influence of institutional undermatching on noncognitive development, and whether or not this influence differs based on students’ first-generation status.

## Conceptual Framework

The conceptual underpinnings of this study are informed by studies of noncognitive development among college students. Specifically, we were guided by Weidman’s (1989) model of undergraduate socialization and other college impact models (Pascarella 1985a) that point to socioeconomic factors, normative pressures, as well as the academic and social contexts within the collegiate environment as developmental influences on the formation of values, aspirations, and career and lifestyle choices. Primarily focused on the U.S. postsecondary context, prior developmental models highlight the combined influence of students’ precollege characteristics, which predispose students to enter certain educational contexts, and in turn, stimulate the formation of values, aspirations and preferences (Astin 1984; Mayhew et al. 2016).

In conceptualizing outcomes central to student development, we build on Pascarella’s (1985b) study of affective development and draw from Astin’s (1991) taxonomy for defining higher education outcomes. Astin’s taxonomy is useful for organizing outcomes along multiple dimensions, based on whether an outcome is cognitive versus affective, and whether an outcome is psychological versus behavioral. These dimensions intersect to form a 2×2 matrix whereby nearly all higher education outcomes may be conceptually situated. For example, the “cognitive-psychological” category includes critical thinking and academic achievement-related outcomes, while the “cognitive-behavioral” category points to such things as education attainment. “Affective-psychological” outcomes include

such things as self-concept and satisfaction with college, while “affective-behavioral” outcomes represent key educational choices (such as major field of study) and educational aspirations.

As previously mentioned, some researchers have referred to affective (or noncognitive) measures within economic models of human capital development or within social-psychological models (Borghans et al. 2008; Heckman and Kautz 2012), conceptualized as important skills associated with motivation, attitudes, and temperament of well-rounded students. Our focus for the present study represents the “affective-psychological” (or noncognitive) domain, often examined as mediating the relationships between students’ backgrounds or curricular interventions and academic or cognitive outcomes (Mayhew et al. 2016). While noncognitive characteristics have been found to be predictive of such things as grades and academic behaviors such as perseverance or retention (Bowman et al. 2019; Farrington et al. 2012), they are also generally understood to continue developing across a person’s lifetime (Kautz et al. 2014).

Furthermore, in examining whether differences exist in the effects of undermatching between first-generation and non-first-generation (i.e., continuing-generation) college students, we also drew from models of social inequality and status attainment (Sullivan 2001). Such models point to the qualitative differences in students’ education—selectivity of institution attended and major field of study—as being more influential towards post-college status outcomes than even the amount of education attained (Lucas 2001). Drawing from the related framework of conflict theory (Collins 1971), undermatching is a possible mechanism through which the education system distributes advantages according to preexisting social positions. In terms of social class, and particularly germane to understanding a student’s interactions with the higher education system, is the level of education attained by the student’s parents, especially in terms whether a student is the first in their family to attend college (i.e., a first-generation college student). Having parents with prior exposure to advanced levels of education represents a distinct form of advantage (relative to parental employment or earnings) in leveraging strategies for success in the first year of college (Alon 2009; Lucas 2001; Pascarella et al. 2004).

## Evidence on Undermatching

Recent studies of college student undermatching have highlighted the assumptions and challenges accompanying this line of inquiry (Bastedo and Flaster 2014), while much of the work in this area has focused on its prevalence (Rodriguez 2015; Smith et al. 2013). Evidence indicates that a student’s likelihood of undermatching is affected by non-academic factors, including college search activities, attitudes related to campus social life and living at home, and dimensions of social and cultural capital (Belasco and Trivette 2015; Ovink et al. 2017; Roksa and Deutschlander 2018). Prevalence aside, prior research has found that lower-SES students are more likely to undermatch than their higher-SES peers (Bastedo and Jaquette 2011; Dillon and Smith 2017; Hoxby and Avery 2013; Ovink et al. 2017; Smith et al. 2013), as are Black and Hispanic students compared to their White and Asian peers (Black et al. 2015; Ovink et al. 2017).

Far less attention has been directed to the outcomes associated with, or the effects of, undermatching. We have identified only a small handful of published studies focused on outcomes that extend beyond initial enrollment in college, including: Muskens et al. (2020) analysis of long-term career outcomes (including employment, income, and satisfaction) of college graduates in Germany; Muskens et al. (2019) study of subjective experiences

during college among students in the Netherlands; Ovink et al. (2017) examination of U.S. students within the first few years of completing college; and Dillon and Smith's (2020) investigation of degree completion and long-term earnings based on two longitudinal samples of U.S. students (those who completed high school and made their college choice from 1975–1983 and from 1998–2002).

Among these studies, the results put forth by Muskens and colleagues are most aligned with the present study given their examination of attitudes among college students in relation to undermatching. Though their analyses were cross-sectional and therefore unable to capture students' developmental trajectories, the results showed that undermatching is associated with lower satisfaction with academic and social aspects of college in the final year of higher education. The remaining three studies all focused on more distal outcomes, including degree attainment and career outcomes. For example, Ovink et al. (2017) uncovered evidence to suggest that undermatching may negatively influence students' odds of completing four-year bachelor's degrees and graduate degrees, and that the selectivity of institutions to which students were initially admissible moderate these relationships. Dillon and Smith (2020) added complimentary evidence that the effects of attending a higher quality college vary by student ability, and that the most favorable graduation and career outcomes are tied to the highest ability students attending the highest quality colleges. Ovink et al. (2017) further reported a negative relationship between undermatching and employment outcomes, while the results varied based on analytic design (specifically, whether the model included high school fixed effects, or an instrumental variable based on proximity of college to one's high school). Adding to this, Muskens et al. (2020) uncovered evidence from within the German context to suggest that undermatching is negatively associated with wages and job satisfaction, which appeared most pronounced among first-generation students and become stronger with age.

Moreover, in an unpublished paper by Fostnacht (2015), students' self-reported experiences during their first year of college were examined across a wide range of U.S. colleges and universities, based on participation in the National Survey of Student Engagement. Results suggest that undermatched students may engage with faculty more often and perceive greater gains across personal and social dimensions of college, while also demonstrating lower levels of institutional satisfaction than their matched peers. The findings also suggest that the influence may differ by students' race/ethnicity and gender. While the self-reported, cross-sectional nature of the underlying data require that we interpret Fostnacht's findings with caution until replicated, the evidence contributes to a more nuanced understanding of undermatching, where the effects may not be uniformly negative for all students.

Additional evidence also suggests that attending less selective institutions may lead to some positive outcomes. Kurlaender and Grodksy (2013) interrogated the concept of mismatch by examined student outcomes four years after entering college (2004–2008) based on data from eight universities in California, three of which were considered highly selective and five were considered moderately selective. Controlling for a host of academic and demographic characteristics, the results indicate that students accumulate more credits when they attend less selective institutions, and that attending an "overmatched" institution (an institution in which the students' prior academic achievements is below the institution's mean) did not clearly influence grades but did decrease the likelihood of dropping out.

Importantly, none of the above studies examined developmental (or change in) outcomes during college. Altogether, it stands to reason that enrolling in institutional contexts that are misaligned with one's academic achievement may have lasting consequences, given the sizeable career effects associated with graduating from college in

general, and from more selective institutions in particular (Mayhew et al. 2016). However, if students who undermatch accumulate credit hours at a faster pace or have greater opportunity to engage in curricular and co-curricular activities, students may arrive at a greater sense of satisfaction towards their institution or experience other forms of non-cognitive gains. Ultimately, the existing evidence on the effects of undermatching is not entirely conclusive, particularly from a developmental perspective, and warrants further investigation.

### Plausible Mechanisms

Informed by the above perspectives and existing evidence, there are three plausible mechanisms through which undermatching may influence students' noncognitive development. Each mechanism represents a distinct premise we evaluate through our analyses. We examine each across all students, and specifically among first-generation students (relative to continuing-generation students), given that noncognitive characteristics may vary by SES backgrounds; prior research points to academic self-efficacy (Wiederkehr et al. 2015), academic motivation (Browman et al. 2017), and satisfaction with college (Stebleton et al. 2014) being systematically lower among students from lower socioeconomic backgrounds.

### Misalignment

First, development may be influenced by undermatching through the misalignment of an institution with a students' capacities. Exposure to a less rigorous curriculum and larger misalignment with an institution's academic profile may serve to de-motivate undermatched students and diminish their satisfaction (Hoxby and Turner 2013). A negative association between undermatching and noncognitive development would support the misalignment premise.

### Peer-Effects

Second, development may be affected by undermatching due to peer-effects, which has been used to examine how educational contexts, as defined by peers, influence student outcomes (Manski 1993; Wolniak and Ballerini 2019). This body of research is premised on notions of human capital formation and education production functions (Carrell et al. 2009; Sacerdote 2001), in which an institution's selectivity is assumed to be an indicator of academic "quality," such that the average behaviors of a group of students influences the behavior of the individual students that comprise a group. Students' achievements and mindsets may be determined by the average achievements and mindsets of their peers. For example, if students at less selective institutional environments display less academic motivation on average than students at more selective institutions, the development of any given students' motivation may be negatively affected by enrolling in less selective institutions, and positively affected when they enroll in more selective institutions. Therefore, the peer-effect premise points to undermatching being negatively associated with noncognitive development relative to matching in selective institutions, due to lower average academic profiles of students' peers.

## Big-Fish-Little-Pond

Third, and to the contrary of the notion of peer-effects, noncognitive development may be positively influenced by undermatching through the ‘big-fish-little-pond’ effect (Fang et al. 2018; Marsh 1987; Marsh and Hau 2003). Students may form higher self-concepts when surrounded by relatively less academically capable students than if they were surrounded by more academically capable students, such that undermatching may be related to greater levels of motivation, satisfaction, and self-efficacy, compared to matched students. In other words, undermatching would be more positively associated with noncognitive development than matching in more- or less-selective institutions.

## Methods

### Study Context

While undermatching is an international phenomenon, research on the prevalence and consequences of undermatching has been conducted mainly within the U.S. context, which introduces several methodological challenges, as discussed by Bastedo and Flaster (2014). For the present study we focus on undermatching in Europe; specifically, the Netherlands. Higher education in the Europe is highly comparable to higher education in the U.S. in terms of educational programs, degrees that can be attained, and job-market prospects following graduation, as illustrated by the blooming exchange of students and scientific staff. Furthermore, Europe and the U.S. demonstrate comparable patterns in the relatively high tendencies of first-generation (versus continuing-generation) students to undermatch, and the corresponding concerns among researchers and policymakers regarding talent that may not be fully developed (Muskens et al. 2020; Campbell et al. 2019; Katsarova 2015). However, notable differences exist that make it especially interesting and appropriate to study undermatching in Europe, and particularly in the Netherlands.

First, as in many European countries, the Netherlands has two types of higher education institutions: more selective and less selective institutions. This differs from the U.S. system, where institutional selectivity is often seen as a continuum (Roderick et al. 2006). Although both types of institutions in the Netherlands offer programs of study at the bachelor’s degree level, there are some important differences. Specifically, the most selective institutions (academic universities), focus on scientific research and education, while the less selective institutions (universities of applied science) are profession-oriented and focus on applied research. In the Netherlands, there are 18 regular academic universities, attended by roughly 250,000 students each year, compared to 37 universities of applied sciences, attended by almost 450,000 students (Dutch Inspectorate of Education 2018). Although there are almost twice as many students enrolled in universities of applied sciences than in academic universities, the direct government funding for academic universities is much higher than for universities of applied sciences; roughly EUR 4.1 billion versus EUR 2.6 billion each year (Hoger Onderwijs Persbureau 2017). Accompanying the Dutch government’s priorities for funding research that takes place at academic universities, the labor market yields higher maximum salaries for professors and lecturers at academic universities than at universities of applied sciences; about EUR 120,000 per year versus EUR 90,000 per year (Netherlands Association of Universities of Applied Sciences

2018). Furthermore, relative to students who attend universities of applied sciences, those who attend academic universities have been found to report greater satisfaction with their institution (Dutch Inspectorate of Education 2018), experience higher rates of degree attainment within the nominal timeframe (Dutch Inspectorate of Education 2018), and enjoy higher salaries (De Mooij et al. 2012).

Second, there are important differences in admission procedures. In the U.S., students' academic and extracurricular performance during high school, in combination with scores achieved on standardized tests widely used by colleges (i.e., the SAT and ACT), determine whether they are deemed admissible to a given institution. Institutions exercise a large degree of autonomy in determining their own admissions standards, and thus, a given students' admissibility. Alternatively, in the Netherlands and many other European countries, a student's eligibility for the most selective institutions is entirely determined by the track completed during secondary education. In the Netherlands, the highest level (VWO<sup>1</sup>) gives access to the most selective higher education institutions, and a lower level (HAVO<sup>2</sup>) only gives access to less selective higher education institutions.

In the Dutch context it is clear whether a student is eligible for the most selective institutions or not, which is markedly different from the U.S. context where a students' admissibility must be empirically estimated by researchers interested in studying academic match, except in the rare situation where an institution provides researchers with precise and complete information about their admissions decisions. In fact, prior studies based on U.S. samples have highlighted the various ways researchers have operationalized undermatch, and that those differences may have influenced prior results (e.g., Dillon and Smith 2017; House 2017). In addition, overmatching (i.e., when students attend more selective institutions than their credentials would permit) is not possible in the Netherlands, in contrast to the U.S. where legacy status, athletic achievements, and other factors may lead to overmatching. Therefore, utilizing data from students in the Netherlands offers an opportunity to study undermatching within a system of clearly defined admissions guidelines.

The well-defined distinction between selective and non-selective institutions in the Netherlands offers a relatively clear framework to determine academic match. By examining undermatching in the Netherlands, we respond to Bastedo and Flaster's (2014) reasoning that the "most defensible undermatching research would be in circumstances where there is bureaucratization of admissions, where it is clear—based on explicit policy—who does and does not have access to specific colleges" (p. 98). In this regard, higher education in the Netherlands represents what Bastedo and Flaster's identify as an "ideal situation for studying undermatch" (p. 98).

## Data

Data for the study were drawn from the Startmonitor, a large-scale longitudinal survey of first year student experiences in the Netherlands. Each year, from 2009 to 2015, participants were randomly selected from all higher education institutions in the Netherlands. We selected students who participated twice: at the beginning and at the end of their first year. Due to changes in the questionnaire across years, not all information was collected in all waves, such that some variables accompanied systematic

<sup>1</sup> VWO (Voorbereidend Wetenschappelijk Onderwijs)=preparatory academic education.

<sup>2</sup> HAVO (Hoger Algemeen Vormend Onderwijs)=higher general secondary education.

**Table 1** Descriptive statistics ( $N = 14,540$ )

	Total sample		First generation		Continuing generation	
	Mean	SD	Mean	SD	Mean	SD
<b>Ascribed characteristics</b>						
Female	0.68	0.47	0.70	0.46	0.67	0.47
Age	18.18	0.93	18.17	1.00	18.18	0.89
Immigrant	0.02	0.12	0.02	0.15	0.01	0.11
Disability or functional limitation	0.18	0.39	0.18	0.38	0.19	0.39
First-generation	0.35	0.48	–	–	–	–
Parental income above average	0.33	0.48	0.16	0.36	0.41	0.49
Parental income below average	0.09	0.28	0.16	0.37	0.05	0.21
At least one parent employed	0.82	0.39	0.80	0.40	0.83	0.38
Grade retention secondary education	0.16	0.37	0.20	0.40	0.14	0.35
<b>Higher education match</b>						
Matched: selective	0.58	0.49	0.47	0.50	0.64	0.48
Matched: less selective	0.34	0.47	0.44	0.50	0.28	0.45
Undermatched	0.08	0.27	0.09	0.29	0.08	0.26
<b>College major</b>						
Education	0.08	0.27	0.10	0.30	0.06	0.25
Agriculture	0.05	0.22	0.04	0.20	0.06	0.23
Nature	0.08	0.27	0.06	0.24	0.09	0.29
Science	0.16	0.37	0.15	0.36	0.17	0.37
Health	0.17	0.38	0.17	0.38	0.17	0.38
Law	0.03	0.18	0.04	0.19	0.03	0.18
Behavior	0.17	0.37	0.17	0.38	0.16	0.37
Language	0.07	0.26	0.06	0.23	0.08	0.28
Economics	0.17	0.37	0.20	0.40	0.15	0.36
<b>Noncognitive measures</b>						
Academic motivation ( $T_1$ )	4.19	0.58	4.21	0.58	4.18	0.58
Academic motivation ( $T_2$ )	4.19	0.58	4.21	0.57	4.17	0.58
Satisfaction with college ( $T_1$ )	8.26	0.99	8.28	0.97	8.25	1.00
Satisfaction with college ( $T_2$ )	7.52	1.25	7.55	1.26	7.50	1.25
Academic self-efficacy: ( $T_1$ )	9.20	1.25	9.10	1.29	9.26	1.23
Academic self-efficacy: ( $T_2$ )	9.63	1.24	9.50	1.26	9.69	1.22

Startmonitor, 2009–2015

All measures are unstandardized.  $T_1$  = at college entry,  $T_2$  = end of first year

(non-random) missing data by year. The resulting sample included 14,540 participants with an average age of just over 18 years, with the majority identifying as female (68%) and roughly one-third indicating they were first-generation college students (35%). Table 1 presents descriptive statistics for all variables contained in our analysis.

**Table 2** Measures of noncognitive attributes and constituent items

Satisfaction with college ( $\alpha_{T1}=0.72$ ;  $\alpha_{T2}=0.75$ )<sup>a</sup>

Item 1: Satisfaction with teachers

Item 2: Satisfaction with fellow students

Item 3: Satisfaction with the atmosphere on the campus

Academic motivation ( $\alpha_{T1}=0.90$ ,  $\alpha_{T2}=0.88$ )<sup>b</sup>

Item 1: I'm very motivated to finish this study successfully

Item 2: The enrollment in this study program was my own choice

Item 3: This study program fits perfectly with my interests

Item 4: The career I can pursue after finishing this study fits perfectly with my interests

Item 5: Because of my choice to enroll in this study program, I'm very confident about my future

Item 6: I have no doubt at all about the correctness of my choice to enroll in this study program

Item 7: This study program fits perfectly with my capacities and skills

Item 8: The career I can pursue after finishing this study fits perfectly with my capacities and skills

Academic self-efficacy

Item 1: What percent chance do you think you have to finish this study program successfully?

Startmonitor, 2009–2015

<sup>a</sup>Survey questions were phrased as follows: Please indicate how satisfied you are with the following aspects of college. Response options: 1 = "Not satisfied at all" to 5 = "Very satisfied"

<sup>b</sup>Survey questions were phrased as follows: Please indicate the extent to which you agree or disagree with each of the following statements. Response options: 1 = "Strongly disagree" to 5 = "Strongly agree"

<sup>c</sup>Response options: 1 = "0%" to 11 = "100%"

## Variables

### Outcomes

We focused on three dependent variables representing dimensions of noncognitive development, measured at the beginning of the first year of college (T1) and at the end of the first year (T2): *Satisfaction with college* (3-item scale: Cronbach's Alpha ( $\alpha$ )<sub>T1</sub>=0.72;  $\alpha$ <sub>T2</sub>=0.75); *Academic Motivation* (8-item scale:  $\alpha$ <sub>T1</sub>=0.90,  $\alpha$ <sub>T2</sub>=0.88); and *Academic Self-efficacy* (single item, range 1–11). The two scaled measures demonstrated reliability (or internal consistency) within the acceptable range of 0.70 to 0.95 (Clark and Watson 1995; Tavakol and Dennick 2011). The *Academic Motivation* and *Self-efficacy* measures were collected in all six waves, while *Satisfaction with college* was only collected at T1 and T2 in 2009. Year-specific fixed effects were included in the models to appropriately control for these data characteristics. Table 2 presents the items contained within each noncognitive measure.

### Academic Match

We created three categorical dummy variables representing students who: (1) Matched in the most selective institutions (participants who were in the highest level of secondary education and enrolled in a most selective higher education institution); (2) Matched in less selective institutions (participants from the less selective track in

secondary education and enrolled in a less selective higher education institution; and (3) Undermatched (participants who completed the most selective track in secondary education and enrolled in a less selective higher education institution). Matched-selective students served as our comparison group throughout the analysis. As previously mentioned, studying academic matching in the centralized context of the Dutch system offers advantages to studied conducted in the U.S. context (Bastedo and Flaster 2014), in which a wide range of techniques have been used to operationalize matching (see House 2017 for a rich description of the approaches researchers have used to operationalize undermatch).

## Covariates

Among the other variables in our analytic model were three self-reported measures of socioeconomic backgrounds: first-generation status (1=one or both parents had attained a higher education degree, 0=Neither parent held a higher education degree); parents' employment status (1=at least one parent is employed, 0=no parent is employed); and parents' relative earnings based on students indicating their parents' income was "above average," "below average," or "average" (these three categories were dummy coded, with "average" serving as the reference group). First-generation status served as a moderator in our models, for which we tested influence above and beyond the influence of the other socioeconomic measures. Our approach to maintaining separate components of SES, rather than examining a combined construct, is consistent with prior studies (Paulsen and St. John 2002; Sewell 1971; Wells and Lynch 2012) that similarly sought not to mask relationships among individual SES components.

Several other variables were included as covariates to account for potential confounding influences. These include the following characteristics (all self-reported by participants): gender, age (ranging from 16 to 29), immigrant status, disability or functional limitation, grade retention during secondary education (i.e., having repeated a grade), and college major (including Education, Agriculture, Nature, Science, Health, Law, Behavior, Language, and Economics).

Altogether, the covariates we have included were informed by prior studies of the causes and consequences of undermatch, tailored to the measures available within the Startmonitor data and reflective of the Dutch context. While the specific covariates researchers have included vary across studies and in relation to the available data, the literature highlights the importance of controlling for students' sociodemographic characteristics, high school academic performance, and family and peer contexts (e.g., Muskens et al. 2020; Smith and Dillon 2017; Roderick et al. 2011). Broadly conducted on U.S. students, prior studies have also included as covariates racial/ethnic identities, living in a rural area, and college application behaviors (e.g., Bastedo and Flaster 2014; Roderick et al. 2008; Smith et al. 2013). Furthermore, studies of the longer term outcomes associated with undermatch have additionally included measures of the postsecondary context within a given institution (Smith and Dillon 2020; Ovink et al. 2017). Related to the postsecondary context, we were informed by prior studies of noncognitive (or affective) development among college students that highlight the importance of one's choice of college major (Pascarella 1985b). The covariates we have included in our analyses were informed by these prior studies, contingent on their availability within the Startmonitor data.

## Analysis

We conducted a series of multivariate regression analyses to estimate factors that influence noncognitive development at the end of the first year ( $T_2$ ), controlling for a parallel measure of the same noncognitive characteristic at the beginning of the first year ( $T_1$ ). Our primary independent variable was *Academic match*. To account for differences in students' demographics and circumstances known to influence higher education experiences and choices, we added controls for background variables and academic major. The resulting estimates represent general effects, or, the average effects across the full sample, statistically controlling for all other variables contained in the model. The general regression equation is presented as Eq. 1.

$$Y_{T_2} = b_0 + b_1X + b_2Y_{T_1} + b_3MATCH + b_4S + b_5C + \varepsilon \quad (1)$$

In Eq. 1,  $Y_{T_2}$  represents each measure of noncognitive attributes at the end of students' first year of college, while  $Y_{T_1}$  is the parallel "pretest" measure collected at the beginning of the first year of college. In addition, *MATCH* represents three categorical variables, including attending a matched-selective institution, a matched less-selective institution, or an undermatched institution; the matched-selective category served as our omitted reference group for comparison. Furthermore,  $X$  includes students' background characteristics (including first-generation status and the other socioeconomic components), and  $S$  signifies the student's college major.  $C$  reflects cohort (or year) fixed effects.

While some prior studies have examined the predictors of undermatching relative to those students who matched in selective institutions (Belasco and Trivette 2015), other studies have examined match in more general terms, examining matching (regardless of institutional selectivity) versus those who did not match (Roderick et al. 2011), which may include both undermatch and overmatch (Dillon and Smith 2017). We have focused our attention on noncognitive outcomes associated with undermatching, relative to both matching at selective and less selective institutions. Our reason for doing this was to better understand the influence of institutional selectivity as distinct from the influence of academic match. As indicated by the mechanisms described above, both the selectivity of one's institution and the student's academic profile may together, and separately, influence noncognitive development.

Adding to the general effects estimated from the full sample, we estimated conditional effects based on first-generation (fg) status versus continuing-generation (cg) status. To formally examine the moderating influence of first-generation status, we employed  $z$ -tests to detect statistically significant differences between coefficients estimated from the two sub-samples, based on the formula:  $z = (\hat{b}_{fg} - \hat{b}_{cg}) / \sqrt{(SE_{fg})^2 - (SE_{cg})^2}$ . See Clogg et al. (1995) for discussion and justification of this test. We flagged only those estimated coefficients that achieved a high level of statistical significance ( $p < 0.01$ ).

Utilizing a pretest–posttest design to examine the effects of academic match on students' noncognitive measures affords optimal statistical control over student differences prior to exposure to college. By using posttest measures as our outcome variable while controlling for the parallel pretest allows the effects of the models' independent variables (e.g., academic match) to account for variation in pretest–posttest gains, above and beyond the influence of the pretest. In other words, by including the pretest in the model, the estimated effects of the independent variables on posttest scores indicate those variables' influence on pretest-to-posttest gains (i.e., development) in college during the timeframe

studied (Pascarella et al. 2003). We interpreted the results accordingly, while recognizing the potential that our results may still be vulnerable to selection bias, as discussed next.

## Robustness Check

Even in the presence of a longitudinal pretest–posttest design with covariate adjustments, students ultimately self-select whether or not they attend a matched-selective or undermatched institution. As a result, students who voluntarily chose to attend one institution type may differ in important ways from those who chose to attend another institution type. To address the potential that self-selection is biasing our multivariate regression estimates, we checked the robustness of our findings by employing a counterfactual framework and re-analyzing the effect of undermatch versus match-selective students. We excluded students who attended matched-less selective institutions given that they did not have the choice to attend a matched-selective or undermatched institution.

To check the robustness of our multivariate regression estimates, we used propensity score matching (PSM) to statistically generate equivalent groups in terms of observed pre-college variables (Raudenbush and Bryk 2002; Thoemmes and Kim 2011), thus approximating a “treatment” group (students who attended an undermatched institution) and a “control” group (students who attended a matched-selective institution). The goal of PSM is to create two equivalent groups by matching students on a set of characteristics that may affect both the propensity to undermatch and the outcome of interest (Thoemmes and Kim 2011). We obtained propensity scores by estimating a logit model predicting undermatch (with undermatch = 1 and matched-selective = 0) based on the covariates ( $X$ ) defined above. Using two-to-one nearest-neighbor matching with a 0.02 caliper level (Austin 2010), each undermatched student was paired with a maximum of two students for whom the difference in propensity scores did not exceed 0.02. This resulted in 1169 students in the undermatched “treatment” group and 2329 students in the matched-selective “control” group. To determine if PSM created equivalent groups, we examined the mean differences in covariates between the unadjusted versus PSM-adjusted samples (Liu and Borden 2019). As shown in Appendix Table A1, no statistically significant mean differences between undermatched and matched-selective students remained in the PSM-adjusted sample.

We then estimated the effects of undermatching (versus matching at a selective institution) in relation to the noncognitive outcomes ( $Y_{T2}$ ), net of the pretest ( $Y_{T1}$ ),  $S$ , and  $C$  (as described above). The resulting estimates represent ATT effects (Reynolds and DesJardins 2009). If self-selection was biasing our results in ways that were not addressed by our longitudinal pretest–posttest design, the PSM estimates should yield significantly different effects of undermatching on noncognitive development.

We offer the PSM estimates as a robustness check of the full sample, covariate adjusted estimates previously described. Evidence from Pascarella et al. (2013) and others (Shadish et al. 2008) has indicated that estimates based on PSM strategies relative to covariate adjusted (with pretest) estimates are comparable in the reduction of bias. Pascarella et al.’s study offered particularly relevant guidance given their longitudinal, pretest–posttest design, and because their independent variable of interest was institution type (attending a liberal arts college versus a four-year institution). Their results yielded “little evidence...to suggest that propensity score matching provided an appreciably more accurate estimate of liberal arts college effects than did more traditional regression-based covariate adjustment” (p. 333), and that “Design would appear to trump analysis (Rubin 2008) and, when it is feasible, a precollege measure of any outcome may be indispensable in obtaining the most

internally valid estimates of college effects” (p. 334). We therefore did not anticipate the PSM results would substantially differ from the covariate-adjusted estimates performed on the full sample. Nevertheless, the possibility of selection bias warranted that we check the robustness of our main multivariate regression estimates.

## Limitations

The study has at least three limitations to consider when interpreting the results. First, as is the case with all secondary data analyses, we were limited in the variables available and the specific operational definitions of those variables. The Startmonitor data contain only self-reported measures; though we used statistical techniques to reliably measure latent noncognitive constructs for two of our three dependent variable (and their pretests), self-reported data introduce inherent challenges to validity (Porter 2011). Similarly, certain aspects of the students’ experiences during college may operate as important mechanism by which attending an undermatched institution may influence the development of noncognitive characteristics during the first year of college, and the extent to which different experiences may vary by first-generation status. It may be that the kinds of social and academic engagement (e.g., discussing courses with other students, tutoring other students, and student-faculty contact) known to influence such things as one’s intellectual and academic self-concept (Cole 2007; Kim and Sax 2014), also play a role in students’ noncognitive development. Future data collection efforts in the Netherlands will benefit from collecting more nuanced information on students’ academic and social engagement.

The second main limitation to this study centers on the fact that only about 8% of the students in the study attended an undermatched institution, compared to the 58% who attended a matched-selective institution and 34% who attended a matched-less selective institution. Though students were randomly selected to participate in the survey project, and national reports confirm that about 8% of students in the Netherlands undermatch in a given year (Van den Broek et al. 2019), the relatively small share of undermatching students has implications for statistical power. As the number of cases belonging to a given category decreases, so too does the statistical power available for detecting differences between categories. As such, our estimated differences between undermatched and matched students are less precise than, for example, our estimated differences between matched-less selective and matched-selective students. However, given the national scope of the data, the 8% of students in the undermatched category translates to roughly 1160 students, and thus still provided sufficient power for estimating general effects, as well as for examining conditional effects based on first-generation status (Faul et al. 2007). Furthermore, it is important to note that the roughly 8% of students in the Netherlands who undermatch is lower than the share of undermatching students in the United States. Though operational definitions of undermatching differ widely across studies conducted on U.S. students (e.g., Bastedo and Flaster 2014; Dillon and Smith 2017; House 2017), the frequency of undermatching in the United States may be as high as 38%, based on Ovink et al. (2017) calculation, while others have noted rates as high as 60% depending on definition employed and sample analyzed (House 2017). Therefore, one should apply caution when generalizing the results of our study to other national contexts.

The third notable limitation is that the lack of random assignment of students into undermatched institutions creates the potential that students’ self-selection into undermatched institutions could bias the results. We directly addressed this threat to internal validity by checking the robustness of our findings by way of PSM techniques, and noted

prior research demonstrating that longitudinal pretest–posttest designs do as much, if not more, to reduce self-selection bias than do analytic approaches that artificially create treatment and control groups within a counterfactual framework (Mayhew et al. 2016; Pascarella et al. 2013; Shadish et al. 2008). Nevertheless, and despite our efforts, the possibility remains that unobservable factors may have confounded our estimated effects of undermatching on noncognitive development. Our results should be interpreted in lieu of these limitations.

## Results

### General Effects

We begin our discussion of results by focusing on the relationships between academic match and students' noncognitive development during the first year of college. As shown in Table 3, based on the pooled sample, several findings emerged. First, controlling for all other variables in the model, the effects of higher education match on noncognitive development varied substantially across the models in both statistical significance and direction of influence. In terms of academic motivation, we found no effects based on academic match. However, in terms of students developing a sense of satisfaction with their college, match appeared to exert an interesting influence. Specifically, relative to students who attended a matched-selective school, students attending an undermatched institution developed significantly more in terms of feeling satisfied with their college experience ( $Beta=0.07, p<0.001$ ). Similar yet stronger results occurred among students who matched at less selective institutions ( $Beta=0.12, p<0.001$ ). These findings suggest that college satisfaction may be cultivated more within less selective institutional environments, regardless of match.

A very different finding emerged in terms of the development of academic self-efficacy. Here, net of all other variables, we found that students who undermatched made comparable gains in academic self-efficacy as those who matched in the most selective track. However, students who matched within a less selective track developed significantly less academic self-efficacy during the first year of college relative to those who matched in the most selective track ( $Beta = -0.10, p < 0.001$ ).

Across the other variables in model, for all three outcomes, the parallel pretest (measured at the beginning of students' first year of college) proved to be large, positive, and statistically significant predictor of the posttest (measured at the end of the students' first year of college). This finding is consistent with what one should expect.

In terms of students' background characteristics, immigrant status had a negative effect on the development of all three noncognitive measures, most notably in terms of satisfaction with college ( $Beta = -0.06, p < 0.001$ ). Having a disability or functional limitation further reduced noncognitive development during the first year of college in terms of academic motivation ( $Beta = -0.02, p < 0.05$ ) and academic self-efficacy ( $Beta = -0.02, p < 0.05$ ). All other areas where students' background characteristics exerted influence were tied to academic self-efficacy, where having above average perceived parental income (versus average) ( $Beta=0.05, p<0.001$ ), age ( $Beta=0.03, p<0.01$ ), and identifying as female ( $Beta=0.02, p<0.05$ ) each had a positive influence, while grade retention ( $Beta = -0.03, p < 0.01$ ) accompanied a negative influence.

**Table 3** Estimated standardized coefficients predicting noncognitive development

	Academic motivation, $T_1$ <i>Beta</i> (SE)	Academic motivation, $T_2$ <i>Beta</i> (SE)	Satisfaction with college, $T_1$ <i>Beta</i> (SE)	Satisfaction with college, $T_2$ <i>Beta</i> (SE)	Academic self-efficacy, $T_1$ <i>Beta</i> (SE)	Academic self-efficacy, $T_2$ <i>Beta</i> (SE)
Noncognitive measure at beginning of college						
Academic motivation, $T_1$	0.52 (0.01)***					
Satisfaction with college, $T_1$			0.38 (0.02)***			
Academic Self-efficacy, $T_1$					0.44 (0.01)***	
Higher education match (Matched: Most selective=0)						
Undermatched	0.00 (0.00)		0.07 (0.02)***		0.00 (0.01)	
Matched: Less selective	-0.00 (0.01)		0.12 (0.02)***		-0.10 (0.01)***	
Student characteristics						
First-generation	0.01 (0.01)		0.00 (0.02)		-0.01 (0.01)	
Parental income above average (average=0)	0.00 (0.01)		0.04 (0.02)		0.05 (0.01)***	
Parental income below average (average=0)	-0.01 (0.01)		0.03 (0.02)		0.00 (0.01)	
At least one parent employed	-0.00 (0.02)		0.03 (0.02)		-0.02 (0.02)	
Age	-0.01 (0.01)		0.00 (0.02)		0.03 (0.01)**	
Female	0.01 (0.01)		0.00 (0.02)		0.02 (0.01)*	
Immigrant	-0.03 (0.01)***		-0.06 (0.02)***		-0.02 (0.01)*	
Disability or functional limitation	-0.02 (0.01)*		-0.03 (0.02)		-0.02 (0.01)*	
Grade retention secondary education	0.00 (0.01)		-0.03 (0.02)		-0.03 (0.01)**	
College major (Economics = 0)						
Education	0.03 (0.01)***		0.14 (0.02)***		-0.02 (0.01)	
Agriculture	-0.01 (0.01)		0.15 (0.02)***		0.00 (0.02)	
Nature	0.00 (0.01)		0.16 (0.02)***		0.00 (0.00)	
Science	0.01 (0.01)		0.11 (0.03)***		-0.01 (0.01)	
Health	0.04 (0.01)***		0.08 (0.03)**		-0.03 (0.01)**	
Law	0.02 (0.01)*		-0.01 (0.02)		-0.02 (0.01)*	

**Table 3** (continued)

	Academic motivation, $T_2$ <i>Beta</i> (SE)	Satisfaction with college, $T_2$ <i>Beta</i> (SE)	Academic self-efficacy, $T_2$ <i>Beta</i> (SE)
Behavior	- 0.02 (0.01)*	0.04 (0.03)	- 0.01 (0.01)
Language	- 0.01 (0.01)	0.11 (0.02)***	- 0.01 (0.01)
Year fixed effects	Yes	No	Yes
Adjusted- $R^2$	0.28	0.24	0.22
<i>N</i>	14539	2710	13724

Startmonitor, 2009–2015

In addition to the variables shown, dummy variables for missing parental income and parental employment status were included in the model but excluded from the table.

\* $p < 0.05$ ; \*\* $p < 0.01$ ; \*\*\* $p < 0.001$

Though not a central focus of our analysis, students' major field of study proved highly predictive of students' noncognitive development, particularly their satisfaction with college. Several statistically significant differences were found in how students' satisfaction with college changed during their first year of college, in which studying Economics appeared most detrimental. In other words, across the eight major fields—each compared to Economics—six were positively related to greater satisfaction; only Law and Behavior fields did not significantly differ from Economics. In terms of the other outcomes, relative to Economics, we found Health and Law majors to be negatively associated with academic self-efficacy, but positively associated with academic motivation during the first year of college. Also in terms of academic motivation and satisfaction with college, students who majored in Education reported significantly greater development than their counterparts who majored in Economics, whereas Behavior majors reported significantly less development of academic motivation.

### Conditional Effects

To uncover the extent to which first-generation status exerts a moderating influence, we turn attention to the conditional effects models. In terms of academic motivation (see Table 4), first-generation status did not appear to moderate the effects of undermatching. Across the other variables in the model, the effects among continuing-generation students largely paralleled those uncovered in the general effects model previously discussed. The only exception (and not a primary focus of this study) was associated with majoring in Health field (versus Economics), for which a statistically significant difference was found between first-generation and continuing-generation students' development of academic motivation.

In terms of the development of college satisfaction, the results show that first-generation status significantly moderated the effects of undermatch (see Table 5). Specifically, relative to students attending a matched-selective institution, first-generation students who undermatched ( $Beta = 0.15$ ,  $p < 0.001$ ) developed significantly more in terms of feeling satisfied with their college than did continuing-generation students who undermatched. For continuing-generation students, undermatching (versus matching at a selective institution) did not have a statistically significant effect on satisfaction with college. When examining the effects of attending a matched-less selective institution (versus attending a matched-selective institution), the results were statistically significant and positive for both first-generation and continuing-generation students ( $Beta = 0.15$ ,  $p < 0.001$  and  $Beta = 0.10$ ,  $p < 0.01$ , respectively), mirroring the results uncovered in the general model based on the pooled sample.

In terms of academic self-efficacy, the general effects model masked differences by first-generation status (see Table 6). Whereas attending an undermatched institution did not yield a statistically significant effect on developing academic self-efficacy relative to attending a matched-selective institution within the pooled sample, we uncovered differences when examining these same relationships within each of the sub-samples. Among first-generation students, undermatching had a positive, statistically significant effect on developing academic self-efficacy ( $Beta = 0.03$ ,  $p < 0.05$ ) which was significantly greater than the effect found among continuing-generation students; for continuing-generation students, undermatching exerted a negative but statistically insignificant influence. Similar to the results for satisfaction with college, we again found that the effect of attending a matched-less selective institution (versus attending a matched-selective institution) for both

**Table 4** Estimated standardized coefficients predicting academic motivation at the end of the first year of college ( $T_2$ ), by first-generation status

	First-generation <i>Beta</i> (SE)	Continuing-generation <i>Beta</i> (SE)
Noncognitive measure at beginning of college		
Academic motivation ( $T_1$ )	0.51 (0.01)***	0.52 (0.01)***
Higher education match (Matched: Most selective = 0)		
Undermatched	0.01 (0.01)	− 0.01 (0.01)
Matched: Less selective	0.01 (0.02)	− 0.01 (0.01)
Student characteristics		
Parental income above average (average = 0)	0.00 (0.02)	0.00 (0.01)*
Parental income below average (average = 0)	0.00 (0.01)	− 0.01 (0.01)
At least one parent employed	0.03 (0.03)	− 0.04 (0.03)
Age	0.01 (0.02)	− 0.02 (0.01)
Female	0.01 (0.01)	0.01 (0.01)
Immigrant	− 0.03 (0.01)**	− 0.03 (0.01)***
Disability or functional limitation	0.00 (0.01)	− 0.02 (0.01)*
Grade retention secondary education	− 0.01 (0.01)	0.00 (0.02)
College major (Economics = 0)		
Education	0.02 (0.01)	0.04 (0.01)***
Agriculture	− 0.02 (0.01)	0.00 (0.01)***
Nature	− 0.01 (0.01)	0.01 (0.01)
Science	0.00 (0.02)	0.01 (0.01)
Health	0.01 (0.01)††	0.05 (0.01)***
Law	0.02 (0.01)	0.02 (0.01)
Behavior	− 0.04 (0.02)*	− 0.01 (0.01)
Language	− 0.01 (0.01)	0.00 (0.01)
Year fixed effects	Yes	Yes
Adjusted- $R^2$	0.27	0.29
$N$	5147	9392

Startmonitor, 2009–2015

In addition to the variables shown, dummy variables for missing parental income and employment status were included in the model but excluded from the table. \* $p < 0.05$ ; \*\* $p < 0.01$ ; \*\*\* $p < 0.001$

†† Estimated effect is significantly ( $p < 0.01$ ) different from continuing-generation students

first-generation and continuing-generation students mirrored those from the pooled sample. In this case, both sets of estimates had a statistically significant and negative influence on academic self-efficacy.

Presented graphically (see Fig. 1), the varied influence of academic match and first-generation status are further highlighted. In terms of students’ development of college satisfaction, we see that the positive effects of attending an undermatched and matched-less selective institution are most pronounced among first-generation students than among continuing-generation students. For developing academic self-efficacy, we see the opposite influence of attending an undermatched (versus matched-selective) institution among first-generation students relative to continuing-generation students, and that attending a matched-less selective institution has negative influence regardless of first-generation status. By comparison, the influence

**Table 5** Estimated standardized coefficients predicting satisfaction with college at the end of the first year of college ( $T_2$ ), by first-generation status

	First-generation <i>Beta</i> (SE)	Continuing-generation <i>Beta</i> (SE)
Noncognitive measure at beginning of college		
Satisfaction with college ( $T_1$ )	0.40 (0.03)***	0.38 (0.02)***
Higher education match (Matched: Most selective = 0)		
Undermatched	0.15 (0.04)***††	0.02 (0.02)
Matched: Less selective	0.15 (0.03)***	0.10 (0.03)**
Student characteristics		
Parental income above average (average = 0)	0.02 (0.03)	0.05 (0.03)*
Parental income below average (average = 0)	0.02 (0.03)	0.03 (0.02)
At least one parent employed	0.04 (0.03)	0.01 (0.02)
Age	− 0.02 (0.04)	0.00 (0.03)
Female	− 0.02 (0.03)	0.01 (0.02)
Immigrant	− 0.10 (0.03)***	− 0.03 (0.02)
Disability or functional limitation	− 0.03 (0.03)	− 0.02 (0.02)
Grade retention secondary education	− 0.02 (0.03)	− 0.02 (0.03)
College major (Economics = 0)		
Education	0.14 (0.04)***	0.14 (0.03)***
Agriculture	0.09 (0.03)**	0.18 (0.03)***
Nature	0.09 (0.04)*	0.19 (0.03)***
Science	0.10 (0.04)*	0.12 (0.03)***
Health		
Law	0.00 (0.00)	− 0.01 (0.03)
Behavior	0.05 (0.04)	0.05 (0.02)
Language	0.11 (0.03)*	0.12 (0.03)***
Year fixed effects	No	No
Adjusted- $R^2$	0.27	0.23
$N$	920	1790

Startmonitor, 2009–2015

In addition to the variables shown, dummy variables for missing parental income and employment status were included in the model but excluded from the table. \* $p < 0.05$ ; \*\* $p < 0.01$ ; \*\*\* $p < 0.001$

†† Estimated effect is significantly ( $p < 0.01$ ) different from continuing-generation students

of academic match and first-generation status are inconsequential in the development of academic motivation. Altogether, the results from the conditional models point to a moderating influence of first-generation status on the relationship between academic undermatch and the development of college satisfaction and academic self-efficacy, above and beyond students' perceived parental income and parental employment status.

## Robustness

Importantly, the multivariate regression estimates discussed above appear to be robust and even somewhat conservative. As shown in Table A2 in the Appendix, compared to the

**Table 6** Estimated standardized (*Beta*) coefficients predicting academic self-efficacy at the end of the first year of college ( $T_2$ ), by first-generation status

	First-generation <i>Beta</i> (SE)	Continuing-generation <i>Beta</i> (SE)
Noncognitive measure at beginning of college		
Academic self-efficacy ( $T_1$ )	0.44 (0.01)***	0.43 (0.01)***
Higher education match (Matched: Most selective = 0)		
Undermatched	0.03 (0.01)*††	− 0.02 (0.01)
Matched: Less selective	− 0.10 (0.02)***	− 0.10 (0.01)***
Student characteristics		
Parental income above average (average = 0)	0.05 (0.01)**	0.05 (0.01)***
Parental income below average (average = 0)	0.01 (0.01)	− 0.02 (0.01)
At least one parent employed	− 0.02 (0.03)	0.00 (0.04)
Age	0.05 (0.02)**	0.02 (0.01)
Female	0.01 (0.01)	0.02 (0.01)*
Immigrant	0.00 (0.01)	− 0.03 (0.01)**
Disability or functional limitation	0.00 (0.01)	− 0.02 (0.01)*
Grade retention secondary education	− 0.05 (0.02)***	− 0.02 (0.01)
College major (Economics = 0)		
Education	− 0.02 (0.02)	− 0.02 (0.01)
Agriculture	0.00 (0.03)	0.00 (0.02)
Nature	0.01 (0.01)	0.00 (0.01)
Science	0.00 (0.01)	− 0.02 (0.01)
Health	− 0.05 (0.02)**	− 0.02 (0.01)
Law	− 0.02 (0.01)	− 0.02 (0.01)
Behavior	− 0.01 (0.02)	− 0.01 (0.01)
Language	− 0.01 (0.02)	− 0.00 (0.01)
Year fixed effects	Yes	Yes
Adjusted- $R^2$	0.23	0.21
<i>N</i>	4844	8880

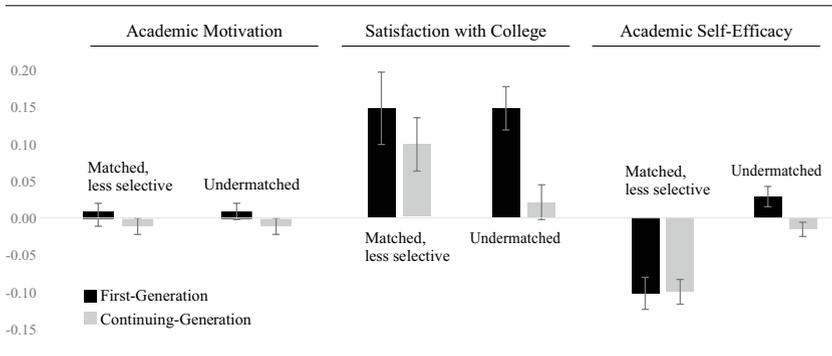
Startmonitor, 2009–2015

In addition to the variables shown, dummy variables for missing parental income and employment status were included in the model but excluded from the table. \* $p < 0.05$ ; \*\* $p < 0.01$ ; \*\*\* $p < 0.001$

††Estimated effect is significantly ( $p < 0.01$ ) different from continuing-generation students

multivariate regression estimates of the full sample (i.e., general effects estimates), the PSM estimates yielded similarly small and non-statistically significant effects of attending an undermatched (versus matched-selective) institution in terms of academic motivation and academic self-efficacy, along with a more pronounced positive and statistically significant effect ( $Beta = 0.14$ ,  $p < 0.01$ ) on satisfaction with college.

Likewise, when first-generation and continuing generation students were examined separately, the PSM estimates again resulted in no statistically significant effect of undermatching (versus matched-selective enrollment) on academic motivation across either group (see Table A3). In terms of satisfaction with college, first-generation status was again found to have a moderating influence based on PSM estimates: consistent with the multivariate regression estimates, attending an undermatched (versus matched-selective)



**Fig. 1** Moderating influence of first-generation and continuing-generation status on the relationships between academic match and non-cognitive development. SOURCE: Startmonitor, 2009–2015

institution was statically significant and nearly identical in magnitude ( $Beta=0.14$ ,  $p<0.01$ ), while undermatching still did not exert a significant influence on college satisfaction among continuing-generation students. In terms of academic self-efficacy, the PSM estimates were more pronounced than the multivariate regression results among first-generation students, while nearly identical among continuing-generation students. Altogether, the PSM estimates indicate that self-selection does not appear to be biasing the results in a substantively meaningful way.

## Discussion and Conclusion

This study aimed to contribute new information on the phenomenon of higher education undermatch in relation to college students' noncognitive development. We were particularly motivated to examine whether or not the influence of undermatching was general across all students, or conditional on first-generation status, which we conceptualize as a key social class characteristic associated with the kinds of capital useful for succeeding in college (Pascarella et al. 2004; Sullivan 2001). A sizeable literature documents the economic benefits associated with attending a more selective higher education institution (Mayhew et al. 2016), prompting many scholars to assume that undermatching is a negative outcome (Belasco and Trivette 2015; Hoxby and Avery 2013) and particularly so for students from lower-SES backgrounds who appear more prone towards undermatching (Smith et al. 2013). However, some evidence offers a counter-narrative, suggesting undermatched students may accumulate more credits and possibly have greater opportunity to engage in curricular and co-curricular activities (Fostnacht 2015; Kurlaender and Grodsky 2013), and prominent scholars of college student development have noted that institutional contexts influence the formation of values and attitudes among students (Astin 1991; Pascarella 1985b; Weidman 1989).

Drawing on data from on a large, national, randomly selected sample of students in the Netherlands, we sought new evidence on the relationship between academic match and students' noncognitive development during the first year of college, which we operationalized

according pre- and post-test measures of academic motivation, academic self-efficacy, and satisfaction with college. Our analyses, first, centered on uncovering the relationships between academic match and noncognitive development over the first year of college. Second, we examined whether these relationships were general for all students, or conditional on first-generation status. We framed our interpretation of results according to three guiding premises, categorized as: *misalignment*; *peers-effect*; and *big-fish-little-pond*. Altogether, the results highlight three main findings.

First, in terms of noncognitive developmental, attending an undermatched institution appeared, on average, to either have a positive influence, or no influence, but never a negative influence. Specifically, in terms of students' feelings of satisfaction towards their college, attending an undermatched institution had a positive influence when compared to attending matched-selective institutions, providing some of the clearest evidence to date that undermatching is not a uniformly negative phenomenon; this differs from what prior research has suggested (Bastedo and Flaster 2014; Belasco and Trivette 2015; Hoxby and Turner 2013) and offers some empirical support for Fostnacht's (2015) results.

Second, our results suggest that the effects of attending an undermatched institution are conditional on (or moderated by) students' first-generation status. Building on the previous finding regarding satisfaction towards college, it appears that the positive effects associated with attending an undermatched institution are concentrated among first-generation students. However, for continuing-generation students, undermatching appears not to have a meaningful influence: for these students, undermatching was unrelated to developing academic motivation, satisfaction towards college, and academic self-efficacy. Though not focused on academic match and based on small samples of students in the U.S. (Shim et al. 2012) and the United Kingdom (Bewick et al. 2010), prior longitudinal studies offer some evidence that self-efficacy may decline during the first year of college. Our findings suggest otherwise, where levels of self-efficacy reported at the end of the first year of college were somewhat greater than those recorded at the beginning of the first year.

Third, in terms of the plausible mechanisms that may account for the relationship between undermatching and noncognitive development, our results did not lend support for peer-effects. Peer-effects is premised on the notion that attending more selective institutions benefits the individual student by way of average academic achievements, behaviors, or mindsets of the students' peers (Manski 1993), such that student development would be negatively affected by enrolling in an undermatched institution. Our findings potentially indicate that peer-effects models may have limited validity in predicting noncognitive outcomes.

Alternatively, our findings align with the big-fish-little-pond premise in general (in terms of satisfaction with college) and particularly among first-generation students (in terms of satisfaction with college and, potentially, academic self-efficacy). The meaning one can assign to this evidence rests on the idea that relatively high achieving students who attend institutions that, on average, serve students who had lower academic profiles prior to college, may acquire more positive attitudes and feelings towards their education. In other words, it appears that being an academic "big fish in a little pond" does good things to one's self concept (Fang et al. 2018; Marsh 1987), especially for first-generation students.

Finally, we found no evidence in support of the misalignment concept; in no instance did we find a significant negative association between undermatching and noncognitive development compared to similar students who attended a matched-selective institution; though, among continuing-generation students and in predicting satisfaction with college,

the size of the effect of undermatching was relatively smaller and less significant. It may be that the alignment between a student's academic profile and her/his institution's academic profile is on the whole less influential for noncognitive development than the underlying selectivity of the institution attended.

Despite policy efforts to make the most selective institutions accessible for students regardless of backgrounds, students from more disadvantaged backgrounds remain less likely to enroll in, or graduate from, selective institutions. One can argue that such students—lower SES, high academic achievers—represent the most socially mobile students and warrant the attention of researchers to understand factors and mechanisms that affect their success in higher education. We show that undermatching promotes noncognitive development during the first year of college in some instances, which in turn may have longer-term positive influence on educational persistence and degree completion, albeit from less selective institutions.

Prior research on the development of, and economic value associated with, “soft skills” (such as motivation and self-efficacy, see Heckman and Kautz 2012) suggests that students who experience greater noncognitive development during college may experience longer-term benefits. And within college impact studies, noncognitive (or affective) measures are often viewed as mediating the relationships between a student's background or curricular experiences and subsequent academic outcomes (Mayhew et al. 2016).

Therefore, an important question for further research is whether the effects of undermatching on noncognitive development subsequently increase students' odds of completing a college degree and achieving career success beyond college. Until further research is conducted to expound on this premise, it is premature to put forth practice-based recommendations based on our findings. However, our findings do clearly provide new developmental evidence that should serve as a warning against assuming that undermatching is universally bad for students. Evidence indicating that first-generation students demonstrate greater gains in their levels of academic self-efficacy and satisfaction with college than their continuing-generation counterparts should encourage more nuanced approaches to advising students on their college destinations. While other studies have documented that attending an undermatched institution may lead to career and economic disadvantages after graduation (Muskens et al. 2019; Ovink et al. 2017), no prior study has examined the mechanisms surrounding (or the indirect influence of) attending an undermatched institution in relation to long-term, post-college outcomes. As Dillon and Smith (2017) aptly state, undermatching “could have could have positive effects on student outcomes, depending on the relative importance of greater resources and stronger peers on the one hand and less competition and more manageable coursework on the other” (p. 46). Until research is conducted that addresses the extent to which noncognitive developmental gains associated with attending an undermatched institution has on post-college outcomes, the total long-term effects of undermatching remains an empirical question.

Moreover, our results call into question the often-negative assumptions tied to institutional undermatch. In some instances, this assumption is based, quite appropriately, on the evidence that attending more selective institutions increases one's chances of degree attainment and career success (Muskens et al. 2020; Ovink et al. 2017). In other instances, this assumption may be rooted in an over-emphasis on the selectivity or competitive rankings

of institutions. In fact, findings from the present study should serve as a reminder of what decades of research has demonstrated: on the whole, differences in the experiences students have *within* a college environment has greater influence than the differences *between* colleges (Mayhew et al. 2016; Pascarella and Terenzini 2005). Our findings may also strengthen Tiboris’ (2014) argument that maintaining individual autonomy in choosing what college to attend may be a greater imperative than assuming that undermatching leads to unfavorable outcomes. Ultimately, if attending an undermatched institution provides students, particularly first-generation students, with a more comfortable, nurturing, and supportive environment, then there is a good chance they will experience greater noncognitive development and, potentially, greater academic attainment in the long run.

### Compliance with Ethical Standards

**Conflict of interest** The authors declare that they have no conflict of interest.

### Appendix

See Table 7, 8, 9.

**Table 7** Sample means of unadjusted and PSM-adjusted samples

Ascribed characteristics	Unadjusted sample			PSM-adjusted sample		
	Matched-selective	Under-matched	<i>t</i> -value	Matched-selective	Under-matched	<i>t</i> -value
Female	0.66	0.75	5.98**	0.75	0.75	0.32
Age	18.35	18.53	7.09**	18.52	18.53	0.44
Immigrant	0.02	0.00	− 5.36**	0.01	0.00	− 0.53
Disability or functional limitation	0.16	0.17	0.94	0.17	0.17	− 0.53
First-generation	0.29	0.40	7.35**	0.39	0.40	0.53
Parental income above average	0.40	0.28	− 8.36**	0.26	0.28	1.17
Parental income below average	0.08	0.09	0.64	0.09	0.09	0.27
At least one parent employed	0.82	0.83	0.62	0.82	0.83	0.40
Grade retention secondary education	0.11	0.19	7.20**	0.18	0.19	0.90
<i>N</i>	8476	1169		2329	1169	

**Table 8** PSM-adjusted estimates of undermatched (vs. matched-most selective) on noncognitive development

Outcome measures ( $T_2$ )	Beta (SE)
Academic motivation	0.00 (0.01)
Satisfaction with college	0.14 (0.04)**
Academic self-efficacy	0.01 (0.02)

Startmonitor, 2009–2015

Estimates were based on linear regression models. In addition to Undermatched (vs. Matched: most selective=0), models contained the pretest ( $T_1$ ) and college major. In addition, the models predicting Academic Motivation and Academic Self-Efficacy include year fixed effects. \* $p < 0.05$ ; \*\* $p < 0.01$ ; \*\*\* $p < 0.001$ .  $N = 3,498$

**Table 9** PSM-adjusted estimates of undermatched (vs. matched-most selective) on noncognitive development, by first-generation status

Outcome measures ( $T_2$ )	First-Generation Beta (SE)	Continuing-Generation Beta (SE)
Academic motivation	0.04 (0.03)	- 0.02 (0.02)
Satisfaction with college	0.14 (0.04)**	0.05 (0.06)
Academic self-efficacy	0.06 (0.03)*	- 0.02 (0.02)

Startmonitor, 2009–2015

Estimates were based on linear regression models. In addition to Undermatched (vs. Matched: most selective=0), models contained the pretest ( $T_1$ ) and college major. In addition, the models predicting Academic Motivation and Academic Self-Efficacy include year fixed effects. \* $p < 0.05$ ; \*\* $p < 0.01$ ; \*\*\* $p < 0.001$ .  $N = 3,498$

## References

- Aljohani, O. (2016). A comprehensive review of the major studies and theoretical models of student retention in higher education. *Higher Education Studies*, 6(2), 1–18.
- Alon, S. (2009). The evolution of class inequality in higher education: Competition, exclusion, and adaptation. *American Sociological Review*, 74(5), 731–755.
- Alon, S., & Tienda, M. (2005). Assessing the mismatch hypothesis: Differences in college graduation rates by institutional selectivity. *Sociology of Education*, 78(4), 294–315.
- Astin, A. W. (1984). Student involvement: A developmental theory for higher education. *Journal of College Student Development*, 25(4), 297–308.
- Astin, A. W. (1991). *Assessment for excellence: The philosophy and practice of assessment and evaluation in higher education*. New York: Macmillan.
- Austin, P. C. (2010). Statistical criteria for selecting the optimal number of untreated subjects matched to each treated subject when using many-to-one matching on the propensity score. *American journal of epidemiology*, 172(9), 1092–1097.
- Bandura, A. (1993). Perceived self-efficacy in cognitive development and functioning. *Educational psychologist*, 28(2), 117–148.
- Bastedo, M. N., & Flaster, A. (2014). Conceptual and methodological problems in research on college undermatch. *Educational Researcher*, 43(2), 93–99.
- Bastedo, M. N., & Jaquette, O. (2011). Running in place: Low-income students and the dynamics of higher education stratification. *Educational Evaluation and Policy Analysis*, 33(3), 318–339.
- Belasco, A. S., & Trivette, M. J. (2015). Aiming low: Estimating the scope and predictors of undermatch. *Journal of Higher Education*, 86(2), 233–263.

- Bewick, B., Koutsopoulou, G., Miles, J., Slaa, E., & Barkham, M. (2010). Changes in undergraduate students' psychological well-being as they progress through university. *Studies in Higher Education, 35*(6), 633–645.
- Black, S. E., Cortes, K. E., Lincove, J. A. (2015). Apply yourself: Racial and ethnic differences in college application (Working Paper No. 21368). National Bureau of economic research. Retrieved March 20, 2019, from <http://www.nber.org/papers/w21368>.
- Borghans, L., Duckworth, A. L., Heckman, J. J., & Ter Weel, B. (2008). The economics and psychology of personality traits. *Journal of Human Resources, 43*(4), 972–1059.
- Bowen, W. G., Chingos, M. M., & McPherson, M. S. (2009). *Crossing the finish line: Completing college at America's public universities*. Princeton, NJ: Princeton University Press.
- Bowman, N. A., Miller, A., Woosley, S., Maxwell, N. P., & Kolze, M. (2019). Understanding the link between noncognitive attributes and college retention. *Research in Higher Education, 60*(2), 135–152.
- Browman, A. S., Destin, M., Carswell, L. K., & Svoboda, R. C. (2017). Perceptions of socioeconomic mobility influence academic persistence among low socioeconomic status students. *Journal of Experimental Social Psychology, 72*, 45–52.
- Campbell, S., Macmillan, L., & Wyness, G. (2019). Mismatch in higher education: Prevalence, drivers and outcomes. UCL Institute of Education, London, UK. Retrieved June 18, 2020, from: <https://mk0nuffieldfounpg9ee.kinstadcn.com/wp-content/uploads/2019/11/Wyness-42856-MPO-Final-Nov19.pdf>.
- Carrell, S. E., Fullerton, R. L., & West, J. E. (2009). Does your cohort matter? Measuring peer effects in college achievement. *Journal of Labor Economics, 27*(3), 439–464.
- Clark, L. A., & Watson, D. (1995). Constructing validity: Basic issues in objective scale development. *Psychological Assessment, 7*(3), 309.
- Clogg, C. C., Petkova, E., & Haritou, A. (1995). Statistical methods for comparing regression coefficients between models. *American Journal of Sociology, 100*(5), 1261–1293.
- Cole, D. (2007). Do interracial interactions matter? An examination of student-faculty contact and intellectual self-concept. *Journal of Higher Education, 78*(3), 249–281.
- Collins, R. (1971). Functional and conflict theories of educational stratification. *American Sociological Review, 36*(6), 1002–1019.
- De Mooij, M., Geerdinck, M., Oostrom, L., & Van Weert, C. (2012). Studeren loont. Inkomens van afgestudeerden in het mbo, hbo en wetenschappelijk onderwijs. *Socialeconomische trends, 2*, 55–67.
- Dillon, E. W., & Smith, J. A. (2017). Determinants of the match between student ability and college quality. *Journal of Labor Economics, 35*(1), 45–66.
- Dillon, E. W., & Smith, J. A. (2020). The consequences of academic match between students and colleges. *Journal of Human Resources, 55*(3), 767–808.
- Dutch Inspectorate of Education. (2018). *The state of education in the Netherlands 2016/2017*. Utrecht: Dutch inspectorate of education.
- Fang, J., Huang, Z., Zhang, M., Huang, F., Li, Z., & Yuan, Q. (2018). The big-fish-little-pond effect on academic self-concept: A meta-analysis. *Frontiers in Psychology, 9*(1569), 1–11.
- Farrington, C. A., Roderick, M., Allensworth, E., Nagaoka, J., Keyes, T. S., Johnson, D. W., et al. (2012). *Teaching adolescents to become learners. The role of noncognitive factors in shaping school performance: A critical literature review*. Chicago: University of Chicago Consortium on Chicago School Research.
- Faul, F., Erdfelder, E., Lang, A.-G., & Buchner, A. (2007). G\*Power 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences. *Behavior Research Methods, 39*, 175–191.
- Fostnacht, K. (2015). Undermatching and the first-year experience: Examining effect heterogeneity. Paper presented at the annual meeting of the association for the study of higher education, Denver, CO.
- Goodchild, L. F., & Wechsler, H. S. (1997). *The history of higher education. ASHE reader series* (2nd ed.). Boston, MA: Pearson Publishing.
- Grossman, M. (2006). Education and non-market outcomes. In E. Hanushek & F. Welch (Eds.), *Handbook of the economics of education* (Vol. 1, pp. 578–633). Amsterdam: Elsevier-North Holland.
- Heckman, J. J., & Kautz, T. (2012). Hard evidence on soft skills. *Labour Economics, 19*(4), 451–464. Retrieved October 3, 2019, from <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3612993/>.
- Heckman, J. J., & Kautz, T. (2013). *Fostering and measuring skills: Interventions that improve character and cognition*. Discussion paper no. 7759. Bonn, Germany: IZA Institute of Labor Economics. Retrieved January 1, 2018, from <https://www.iza.org/publications/dp/7750/fostering-and-measuring-skills-interventions-that-improve-character-and-cognition>.
- Hippe, R., Araújo, L., Dinis da Costa, P. (2016). *Equity in education in Europe; Luxembourg (Luxembourg): Publications office of the European Union; EUR 28285 EN*.
- Hoger Onderwijs Persbureau. (2017). *Hoger onderwijs bekostigen: De scenario's*. Amsterdam: HOP.

- House, E. A. (2017). *Finding the best fit: Exploring postsecondary undermatch in Tennessee [Unpublished doctoral dissertation]*. Michigan: University of Michigan.
- Hoxby, C. M., & Avery, C. (2013). The missing “One-Offs”: The hidden supply of high-achieving, low income students. *Brookings Papers on Economic Activity*, 1, 1–65.
- Hoxby, C. M., & Turner, S. (2013). *Expanding college opportunities for high achieving, low income students (SIEPR 12–014)*. Stanford, CA: Stanford Institute for Economic Policy Research.
- Kamhöfer, D. A., Schmitz, H., & Westphal, M. (2019). Heterogeneity in marginal non-monetary returns to higher education. *Journal of the European Economic Association*, 17(1), 205–244. <https://doi.org/10.1093/jeea/jvx058>.
- Katsarova, I. (2015). Higher education in the EU: Approaches, issues and trends. European parliament, directorate-general for parliamentary research services. Retrieved March 18, 2020, from <https://www.europarl.europa.eu/EPRS/EPRS-IDA-554169-Higher-education-in-the-EU-FINAL.pdf>.
- Kautz, T., Heckman, J. J., Diris, R., Weel, B., & Borghans, L. (2014). *Fostering and measuring skills: Improving cognitive and non-cognitive skills to promote lifetime success*. Cambridge, MA: National Bureau of Economic Research, Working Paper 20749. Retrieved March 13, 2019, from <https://www.nber.org/papers/w20749>.
- Kim, Y. K., & Sax, L. J. (2014). The effects of student-faculty interactions on academic self-concept: Does academic major matter? *Research in Higher Education*, 55(8), 780–809.
- Kurlaender, M., & Grodsky, E. (2013). Mismatch and the paternalistic justification for selective college admissions. *Sociology of Education*, 86(4), 294–310.
- Linnenbrink, E. A., & Pintrich, P. R. (2002). Motivation as an enabler for academic success. *School psychology review*, 31(3), 313–327.
- Liu, X., & Borden, V. (2019). Addressing self-selection and endogeneity in higher education research. *Theory and Method in Higher Education Research*, 5, 129–151.
- Long, M. C. (2008). College quality and early adult outcomes. *Economics of Education Review*, 27(5), 588–602.
- Long, M. C. (2010). Changes in the returns to education and college quality. *Economics of Education Review*, 29(3), 338–347.
- Lucas, S. R. (2001). Effectively maintained inequality: Education transitions, track mobility, and social background effects. *American Journal of Sociology*, 106(6), 1642–1690.
- Manski, C. F. (1993). Identification of endogenous social effects: The reflection problem. *Review of Economic Studies*, 60(3), 531–542.
- Marsh, H. W. (1987). The big-fish-little-pond effect on academic self-concept. *Journal of educational psychology*, 79(3), 280.
- Marsh, H. W., & Hau, K. T. (2003). Big-fish-little-pond effect on academic self-concept: A cross-cultural (26-country) test of the negative effects of academically selective schools. *American psychologist*, 58(5), 364.
- Mayhew, M. J., Rockenbach, A. N., Bowman, N. A., Seifert, T. A., Wolniak, G. C., Pascarella, E. T., & Terenzini, P. T. (2016). *How college affects students: 21st century evidence that higher education works*. San Francisco, CA: Wiley.
- McMahon, W. W. (2009). *Higher learning, greater good: The private and social benefits of higher education*. Baltimore, MD: Johns Hopkins University Press.
- Muskens, M., Frankenhuys, W. E., & Borghans, L. (2019). Low-income students in higher education: Undermatching predicts decreased satisfaction toward the final stage in college. *Journal of Youth and Adolescence*, 48(7), 1296–1310.
- Muskens, M., & Wolniak, G. C., & Borghans, L. (2020). The Long-Term Consequences of College Undermatching on Career and Personal Well-Being After College. In B. Broucker, V. Borden, T. Kallenerg, & C. Milsom (Eds.), *Responsibility of Higher Education Systems: What? Why? How?* (pp. 51–73). Rotterdam, Netherlands: Brill.
- Netherlands Association of Universities of Applied Sciences. (2018). *Collective labour agreement of Dutch universities of applied sciences*. Den Haag: Vereniging Hogeschole.
- Ovink, S., Kalogrides, D., Nannery, M., & Delaney, P. (2017). College match and undermatch: Assessing student preferences, college proximity, and inequality in post-college outcomes. *Research in Higher Education*, 58(7), 1–38.
- Pascarella, E. (1985a). College environmental influences on learning and cognitive development: A critical review and synthesis. In J. Smart (Ed.), *Higher education: Handbook of theory and research*. New York: Agathon.
- Pascarella, E. T. (1985b). Students’ affective development within the college environment. *Journal of Higher Education*, 56(6), 640–663.

- Pascarella, E. T., Pierson, C. T., Wolniak, G. C., & Terenzini, P. T. (2004). First-generation college students: Additional evidence on college experiences and outcomes. *Journal of Higher Education*, 75(3), 249–284.
- Pascarella, E. T., Salisbury, M. H., & Blaich, C. (2013). Design and analysis in college impact research: Which counts more? *Journal of College Student Development*, 54(3), 329–335.
- Pascarella, E. T., & Terenzini, P. T. (2005). *How college affects students: A third decade of research* (Vol. 2). San Francisco, CA: Jossey-Bass.
- Pascarella, E. T., Wolniak, G. C., & Pierson, C. T. (2003). Explaining student growth in college when you don't think you are. *Journal of College Student Development*, 44(1), 122–126.
- Paulsen, M. B., & St. John, E. P. (2002). Social class and college costs: Examining the financial nexus between college choice and persistence. *Journal of Higher Education*, 73(2), 189–236.
- Porter, S. R. (2011). Do college student surveys have any validity? *The Review of Higher Education*, 35, 45–76.
- Raudenbush, S. W., & Bryk, A. S. (2002). *Hierarchical linear models: Applications and data analysis methods*. Sage Publications.
- Reynolds, C. L., & DesJardins, S. L. (2009). The use of matching methods in higher education research: Answering whether attendance at a 2-year institution results in differences in educational attainment. In J. Smart (Ed.), *Higher education: Handbook of theory and research*. Dordrecht: Springer. [https://doi.org/10.1007/978-1-4020-9628-0\\_2](https://doi.org/10.1007/978-1-4020-9628-0_2).
- Roderick, M., Coca, V., & Nagaoka, J. (2011). Potholes on the road to college: High school effects in shaping urban students' participation in college application, four-year college enrollment, and college match. *Sociology of Education*, 84(3), 178–211.
- Roderick, M., Nagaoka, J., Allensworth, E., Coca, V., Correa, M., & Stoker, G. (2006). *From high school to the future: A first look at Chicago public school graduates' college enrollment, college preparation, and graduation from four-year colleges*. Chicago: Consortium on Chicago School Research.
- Rodriguez, A. (2015). Tradeoffs and limitations: Understanding the estimation of college undermatch. *Research in Higher Education*, 56(6), 566–594.
- Roksa, J., & Deuschlander, D. (2018). Applying to college: The role of family resources in academic undermatch. *Teachers College Record*, 120(6), 1–30.
- Rubin, D. (2008). For objective causal inference, design trumps analysis. *Annals of Applied Statistics*, 2, 808–840.
- Sacerdote, B. (2001). Peer effects with random assignment: Results for dartmouth roommates. *Quarterly Journal of Economics*, 116(2), 681–704.
- Sedlacek, W. E. (2017). *Measuring noncognitive variables: Improving admissions, success, and retention for underrepresented students*. Sterling, VA: Stylus.
- Sewell, W. H. (1971). Inequality of opportunity for higher education. *American Sociological Review*, 36(5), 793–809.
- Shadish, W. R., Clark, M. H., & Steiner, P. M. (2008). Can nonrandomized experiments yield accurate answers? A randomized experiment comparing random and nonrandom assignment. *Journal of the American Statistical Association*, 103(484), 1334–1343.
- Shim, S. S., Ryan, A. M., & Cassady, J. (2012). Changes in self-efficacy across the first year in college: The role of achievement goals. *Educational Psychology An International Journal of Experimental Educational Psychology*, 32(2), 149–167.
- Smith, J., Pender, M., & Howell, J. (2013). The full extent of student-college academic undermatch. *Economics of Education Review*, 32, 247–261.
- Stebleton, M. J., Soria, K. M., & Huesman, R. L. (2014). First-generation students' sense of belonging, mental health, and use of counseling services at public research universities. *Journal of College Counseling*, 17(1), 6–17.
- Sullivan, A. (2001). Cultural capital and educational attainment. *Sociology*, 35(4), 893–912.
- Tavakol, M., & Dennick, R. (2011). Making Sense of Cronbach's Alpha. *International Journal of Medical Education*, 2, 53–55.
- Tiboris, M. (2014). What's wrong with undermatching? *Journal of Philosophy of Education*, 48(4), 46–664.
- Titus, M. A. (2004). An examination of the influence of institutional context on student persistence at 4-year colleges and universities: A multilevel approach. *Research in Higher Education*, 45, 673–699.
- Thoemmes, F. J., & Kim, E. S. (2011). A systematic review of propensity score methods in the social sciences. *Multivariate Behavioral Research*, 46(1), 90–118.
- Valentine, J. C., DuBois, D. L., & Cooper, H. (2004). The relation between self-beliefs and academic achievement: A meta-analytic review. *Educational psychologist*, 39(2), 111–133.
- Van den Broek, A., Cuppen, J., Warps, J., Termorshuizen, T., Lodewick, J., Brukx, D. et al. (2019). Monitor beleidsmaatregelen hoger onderwijs 2018–2019. Nijmegen: ResearchNed. Retrieved September

- 2, 2020, from <https://www.rijksoverheid.nl/binaries/rijksoverheid/documenten/rapporten/2019/08/31/monitor-beleidsmaatregelen-hoger-onderwijs-2018-2019/monitor-beleidsmaatregelen-hoger-onderwijs-2018-2019.pdf>.
- Weidman, J. (1989). Undergraduate socialization: A conceptual approach. In J. Smart (Ed.), *Higher education: Handbook of theory and research* (Vol. 5, pp. 289–322). New York: Agathon.
- Wells, R., & Lynch, C. (2012). Delayed entry: The influences of family income, parental education, and parental occupation on the college transition. *Journal of Higher Education*, 83(5), 671–697.
- Wiederkehr, V., Darnon, C., Chazal, S., Guimond, S., & Martinot, D. (2015). From social class to self-efficacy: Internalization of low social status pupils' school performance. *Social Psychology of Education*, 18(4), 769–784.
- Wolniak, G., & Ballerini, V. (2019). Peer effects, higher education. In P. Teixeira & J. Shin (Eds.), *Encyclopedia of international higher education systems and institutions*. Dordrecht: Springer. [https://doi.org/10.1007/978-94-017-9553-1\\_84-1](https://doi.org/10.1007/978-94-017-9553-1_84-1).

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