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Credential Inflation and Decredentialization: Re-examining the Mechanism of the Devaluation of Degrees

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Abstract

Sociologists have long used credential inflation theory to explain the devaluation of tertiary education degrees as the consequence of the excessive supply of educated personnel. However, the literature has inadequately examined two fundamental conditions: the combination of degrees/skills that individuals possess and the level of degrees. In this article, cross-country multilevel regressions reveal lower-level degrees (i.e. short-cycle tertiary) are devalued due to the larger extent of lower-level tertiary expansion in a society, regardless of degree holders' skills level. This is consistent with the concept of credential inflation. In contrast, alongside the proliferation of higher-level tertiary education (i.e. bachelor and above), individuals with such degrees are penalized only when they lack high skills. Put differently, higher-level degree holders retain their rewards despite their diminishing scarcity as long as they possess high skills. Meanwhile, high skills unaccompanied by tertiary degrees lose their premium merely in connection with lower-level tertiary expansion. These results suggest credentialism is intensified and credential inflation operates in societies where the extent of lower-level tertiary expansion is relatively large, whereas 'decredentialization' emerges along with the larger extent of higher-level tertiary expansion in a way that devalues credentials as such whilst relatively enhancing the role of skills in reward allocation.

Introduction

The past few decades have witnessed a remarkable expansion of education worldwide. By 2019, approximately 38 per cent of 25–64 year-olds in OECD countries had attained tertiary education (OECD, 2020). In response, the existing literature argues that the association between educational credentials and economic rewards generally weakens as a result of credential inflation (e.g. Collins, 1979, 2011; Brown, 2001; Bills and Brown, 2011). Recent work in this vein has further focused on the heterogeneity among the highly educated, suggesting that the premium for education and its elasticity resulting from educational expansion differs depending on fields of study, prestige of education institutions, and socio-economic backgrounds (Kariya, 2011; Bills, 2016; Ortiz and Rodriguez-Menés, 2016; Di Stasio, 2017; DiPrete *et al.*, 2017; Posselt and Grodsky, 2017; Tholen, 2017). In doing so, it offers a counter-argument to functionalist perspectives, which have long held that higher levels of education are linked with higher productivity

that ensures economic rewards, regardless of whether education genuinely nurtures ability (i.e. human capital theory) (Mincer, 1958, 1974; Schultz, 1961; Becker, 1964) or merely signals high potential/trainability (i.e. signalling/labour queue theory) (Spence, 1973; Thurow, 1975).

Although prior research has elucidated the nuanced structure of progressive devaluations of educational credentials, two important dimensions have remained empirically elusive. First, while credential inflation has been primarily conceptualized as the consequence of the excessive supply of educated human resources as compared to labour demand (e.g. Brown, 2003; Bills and Brown, 2011), there has been little empirical evidence focused on labour supply: the potential difference in economic rewards between those who merely possess high-level credentials unaccompanied by actual high skills (i.e. nominal degree) and those with both high-level credentials and high skills. This research gap is particularly critical given that sociologists have traditionally explained variance in the devaluation of credentials among equally qualified individuals (e.g. tertiary graduates) by investigating social backgrounds (i.e. the advantaged are more likely than their disadvantaged counterparts to obtain more prestigious educational qualifications, thus retaining preferable rewards even amongst the expansion of tertiary education) (Tholen, 2017). Consequently, these foci have obscured one possibility that heterogeneous returns to degrees may be attributed to the actual skill level of nominally equivalent degree holders.

Second, in terms of the proliferation of tertiary education as a driving force of credential inflation, the literature has paid little attention to the distinction between higher-level tertiary (i.e. International Standard Classification of Education: ISCED 2011 Level 6 and above) and lower-level tertiary (i.e. ISCED 2011 Level 5). The long-standing approach to analyse the consequences of educational expansion has been to quantify the percentage of degree holders in a way that conflates both higher-level and lower-level *or* limits itself to only higher-level degree holders. As long as both levels of educational expansion demonstrate the same effect on the depreciation of degrees, this conflation is not necessarily cause for concern. However, it is logical to assume that these two dimensions differently affect the scarcity and hence the signalling value of individuals' educational credentials.

One may therefore detect the nuanced mechanism of devaluation of degrees by incorporating the aforementioned perspectives at both the individual level (i.e. whether tertiary degrees are accompanied by high skills) and the societal level (i.e. the distinction between higher-level and lower-level tertiary expansion). Indeed, as detailed in the following sections, the result of our analysis reveals credentialism is intensified and hence the nominal level of degrees, rather than skills, does matter within educational expansion of lower-level tertiary credentials. In contrast, what we call 'decredentialization' operates in association with higher-level tertiary expansion in a way that devalues credentials *per se* and penalizes degree holders only when they lack high skills. Put differently, the economic return to tertiary degrees does not simply decline, despite their diminishing scarcity, so long as these degrees are accompanied by high skills. These findings, in tandem with the reconceptualization of the approach and its attendant methods we present here, are of great importance both to social science research and social policy.

As such, this paper revisits credential inflation with close attention to (i) whether individuals' degrees are merely nominal or accompanied by high skills and (ii) how differential expansion of higher-level and lower-level tertiary education relates to the devaluation of individuals' tertiary degrees. After reviewing previous research and describing hypotheses in the next section, we outline our data and methods. We then report results of our empirical analysis, followed by further discussion around our intended theoretical contribution: 'decredentialization'.

Devaluation of Educational Credentials

The positive association between educational credentials and economic benefits has been confirmed by a vast literature. Regardless of whether higher levels of education genuinely nurture skills (Mincer, 1958, 1974; Schultz, 1961; Becker, 1964) or merely signify high potential (Spence, 1973; Thurow, 1975), highly educated people are more likely than less educated counterparts to acquire preferable rewards. This relationship may be intensified, from the perspective of social closure, once the privileged exclude others from accessing economic assets by using educational credentials and other forms of capital as criteria to hold membership within the select community (Murphy, 1988; Weeden, 2002; Rivera, 2011; Smyth and McCoy, 2011; Brown, 2013; Bol and Weeden, 2015; Posselt and Grodsky, 2017; Tholen, 2017).

However, in paying attention to the value of educational credentials as positional goods, credential inflation theory has cast doubt on the idea that higher levels of education automatically result in better economic status (Collins, 1979, 2011; Van de Werfhorst, 2009;

Horowitz, 2018). The fundamental contribution of this line of research has been its focus on the depreciation of educational credentials due to the larger share of educated people in a given society (Bills and Brown, 2011). This phenomenon can, in theory, be explained by both demand side and supply side issues.

Sociologists have historically favoured the demand side story: credential inflation occurs when growth in the number of people with high credentials outpaces the increase in job opportunities that require high educational attainment (Brown, 2003; Bills and Brown, 2011). This has also been investigated as a problem of overeducation (Verhaest and Van Der Velden, 2013; Di Stasio, Bol and van de Werfhorst, 2016; Di Stasio, 2017; Nieto and Ramos, 2017). In a similar vein, recent research has further argued returns to education differ depending on fields of study and prestige of education institutions, as well as socio-economic statuses of individuals (Kariya, 2011; Bills, 2016; Ortiz and Rodriguez-Menés, 2016; Di Stasio, 2017; DiPrete *et al.*, 2017; Posselt and Grodsky, 2017; Tholen, 2017).

Although impressive findings have emerged within these demand-side studies, the supply side story has been inadequately accounted for: higher degrees are significantly devalued by the (lowered) quality of highly educated people. That is, the existing literature has long attempted to delineate the link between various types of credentials and economic rewards based on the assumption that credentials reflect actual skills (Araki, 2020). Meanwhile, as reviewed, sociological research often explains the heterogeneity in returns to education as a product of variances in socio-economic statuses. Consequently, one fundamental possibility has remained empirically untested: the mechanism of devaluation of credentials differs depending on whether or not degree holders actually possess high skills. For example, one may assume individuals with a high degree and high skills may retain their rewards, whereas those who merely possess a high degree without high skills (i.e. a nominal degree) are penalized as societal-level educational expansion continues apace.

Indeed, recent studies demonstrate the importance of distinguishing between educational attainment and actual skills. For example, Hanushek and colleagues have revealed skills, rather than years of schooling, play important roles in achieving economic success (Hanushek and Woessmann, 2015; Hanushek *et al.*, 2015). Sociologists have also detected the distinct impact of skills and credentials on socio-economic outcomes (Kerckhoff, Raudenbush and Glennie, 2001; Gesthuizen, Solga and Künster, 2011; Doren and Grodsky, 2016). Among others, Flisi *et al.* (2017) shed light on the discrepancy between overeducation and overskilling, implying skills levels should be taken into account in analysing the (de)-valuation of education. In addition, Araki (2020) reveals labour market rewards are allocated based on the composite of credentials and skills in a nuanced way, depending, in part, on societal-level educational conditions.

While this line of work has helped advance understanding of differentials in economic returns to education, little attention has been paid to the distinction between higher-level (ISCED 2011 Level 6 and above) and lower-level tertiary degrees (ISCED 2011 Level 5). Indeed, the literature has revealed that the premium for individual credentials differs depending on their levels as well as types (Bills, 2016; Di Stasio, 2017; DiPrete *et al.*, 2017). However, when it comes to the societal-level expansion of tertiary education, the long-standing approach has been to simply quantify the percentage of total tertiary degree holders (including both higher-level and lower-level) *or* that of only higher-level tertiary graduates. This approach may be questioned because the proliferation of higher-level tertiary education and that of lower-level tertiary education differently affect the scarcity and hence the signalling power of specific credentials in a given society, resulting in heterogeneous economic returns to education. Specifically, the devaluation of higher-level degrees may happen only when higher-level tertiary expansion progresses, whereas lower-level degrees may lose their premium in association with lower-level tertiary expansion. Furthermore, such devaluation may be mitigated or even offset when degree holders also possess high skills. Nevertheless, if the exclusion of less educated people is strengthened by educational expansion as closure theory argues, higher-level tertiary expansion may lead to devaluation of lower-level degrees regardless of attendant skill levels.

Filling this research gap would significantly contribute to better understanding not only the mechanism of devaluation of credentials as such but also the nuanced process of stratification in various societies through the lens of education and labour market outcomes. However, these aspects have been obscured under the influential notion of credential inflation. To this end, the current paper re-examines credential inflation via empirically analysing the economic return to tertiary degrees with particular attention to (i) whether individuals' degrees are accompanied by high skills; and (ii) the distinction between higher-level and lower-level tertiary expansion. In so doing, based on the concept of credential inflation and relevant theories reviewed above, we aim to test the following three hypotheses:

H1: Tertiary degrees are devalued in association with the expansion of tertiary education (including both lower-level and higher-level). Yet, degrees accompanied by high skills are not devalued or at least face relatively small depreciation compared to nominal degrees without high skills. Meanwhile, high skills unaccompanied by tertiary degrees are also devalued due to intensified closure.

H2: In association with lower-level tertiary expansion, only lower-level degrees are devalued while higher-level degrees retain their returns. Yet, lower-level degrees accompanied by high skills are not devalued or at least face the relatively small depreciation compared to nominal lower-level degrees. Meanwhile, high skills unaccompanied by tertiary degrees are also devalued due to intensified closure.

H3: In association with higher-level tertiary expansion, higher-level degrees are devalued, but it is not the case (or occurs in a quantitatively reduced manner) for those with high skills. Meanwhile, lower-level degrees (regardless of their skills level) as well as high skills unaccompanied by tertiary degrees are also devalued due to intensified closure.

Data and Methods

We use data from the Programme for the International Assessment of Adult Competencies (PIAAC) conducted by the OECD, which supports international comparisons of analyses of the link between educational attainment, skills, and labour market outcomes. PIAAC is primarily composed of assessments of cognitive skills and questionnaires for adults aged from 16 to 65 years. The major components of the PIAAC assessment are literacy and numeracy, both of which are measured on a standardized scale from 0 to 500. The scores are also linked to the concept of proficiency levels, among which Level 4 or 5 (equivalent to test score 326 points and above) are interpretable as high skills (OECD, 2019). In addition to cognitive skills data, PIAAC questionnaires provide wide-ranging variables, such as educational attainment, gender, age, and social backgrounds. For our analysis, participants in the prime working age (i.e. between 25 and 54 years) are extracted given the possibility that many of the youngest cohort (i.e. aged 16–24 years) are still in education and that the oldest cohort (i.e. aged 55–65 years) is more likely to be affected by various work–life experiences including lifelong learning. As detailed in Table 1, we utilize data for 91,217 individuals from 26 countries participating in PIAAC between 2011 and 2015.

As returns to degrees are significantly influenced by both individual and societal level factors, we conduct a cross-sectional multilevel analysis using the PIAAC data and other country-level data. Admittedly, a country-specific analysis would have been effective approach to delineate the linkage between societal-level educational expansion, individual-level degrees, and their economic rewards. In particular, given the nature of educational expansion that incorporates changes over time within a society (and indeed much of the research reviewed previously has analysed country-specific trends), the longitudinal approach focused on particular cases is essential. Nevertheless, country-specific analyses do not necessarily provide generalizable findings beyond the boundary of states. In this regard, as demonstrated by several previous studies (e.g. Araki, 2020; Heisig, Elbers and Solga, 2020), cross-country multilevel models with fundamental societal variables as controls have the potential to reveal broader trends that might not be detectable within the country-specific approach. Furthermore, given the fact that PIAAC has been conducted only once in each country (except for the United States) and thus we cannot undertake internationally comparable longitudinal analyses incorporating skills measures, the present paper adopts the cross-country model. Potential problems with this analytic strategy, as well as possible solutions, are further discussed below.

As regards the outcome variable, we use the International Socio-Economic Index (ISEI) of Occupational Status, which permits a transparent linear model, as distinct from dichotomized measures such as skilled/semi-skilled occupations and earnings quantiles. The continuous measure of earnings would have been an alternative here, but a number of PIAAC countries merely make quantiles data publicly available to ensure anonymity of participants. Although PIAAC does not directly include ISEI either, one may use the International Standard Classification of Occupations (one digit) defined by the International Labour Organization for all participants to create the scale of ISEI (see Ganzeboom, 2010 for more details about ISEI).

Per predictor variables, educational credentials are quantified by two dummy variables for the highest educational qualification attained, namely ISCED 2011 Level 5 (i.e. lower-level degrees) and ISCED 2011 Level 6 and above (i.e. higher-level degrees). Another potential operationalization would have been to divide degrees not only by their levels but also by fields of study and prestige of education institutions. Unfortunately, such data are not available for many

Table 1. Target countries (PIAAC round and the number of samples)

Country	Round	Respondents	Country	Round	Respondents
Austria	1	2,998	Japan	1	2,742
Belgium	1	2,747	South Korea	1	3,777
Canada	1	14,869	Netherlands	1	2,798
Chile	2	2,780	New Zealand	2	3,287
Czech Republic	1	2,957	Norway	1	2,581
Denmark	1	3,593	Poland	1	3,298
Finland	1	2,972	Slovak Republic	1	2,971
France	1	3,694	Slovenia	2	2,857
Germany	1	3,118	Spain	1	3,462
Greece	2	2,580	Sweden	1	2,430
Ireland	1	3,580	Turkey	2	2,297
Israel	2	2,601	United Kingdom	1	4,856
Italy	1	2,579	United States	1	2,793
Total number of respondents					91,217

Notes: PIAAC has been conducted three times thus far: Round 1 (2011–2012), Round 2 (2014–2015), and Round 3 (2017). 'Round' in the Table is the round of PIAAC in which each country participated. 'Respondents' indicates the number of valid cases used in this analysis.

Source: PIAAC data (https://webfs.oecd.org/piaac/puf-data/) [accessed 8 May 2021].

samples in the current analysis, thus future research must incorporate these heterogeneities.

To define degrees with/without high skills, standardized scores of cognitive skills (literacy and numeracy) are utilized. Among 10 plausible values (PV) in the PIAAC public use data, the first PV, which has often been employed to investigate the economic return to skills (e.g. Hanushek *et al.*, 2015), is extracted to calculate the mean score of literacy and numeracy.[1] Referring to the definition of proficiency levels set by the OECD, a respondent whose mean score is 326 points and above is regarded as holding high skills. Combining the measures of tertiary degrees and high skills, those who possess both a degree and high skills are assigned 1 as 'degree holders with high skills', whereas those with simply a tertiary degree but lacking high skills are assigned 1 as 'nominal degree holders'. In addition, to better explain the function of credentials including its role as closure, individuals with high skills unaccompanied by a tertiary degree are also assigned a dummy to distinguish them from those who possess neither of them. This strategy is aligned with the concept of four credential/skill combinations proposed by Araki (2020).[2]

Here, we must bear in mind that skills assessed by PIAAC represent merely one dimension of broader concepts of competences. Indeed, social and emotional skills as well as occupation specific skills, which are not included in PIAAC, have proved to be promoters of economic rewards (Heckman *et al.*, 2010; Kautz *et al.*, 2014; OECD, 2015). Nonetheless, prior studies have also argued that general information-processing skills measured by PIAAC operate as the key to economic success (Hanushek *et al.*, 2015; OECD, 2016; Araki, 2020). In addition, PIAAC is the only available dataset embracing adult cognitive skills in conjunction with educational attainment and labour market outcomes, each of which is crucial for examining the devaluation of degrees with/without high skills in an internationally comparable way. We therefore use PIAAC data as the foundation for further elaboration.

To precisely examine the association between credential/skill combinations and ISEI, the following individual-level variables are accounted for: gender (men are assigned 1 with women as the reference), cohorts (25–34 year-olds and 35–44 year-olds are assigned 1, respectively, with 45–54 year-olds as the reference), immigration (first-generation immigrants are assigned 1 with others as the reference), cultural capital (sum of standardized scores of mother's education, father's education, and the number of books at home),[3] and years of paid work experience. The reference year of individual-level variables is the year when each country participated in PIAAC (i.e. between 2011 and 2015).

In terms of societal-level variables, the extent of educational expansion refers to the percentage of the population (aged from 25 to 64 years) who have completed tertiary education. As with individual-level degrees, lower-level and higher-level expansions are quantified using the classification of ISCED 2011 (i.e. Level 5 for lower-level; Level 6 and above for higher-level). One

limitation of this approach is that these measures do not directly capture any changes over time, a key dimension within educational expansion. Nonetheless, the difference in the said measure across countries (i.e. the percentage of tertiary graduates at the lower-level and higher-level at one point in time as the status quo) can be taken as a quasi-measure for the progress of educational expansion when employing cross-country multilevel models. In addition to this approach, one alternative operationalization is to use the cross-cohort variance within countries (i.e. the difference in the share of tertiary graduates among older versus younger cohorts), which implies the extent to which each country has enhanced access to higher levels of education, albeit still measured at one point in time. Indeed, recent research using the PIAAC data to analyse the returns to education and skills (e.g. Araki, 2020) employs the cross-cohort indicator in conjunction with the simple cross-country measure to verify the robustness of analysis results and implications. The current paper therefore incorporates both the percentage of the entire population with tertiary degrees and its cross-cohort variation between those aged from 55 to 64 years and those from 25 to 34 years.

Alongside educational expansion, country-level independent variables include GDP (per capita, purchasing power parities), union density, and the strength of tracking in education system. GDP and union density are employed given that economic returns to education are significantly influenced by macroeconomic factors and the extent to which people are collectively protected in a given society (Weeden, 2002; Smyth and McCoy, 2011; Bol and Weeden, 2015). Furthermore, it is essential to adjust for tracking as it affects the value of credentials considerably in tandem with the labour market (Bol and van de Werfhorst, 2013; Levels, van der Velden and Di Stasio, 2014; Di Stasio, Bol and van de Werfhorst, 2016; Di Stasio, 2017; DiPrete *et al.*, 2017; Bol *et al.*, 2019). The reference years of these data range from 2010 to 2014 (see Table 2 for descriptive statistics and details about reference years).

Using these individual-level and country-level variables, we conduct the following four models of multilevel linear regressions. Model 1 employs only individual-level predictor variables to investigate the overall effects of tertiary degrees with/without high skills after controlling for social backgrounds. The variables concerning degrees here include both lower-level and higher-level. Although there is the possibility of reverse causation between credential/skill combinations and ISEI (i.e. people may enhance their educational attainment and skills via work experience), the current model adopts the assumption that degrees/skills affect ISEI.

$$Y_{ij} = b_{0j} + b_1 M_{ij} + b_2 A_{(25-34)_{ij}} + b_3 A_{(35-44)_{ij}} + b_4 I_{ij} + b_5 C_{ij} + b_6 W_{ij} + b_7 SwoD_{ij} + b_8 DwoS_{ij} + b_9 DwS_{ij} + \varepsilon_{ij} \ldots, \quad (1)$$

where i = Level 1 (individual), j = Level 2 (country), Y_{ij} = ISEI for individual i in country j, b_n = coefficient of individual-level predictors, M_{ij} = men dummy, $A_{(25-34)ij}$ = 25–34-year-old dummy, $A_{(35-44)ij}$ = 35–44-year-old dummy, I_{ij} = first-generation immigrant dummy, C_{ij} = cultural capital, W_{ij} = years of paid work, $SwoD_{ij}$ = high skills without a tertiary degree, $DwoS_{ij}$ = a tertiary degree without high skills, DwS_{ij} = a tertiary degree with high skills, and ε_{ij} = residual for individual i in country j.

In Model 2, country-level variables and six cross-level interaction terms are added to Model 1. Interaction terms are created based on three individual-level variables (i.e. *SwoD*, *DwoS*, and *DwS* in equation 1) and two country-level variables (i.e. the extent of educational expansion and its cross-cohort difference in each country). In this model, educational expansion is quantified by the percentage of the population with total tertiary degrees including both lower-level and higher-level. These interaction terms in tandem with main effects show how the devaluation of degrees due to educational expansion, if any, differs depending on the possession of high skills. In doing so, random slopes for credential/skill combinations are incorporated in accordance with Heisig and Schaeffer (2019). This analysis corresponds to *H1*.

$$b_{0j}(\text{in equation 1}) = \gamma_{00} + \gamma_{01} E_j + \gamma_{02} DE_j + \gamma_{03} T_j + \gamma_{04} G_j + \gamma_{05} U_j + u_{0j} \ldots, \quad (2a)$$

$$b_7(\text{in equation 1}) = \gamma_{70} + u_{7j} \ldots, \quad (2b)$$

$$b_8(\text{in equation 1}) = \gamma_{80} + u_{8j} \ldots, \quad (2c)$$

and

$$b_9(\text{in equation 1}) = \gamma_{90} + u_{9j} \ldots, \quad (2d)$$

where γ_{00} = average intercept, γ_{0n} = coefficient of country-level predictors, E_j = the extent of educational expansion, DE_j = the cross-cohort difference in the extent of educational expansion, T_j = the index of tracking, G_j = GDP per capita, U_j = union density, u_{0j} = country (j) dependent deviation, γ_{n0} = average coefficient of three individual-level credential/skill variables, and u_{nj} = country dependent deviation of the slopes for three credential/skill variables. We substitute equations 2(a–d) into equation 1 and denote b_n by γ_{n0}. Six cross-level interaction terms between three credential/skill combinations and two

societal conditions (i.e. the extent of educational expansion and its cross-cohort difference) are also added as follows:

$$\begin{aligned} Y_{ij} = {} & \gamma_{00} + \gamma_{10}M_{ij} + \gamma_{20}A_{(25-34)_{ij}} + \gamma_{30}A_{(35-44)_{ij}} + \gamma_{40}I_{ij} \\ & + \gamma_{50}C_{ij} + \gamma_{60}W_{ij} + (\gamma_{70} + u_{7j})SwoD_{ij} \\ & + (\gamma_{80} + u_{8j})DwoS_{ij} + (\gamma_{90} + u_{9j})DwS_{ij} + \gamma_{01}E_j \\ & + \gamma_{02}DE_j + \gamma_{03}T_j + \gamma_{04}G_j + \gamma_{05}U_j + \gamma_{71}SwoD_{ij}E_j \\ & + \gamma_{81}DwoS_{ij}E_j + \gamma_{91}DwS_{ij}E_j + \gamma_{72}SwoD_{ij}DE_j \\ & + \gamma_{82}DwoS_{ij}DE_j + \gamma_{92}DwS_{ij}DE_j + u_{0j} + \varepsilon_{ij} \\ = {} & \gamma_{00} + \gamma_{10}M_{ij} + \gamma_{20}A_{(25-34)_{ij}} + \gamma_{30}A_{(35-44)_{ij}} + \gamma_{40}I_{ij} \\ & + \gamma_{50}C_{ij} + \gamma_{60}W_{ij} + \gamma_{70}SwoD_{ij} + \gamma_{80}DwoS_{ij} \\ & + \gamma_{90}DwS_{ij} + \gamma_{01}E_j + \gamma_{02}DE_j + \gamma_{03}T_j + \gamma_{04}G_j \\ & + \gamma_{05}U_j + \gamma_{71}SwoD_{ij}E_j + \gamma_{81}DwoS_{ij}E_j + \gamma_{91}DwS_{ij}E_j \\ & + \gamma_{72}SwoD_{ij}DE_j + \gamma_{82}DwoS_{ij}DE_j + \gamma_{92}DwS_{ij}DE_j \\ & + u_{0j} + u_{7j}SwoD_{ij} + u_{8j}DwoS_{ij} + u_{9j}DwS_{ij} + \varepsilon_{ij}.... \end{aligned} \tag{2e}$$

In Model 3, individual-level tertiary degrees are classified into lower-level (ISCED 2011 Level 5) and higher-level (ISCED 2011 Level 6 and above). In addition, country-level educational expansion measures are also distinguished between two levels for both the status quo and the cross-cohort difference, thus resulting in four educational variables at the societal level. Accordingly, 12 cross-level interaction terms are generated by multiplying four country-level variables and three credential/skill combinations. As with Model 2, these interactions alongside individual-level educational variables are focused on to test Hypotheses 2 and 3:

$$\begin{aligned} Y_{ij} = {} & \gamma_{00} + \gamma_{10}M_{ij} + \gamma_{20}A_{(25-34)_{ij}} + \gamma_{30}A_{(35-44)_{ij}} + \gamma_{40}I_{ij} \\ & + \gamma_{50}C_{ij} + \gamma_{60}W_{ij} + \gamma_{70}SwoD_{ij} + \gamma_{80}LDwoS_{ij} \\ & + \gamma_{90}LDwS_{ij} + \gamma_{100}HDwoS_{ij} + \gamma_{110}HDwS_{ij} \\ & + \gamma_{01}LE_j + \gamma_{02}HE_j + \gamma_{03}DLE_j + \gamma_{04}DHE_j + \gamma_{05}T_j \\ & + \gamma_{06}G_j + \gamma_{07}U_j + \gamma_{71}SwoD_{ij}LE_j \\ & + \gamma_{81}LDwoS_{ij}LE_j + \gamma_{91}LDwS_{ij}LE_j \\ & + \gamma_{101}HDwoS_{ij}LE_j + \gamma_{111}HDwS_{ij}LE_j \\ & + \gamma_{72}SwoD_{ij}HE_j + \gamma_{82}LDwoS_{ij}HE_j \\ & + \gamma_{92}LDwS_{ij}HE_j + \gamma_{102}HDwoS_{ij}HE_j \\ & + \gamma_{112}HDwS_{ij}HE_j + \gamma_{73}SwoD_{ij}DLE_j \\ & + \gamma_{83}LDwoS_{ij}DLE_j + \gamma_{93}LDwS_{ij}DLE_j \\ & + \gamma_{103}HDwoS_{ij}DLE_j + \gamma_{113}HDwS_{ij}DLE_j \\ & + \gamma_{74}SwoD_{ij}DHE_j + \gamma_{84}LDwoS_{ij}DHE_j \\ & + \gamma_{94}LDwS_{ij}DHE_j + \gamma_{104}HDwoS_{ij}DHE_j \\ & + \gamma_{114}HDwS_{ij}DHE_j + u_{0j} + u_{7j}SwoD_{ij} \\ & + u_{8j}LDwoS_{ij} + u_{9j}LDwS_{ij} + u_{10j}HDwoS_{ij} \\ & + u_{11j}HDwS_{ij} + \varepsilon_{ij}... \end{aligned} \tag{3}$$

where $LDwoS_{ij}$ = a lower-level tertiary degree without high skills, $LDwS_{ij}$ = a lower-level tertiary degree with high skills, $HDwoS_{ij}$ = a higher-level tertiary degree without high skills, $HDwS_{ij}$ = a higher-level tertiary degree with high skills, LE = the extent of lower-level tertiary expansion, HE= the extent of higher-level tertiary expansion, DLE = the cross-cohort difference in the extent of lower-level tertiary expansion, and DHE = the cross-cohort difference in the extent of higher-level tertiary expansion.

Finally, as a robustness check, Model 4 simply omits three country-level measures (i.e. T, G, and U) from Model 3 given the possible bias caused by the excessive number of Level 2 variables as compared to the sample size at the societal level.

Results

Table 3 shows the results of our multilevel linear regressions. In Model 1 where only individual-level variables are included without distinguishing higher- versus lower-level degrees, all the predictors including degrees with/without high skills demonstrate significant coefficients at the 0.1 per cent level (i.e. b_7=0.173, b_8=0.341, and b_9=0.430 in Model 1). This means one may expect higher ISEI by holding a tertiary degree and/or high skills. It is worthy of note that there are statistically significant differences in the effect size across these three educational variables,[4] suggesting degree holders who also possess high skills are more likely than others to obtain higher ISEI, followed by nominal degree holders unaccompanied by high skills and then highly skilled people without a tertiary degree.

The significant coefficients of individual-level predictors are observed even after accounting for country-level variables and cross-level interactions between educational expansion and individuals' credential/skill combinations (Model 2). However, one substantial inconsistency detected is that the difference in effect size between a tertiary degree with and without high skills becomes insignificant in Model 2 (i.e. γ_{70}=0.311, γ_{80}=0.523, and γ_{90}=0.553). That is, in line with prior studies (e.g. Araki, 2020), the possession of high educational credentials (i.e. tertiary degrees) plays an essential role in realising preferable labour market outcomes, whereas the contribution of high skills is tangible only among those without a tertiary degree.

Nevertheless, all of three credential/skill combinations are likely to be devalued in societies where the share of tertiary graduates is relatively large. Indeed, three interaction terms between the extent of educational expansion (i.e. the percentage of the population with tertiary degrees) and the said three individual-level educational variables show negative coefficients and they are statistically significant at the 0.1 per cent or 1 per cent level (i.e. $\gamma_{71} = -0.004$, $\gamma_{81} = -0.005$, and $\gamma_{91} = -0.003$). Meanwhile, other interactions between the cross-cohort difference in the proportion of tertiary graduates in each country and credential/skill

Table 2. Descriptive statistics

Variables	Mean	S.D.	Min.	Max.
Individual level				
International socio-economic index (ISEI)	44.26	15.35	18.00	65.00
Gender (male dummy)	0.49	0.50	0.00	1.00
Cohort: 25–34 years old	0.32	0.47	0.00	1.00
Cohort: 35–44 years old	0.34	0.47	0.00	1.00
Cohort: 45–54 years old	0.33	0.47	0.00	1.00
First-generation immigrant	0.12	0.32	0.00	1.00
Cultural capital	0.11	2.29	−3.28	17.14
Years of paid work	17.04	9.61	0.00	47.00
Higher-level degree with high skills	0.08	0.26	0.00	1.00
Higher-level degree without high skills	0.21	0.41	0.00	1.00
Lower-level degree with high skills	0.02	0.12	0.00	1.00
Lower-level degree without high skills	0.12	0.33	0.00	1.00
High skills without tertiary degree	0.03	0.16	0.00	1.00
Country level				
Higher-level tertiary expansion	22.02	6.31	12.02	35.15
Lower-level tertiary expansion	9.30	6.48	0.00	24.17
Difference in higher-level tertiary expansion	12.92	6.37	1.08	27.74
Difference in lower-level tertiary expansion	2.53	7.00	−13.69	24.51
Index of tracking	−0.01	0.97	−1.31	1.79
GDP per capita (USD, PPP)	35,080.98	9,065.94	20,562.26	57,998.85
Union density	28.48	17.96	7.74	68.61
Observations: individuals = 91,217, countries = 26				

Notes: At the individual level, 'Higher-level degree with high skills' means the possession of both a higher-level tertiary degree (ISCED 2011 Level 6 and above) and high skills (the mean score of literacy and numeracy in PIAAC is 326 and above), whereas 'Higher-level degree without high skills' is a dummy for those who hold a higher-level tertiary degree without high skills. 'Lower-level degree with high skills' and 'Lower-level degree without high skills' are dummies for individuals who possess a short-cycle tertiary degree (ISCED 2011 Level 5) with/without high skills, respectively. At the country level, 'Higher-level tertiary expansion' and 'Lower-level tertiary expansion' are the percentage of adults whose highest educational attainment is 'ISCED 2011 Level 6 and above' and 'ISCED 2011 Level 5', respectively. 'Difference in higher-level tertiary expansion' and 'Difference in lower-level tertiary expansion' are the difference in 'Higher-level tertiary expansion' and 'Lower-level tertiary expansion' between two cohorts (aged 55–64 and aged 25–34) in each country. The reference year of individual-level data is when each country participated in PIAAC (i.e. 2011–2012 for Round 1 countries, 2014–2015 for Round 2 countries). Educational expansion and union density refer to the data in 2010, whereas the reference year of GDP per capita is 2010 for PIAAC Round 1 countries and 2013 or 2014 for PIAAC Round 2 countries. For the tracking index, see Bol and van de Werfhorst (2013).

Source: PIAAC data, OECD.Stat (http://stats.oecd.org/) [accessed 8 May 2021], and Bol and van de Werfhorst (2013).

combinations at the individual level do not demonstrate any substantial signs. This suggests the devaluation of degrees primarily emerges in association with the status quo of the scarcity of such educational assets among the entire population in each society rather than the extent to which it differs between older and younger age groups at one point in time. In other models that follow, it is also the status quo (i.e. *LE* and *HE*), not the cross-cohort variation (i.e. *DLE* and *DHE*), that indicates the significant link with the diminishing return to degrees and high skills. *H1* is thus partially supported in that tertiary degrees, as well as high skills unaccompanied by degrees, are devalued within educational expansion. Moreover, the devaluation of degrees is not mitigated even when they are accompanied by high skills.

In Model 3, tertiary degrees are divided into lower-level (i.e. ISECD 2011 Level 5) and higher-level (i.e. ISECD 2011 Level 6 and above) at both the individual and country levels. In terms of main effects of individual-level credential/skill combinations, clear stratification is observed according to degree level. While the magnitude of high skills unaccompanied by tertiary degrees is relatively small (albeit significantly positive), degree holders are likely to enjoy higher ISEI regardless of their skills level. In particular, the effect size of higher-level degrees is substantially larger than that of lower-level (i.e. $\gamma_{70} = 0.246$, $\gamma_{80} = 0.389$, $\gamma_{90} = 0.306$, $\gamma_{100} = 0.577$, and $\gamma_{110} = 0.572$). This corroborates the aforementioned argument that credentials, rather than cognitive skills as such, operate as the key determinant of socio-economic success.

Herein, cross-level interactions between lower/higher-level tertiary expansion and lower/higher-level degrees with/without high skills indicate a more nuanced

Table 3. Multilevel regression of ISEI

Predictor variable		Model 1		Model 2	
		B	S.E.	*B*	S.E.
Intercept		3.463***	0.010	3.371***	0.061
Level 1 (individual)	Men (dummy)	−0.013***	0.002	−0.011***	0.002
	25–34 years old	0.045***	0.004	0.043***	0.004
	35–44 years old	0.032***	0.003	0.031***	0.003
	First-generation immigrant	−0.074***	0.003	−0.071***	0.003
	Cultural capital (composite of parental education and books)	0.020***	0.000	0.019***	0.000
	Years of paid work	0.005***	0.000	0.005***	0.000
	High skills without tertiary degree	0.173***	0.007	0.311***	0.050
	Tertiary degree without high skills	0.340***	0.002	0.523***	0.033
	Tertiary degree with high skills	0.430***	0.004	0.553***	0.035
Cross-level interactions	Educational expansion				
	× High skills without tertiary degree			−0.004**	0.001
	× Tertiary degree without high skills			−0.005***	0.001
	× Tertiary degree with high skills			−0.003**	0.001
	Difference in educational expansion				
	× High skills without tertiary degree			0.000	0.001
	× Tertiary degree without high skills			0.000	0.001
	× Tertiary degree with high skills			−0.001	0.001
Level 2 (country)	Educational expansion			0.002	0.002
	Difference in educational expansion			−0.002	0.001
	Index of tracking			0.008	0.013
	GDP per capita (USD, PPP)/10,000			0.016	0.014
	Union density			0.000	0.001
Variance (random effect)	Covariance structure (intercept)	0.002**		0.001	
	High skills without tertiary degree			0.001	
	Tertiary degree without high skills			0.001**	
	Tertiary degree with high skills			0.001*	
Model fit	−2LL	145,621.936		144,885.348	
	AIC	145,625.936		144,895.348	

		Model 3		Model 4	
Intercept		3.353***	0.079	3.401***	0.054
Level 1 (individual)	Men (dummy)	−0.014***	0.002	−0.014***	0.002
	25–34 years old	0.052***	0.004	0.052***	0.004
	35–44 years old	0.036***	0.003	0.036***	0.003
	First-generation immigrant	−0.081***	0.003	−0.081***	0.003
	Cultural capital (composite of parental education and books)	0.015***	0.000	0.015***	0.000
	Years of paid pork	0.006***	0.000	0.006***	0.000
	High skills without tertiary degree	0.246***	0.053	0.250***	0.052
	Lower-level degree without high skills	0.389***	0.055	0.391***	0.055
	Lower-level degree with high skills	0.306***	0.054	0.305***	0.054
	Higher-level degree without high skills	0.577***	0.048	0.576***	0.048
	Higher-level degree with high skills	0.572***	0.046	0.573***	0.046
Cross-level interactions	Lower-level tertiary expansion				
	× High skills without tertiary degree	−0.006**	0.002	−0.006**	0.002
	× Lower-level degree without high skills	−0.005*	0.002	−0.005*	0.002
	× Lower-level degree with high skills	−0.005**	0.002	−0.005**	0.002
	× Higher-level degree without high skills	−0.003	0.002	−0.003	0.002

(continued)

Table 3. (Continued)

		Model 3		Model 4	
	× Higher-level degree with high skills	−0.002	0.002	−0.002	0.002
	Higher-level tertiary expansion				
	× High skills without tertiary degree	−0.001	0.002	−0.001	0.002
	× Lower-level degree without high skills	−0.005*	0.002	−0.005*	0.002
	× Lower-level degree with high skills	0.003	0.002	0.003	0.002
	× Higher-level degree without high skills	−0.005*	0.002	−0.005*	0.002
	× Higher-level degree with high skills	−0.004	0.002	−0.004	0.002
	Difference in lower-level tertiary expansion				
	× High skills without tertiary degree	−0.002	0.002	−0.002	0.002
	× Lower-level degree without high skills	0.002	0.002	0.002	0.002
	× Lower-level degree with high skills	0.002	0.002	0.002	0.002
	× Higher-level degree without high skills	0.000	0.002	0.000	0.002
	× Higher-level degree with high skills	−0.001	0.002	−0.001	0.002
	Difference in higher-level tertiary expansion				
	× High skills without tertiary degree	0.002	0.002	0.002	0.002
	× Lower-level degree without high skills	0.000	0.002	0.000	0.002
	× Lower-level degree with high skills	−0.003	0.002	−0.003	0.002
	× Higher-level degree without high skills	−0.001	0.002	−0.001	0.002
	× Higher-level degree with high skills	0.000	0.002	0.000	0.002
Level two (country)	Lower-level tertiary expansion	0.002	0.003	0.002	0.002
	Higher-level tertiary expansion	0.003	0.003	0.003	0.002
	Difference in lower-level tertiary expansion	−0.002	0.002	−0.003	0.002
	Difference in higher-level tertiary expansion	−0.002	0.002	−0.002	0.002
	Index of tracking	0.011	0.017		
	GDP per capita (USD, PPP)/10,000	0.012	0.017		
	Union density	0.000	0.001		
Variance (random effect)	Covariance structure (intercept)	0.000		0.000	
	High skills without tertiary degree	0.001		0.001	
	Lower-level degree without high skills	0.002*		0.002*	
	Lower-level degree with high skills	0.000		0.000	
	Higher-level degree without high skills	0.002**		0.002**	
	Higher-level degree with high skills	0.001*		0.001*	
Model fit	−2LL	142,076.549		142,052.229	
	AIC	142,090.550		142,066.230	

***$P < 0.001$,

**$P < 0.01$,

*$P < 0.05$ (two tailed).

N: individual = 91,217, country = 26.

Notes: Data are weighted using the full sample weight. 'Tertiary degree' and 'Educational expansion' include both higher- and lower-levels at the individual and societal levels, respectively. The outcome variable is the logarithm of ISEI.

structure of economic returns to various credential/skill combinations. Firstly, interaction terms between the extent of lower-level tertiary expansion (i.e. the percentage of the population with short-cycle tertiary degrees) and individuals' lower-level degrees (both with and without high skills) as well as high skills unaccompanied by degrees show negative signs, and they are statistically significant (i.e. $\gamma_{71} = -0.006$, $\gamma_{81} = -0.005$, and $\gamma_{91} = -0.005$). Meanwhile, interactions incorporating individuals' higher-level degrees do not indicate any substantial signs. That is, as stated in *H2*, lower-level degrees are likely to be devalued and individuals who possess merely high skills without tertiary degrees are penalized in societies where the share of lower-level degree holders is relatively large. In contrast, higher-level degrees are not necessarily depreciated. Nonetheless, as confirmed in Model 2 and contrary to our hypothesis, the devaluation of lower-level degrees is not cancelled out even when they are accompanied by high skills. One may argue that this result supports the soundness of conventional

framework of credential inflation, which puts emphasis on the excessive supply of human resources with higher levels of education as compared to the labour demand, rather than paying attention to the variance in skills levels among educated personnel.

However, secondly, the interactions between the extent of higher-level tertiary expansion (i.e. the share of tertiary graduates with bachelor degrees and above) and credential/skill combinations demonstrate an interesting contrast to the ones involving lower-level tertiary expansion. In terms of individuals' higher-level degrees, their depreciation is confirmed only when they are unaccompanied by high skills, whereas those with high skills are not significantly devalued despite the negative coefficient of the interaction term with the extent of higher-level tertiary expansion (i.e. $\gamma_{102} = -0.005$ and $\gamma_{112} = -0.004$, but only γ_{102} is statistically significant at the 0.5 per cent level). Meanwhile, the economic return to lower-level degrees in the form of ISEI also becomes small in societies where the percentage of the population with higher-level degrees is relatively high (i.e. the larger extent of higher-level tertiary expansion), but this is the case only when lower-level degrees are unaccompanied by high skills (i.e. $\gamma_{82} = -0.005$ and $\gamma_{92} = 0.003$, and γ_{82} is statistically significant at the 0.5 per cent level). Furthermore, the interaction between the extent of higher-level tertiary expansion and individuals' high skills without degrees does not indicate a substantial negative sign (i.e. $\gamma_{72} = -0.001$ but this is statistically insignificant). These results suggest that the larger share of higher-level tertiary graduates in a society is associated with the devaluation of individuals' degrees unaccompanied by high skills, regardless of the nominal level of credentials. Put differently, so long as individuals possess high skills, they are not explicitly penalized in the labour market even when lacking tertiary degrees. This finding is also supported by an additional robustness check using the continuous skills measure instead of credential/skill combinations (see Supplementary Appendix).

The same structure is confirmed in Model 4 that omits several country-level variables unused for cross-level interactions. *H3* is therefore supported as far as the depreciation of lower-/higher-level degrees without high skills is concerned. In addition, higher-level degrees with high skills retain their returns as stated in *H3*, but we also find that individuals who possess high skills with lower-level degrees or below are not penalized either. This is a distinct social phenomenon, which is apparently different from the one observed in relation to lower-level tertiary expansion. We discuss the potential mechanisms behind these results and implications in the next section.

Discussion and Conclusion

This article has re-examined the devaluation of degrees, a phenomenon long conceptualized as credential inflation by social scientists. Previous research has elucidated the variance in economic returns to different types of credentials when considering the influence of educational expansion, primarily from the demand side perspective: credential inflation occurs when growth in access to higher levels of education outpaces an increase in labour market opportunities that genuinely require higher educational attainment. However, that body of research has inadequately incorporated the supply side issue: the depreciation of degrees may occur due to the lowered quality (i.e. skills levels) of highly educated people. Consequently, while the dispersion in economic returns to degrees has been explained with attention to the influence of socio-economic statuses of degree holders as well as types of credentials, the internal factor (i.e. whether they are accompanied by high skills) has been insufficiently investigated. Even among several pioneering studies that did incorporate the distinction between educational attainment and skills, these still largely overlook the distinctive roles of different levels of tertiary education, resulting in the inadequate explanation of the diminishing value of degrees.

To address this gap, we analyse the structure of devaluation of tertiary degrees associated with educational expansion with a focus on (i) the heterogeneity across credential/skill combinations and (ii) the distinction between lower-level (ISCED 2011 Level 5) and higher-level (ISCED 2011 Level 6 and above) degrees at both the individual and societal levels. Multilevel linear regression analyses, using PIAAC data for 91,217 individuals in 26 countries, reveal that tertiary degrees and high skills generally contribute to obtaining higher ISEI even after adjusting for other individual-level and country-level predictors. In particular, regardless of skills level, those with higher-level degrees are more likely than others to enjoy economic returns, followed by lower-level degree holders and then highly skilled people without tertiary degrees. This result corroborates recent arguments that educational credentials rather than cognitive skills play the more significant role in the distribution of labour market outcomes (e.g. Araki, 2020).

However, we may add nuance to the recognition that tertiary degrees are devalued in association with the larger extent of educational expansion. First, the economic return to lower-level degrees becomes smaller in

countries where the share of tertiary graduates with lower-level degrees is relatively large and hence such degrees are not scarce. This devaluation is confirmed even when lower-level degrees are accompanied by high skills. Furthermore, high skills unaccompanied by tertiary degrees are also depreciated. These results suggest that, due to the lower-level tertiary expansion, (i) credential inflation is at work in a way that devalues lower-level degrees whose supply exceeds labour demand; and (ii) social closure is intensified such that individuals who do not possess tertiary degrees are penalized (in addition to their originally smaller premium as compared to credential holders). This phenomenon does corroborate the conventional notion of credential inflation.

Second, in contrast, individuals' higher-level degrees are devalued along with the larger extent of higher-level tertiary expansion (i.e. the higher percentage of the population with higher-level degrees in a society) only when such degrees are unaccompanied by high skills (i.e. nominal degrees). That is, so long as individuals possess both higher-level degrees and high skills, they are not penalized by the diminishing scarcity of their credentials. At the same time, the economic return to lower-level degrees without high skills also declines due to higher-level tertiary expansion, but this devaluation is not confirmed for lower-level degrees accompanied by high skills. Moreover, highly skilled people without tertiary degrees are not penalized in societies where the proportion of tertiary graduates with higher-level degrees is relatively large. Here, the results are not interpretable based on the traditional concept of credential inflation, according to which higher-level degrees should be devalued even though they are accompanied by high skills. Likewise, from the perspective of closure theory, one would expect the depreciation of lower-level degrees and non-tertiary graduates despite their high skills. Yet, our analysis does not confirm this. Instead, we find nominal degree holders who do not possess high skills are significantly penalized by the larger extent of higher-level tertiary expansion. In the sense that credentials as such lose their economic values only when they are unaccompanied by actual skills and hence the role of skills rather than nominal degrees is relatively enhanced in reward allocation, one may call this phenomenon 'decredentialization'. This is a distinct dimension of devaluation of degrees, which cannot be explained by the traditional notion of credential inflation that anticipates the declining returns to credentials regardless of their skills level. We therefore argue 'decredentialization' is detectable only by distinguishing (i) nominal degrees from the ones with high skills; and (ii) lower-level versus higher-level tertiary expansion.

Table 4. Multiple regression (OLS) of the percentage of highly skilled people

	B	S.E.	β
Constant	0.769	3.330	–
Lower-level tertiary expansion	0.198	0.143	0.246
Higher-level tertiary expansion	0.370*	0.146	0.448
Adjusted R^2	0.250		

$^{***}P < 0.001$,
$^{**}P < 0.01$,
$^{*}P < 0.05$ [two tailed] [$N = 26$].

Notes: Data are unweighted. This table is the result of a multiple regression of the percentage of population with high skills among adults aged 25–65 years, using country-level data. Predictor variables are two measures: the percentage of those with higher-level tertiary degrees and that with lower-level tertiary degrees.

To sum up, two types of educational expansion, one at lower-level and the other at higher-level, lead to two distinguishable social phenomena: credential inflation and 'decredentialization'. As to the mechanism behind these relationships, one may provisionally hypothesize that lower-level and higher-level tertiary expansions distinctively affect the sensitivity to high skills in the labour market, resulting in different types of devaluation of degrees. Specifically, as indicated in Table 4, the share of higher-level tertiary graduates in a society is significantly correlated with that of the population with high skills, while the proportion of lower-level tertiary graduates does not show a significant link with the accumulation of high skills.[5] Therefore, in a society where the extent of higher-level tertiary expansion is large, the percentage of highly skilled people among the population is more likely to be high, and hence employers become more sensitive to the distinction between nominal degrees and degrees with high skills. As a result, 'decredentialization' operates in a way that penalizes tertiary graduates without high skills whilst maintaining rewards for highly skilled people regardless of educational credentials. This also suggests, unlike credentials that lose economic value due to their diminishing scarcity, high skills retain their rewards even though their rarity deteriorates. This interpretation is aligned with the discussion by Araki (2020), which argues credentials possess relative values, whereas high skills operate as absolute assets.[6]

Meanwhile, Table 4 suggests the extent of lower-level tertiary expansion is not explicitly associated with the accumulation of highly skilled people (at least in terms of general information-processing skills as measured by PIAAC). In this case, sensitivity to high skills remains relatively low amongst employers, and hence

the value of nominal degrees may persist. Consequently, in a society saturated with lower-level degree holders, higher-level degrees are not devalued even though they are unaccompanied by high skills. Put differently, credentialism is at work in this type of society.

The aforementioned hypothetical argument further underscores the significance of the concept of 'decredentialization'. 'Decredentialization', which emerges in conjunction with higher-level tertiary expansion, seemingly suits a functionalist argument that highly skilled people make good match with preferable economic rewards. However, it is important to note that this matching through the devaluation of nominal degrees (i.e. decredentialization) is not a monotonous process but a theoretically rich phenomenon. This is because, while in our analysis lower- and higher-level tertiary expansions are independently dealt with, there are—in reality—more complex combinations among them. For example, lower-level tertiary expansion may be dominant in some societies, whereas higher-level tertiary education may prevail in other societies. Depending on this composite of lower- and higher-level tertiary expansions, either intensified credentialism (i.e. anti-functionalist phenomena), nullified credentialism (i.e. pro-functionalist phenomena), or their mixture may emerge. In this regard, what we call 'decredentialization' becomes of key theoretical importance as it distinguishes these phenomena conceptually and empirically. Put differently, answering questions about to what extent and how each society has promoted/undermined 'decredentialization' would promote our understanding of the mechanism of devaluation of degrees and much broader societal structures, which would be otherwise undetectable only through the conventional concept of credential inflation.

To further clarify how and why these heterogeneous phenomena operate, additional empirical analyses and theoretical sophistication are required. First, while we incorporate 26 countries in multilevel regressions with country-level indicators as controls, one may assume there is a variation in the association between degrees and economic rewards across societies, and importantly, such structures may change over time (Di Stasio, 2017). Thus, in addition to a cross-country approach demonstrated here, country-specific analyses using longitudinal data are essential to obtain further insights. Second, given that returns to credentials vary depending on fields of study and selectivity of education institutions (Bills, 2016; Ortiz and Rodriguez-Menés, 2016; Posselt and Grodsky, 2017), educational variables should be further detailed. Likewise, while general information-processing competences are herein used to quantify skills, their scope should be extended to non-cognitive and occupation-specific skills as the key to economic outcomes (Heckman *et al.*, 2010; Kautz *et al.*, 2014; OECD, 2015). Third, in scrutinizing the values of education with/without skills, outcome measures can also be stretched to non-economic ones (e.g. health and subjective well-being) and even societal-level consequences such as economic growth and social cohesion (Araki, 2021; Rappleye and Komatsu, 2021; Schofer, Ramirez and Meyer, 2021).Finally, heterogeneity across individual social backgrounds is another important question. Although key individual-level measures are controlled for in our analysis, this does not provide adequate evidence concerning how returns to different types of degrees vary in accordance with social backgrounds. This investigation would lead to further elucidation of questions surrounding social mobility and inequality.

Despite the said room for further elaboration, the contribution of this paper is significant as the empirical analysis focused on the devaluation of degrees with/without high skills and on the difference between higher-level and lower-level tertiary education at both the individual and societal levels. We argue that these findings in conjunction with the accompanying theoretical discussions would pave the way for a better understanding of credentialism and much broader social mechanisms of reward allocation.

Notes

1 Literacy and numeracy are combined in accordance with Araki (2020). Also, it is important to note the analysis results are robust even when 10 PVs are incorporated instead of using the first PV only.

2 Another potential operationalization is to use the mean score of literacy and numeracy as the continuous measure, instead of dichotomizing it to create categorical variables (i.e. the combination of credentials and skills). However, this strategy does not necessarily provide clear evidence to test the aforementioned hypotheses focused on the heterogeneous mechanisms of *devaluation* of degrees when comparing them with and without *high* skills in relation to societal-level educational conditions (i.e. the primary focus of this research is not to mathematically calculate the returns to degrees/skills and their interactions at the individual level). Nevertheless, an analysis with the continuous skills measure can be used as a robustness check, albeit partially. We thus show the model incorporating the mean score of literacy and numeracy, lower-level tertiary degrees, and higher-level tertiary degrees in Supplementary

Appendix for reference. Note that the results support the main arguments that follow.

3 Mother's education and father's education are quantified by a tertiary education dummy (tertiary education = 1), respectively, while the number of books at home is based on six categories (10 or less = 1, 11–25 = 2, 26–100 = 3, 101–200 = 4, 201–500 = 5, more than 500 = 6), which are used as continuous variables.

4 The significance of the difference in effect size is tested by replacing the reference (i.e. possessing neither a tertiary degree nor high skills) with other credential/skill combinations, using the conventional 5 per cent level. Hereafter, the difference is examined via the same approach.

5 In Table 4, a multiple regression analysis is conducted, using country-level data on the percentage of individuals with high skills (as the outcome), that with lower-level and higher-level tertiary degrees, respectively (as predictors). The result shows the share of higher-level tertiary graduates is significantly associated with the outcome.

6 With regard to the logic behind the positive association between ISEI and high skills measured by the level of information-processing competencies, there are two theoretical explanations. On the one hand, from the perspective of human capital theory, high skills *per se* are required for prestigious jobs, and hence employers favour highly skilled people who can work productively by directly using such skills. On the other, based on signalling and labour queue theory, information-processing skills may function as signals of high productivity/trainability, which is appreciated by the labour market. Should this be the case, by incorporating the consequence of lower-level and higher-level tertiary expansion, we may also conceptualize the multi-stage signalling. In societies with the larger proportion of lower-level degree holders, nominal levels of credentials operate as signals of high productivity and consequently individuals' lower-level degrees are devalued (first-stage signalling). Meanwhile, as higher-level tertiary education expands, the signalling value of nominal degrees deteriorates as part of 'decredentialization' and subsequently information-processing skills start to function as signals (second-stage signalling).

Supplementary Data

Supplementary data are available at *ESR* online.

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References

Araki, S. (2020). Educational expansion, skills diffusion, and the economic value of credentials and skills. *American Sociological Review*, **85**, 128–175.

Araki, S. (2021). Does education make people happy? Spotlighting the overlooked societal condition. *Journal of Happiness Studies* (Online First). DOI: 10.1007/s10902-021-00416-y

Becker, G. S. (1964). *Human Capital: A Theoretical and Empirical Analysis with Special Reference to Education*. New York: National Bureau of Economic Research.

Bills, D. B. (2016). Congested credentials: the material and positional economies of schooling. *Research in Social Stratification and Mobility*, **43**, 65–70.

Bills, D. B. and Brown, D. K. (2011). New directions in educational credentialism. *Research in Social Stratification and Mobility*, **29**, 1–4.

Bol, T. *et al.* (2019). School-to-work linkages, educational mismatches, and labor market outcomes. *American Sociological Review*, **84**, 275–307.

Bol, T. and Weeden, K. A. (2015). Occupational closure and wage inequality in Germany and the United Kingdom. *European Sociological Review*, **31**, 354–369.

Bol, T. and van de Werfhorst, H. G. (2013). Educational systems and the trade-off between labor market allocation and equality of educational opportunity. *Comparative Education Review*, **57**, 285–308.

Brown, D. K. (2001). The social sources of educational credentialism: status cultures, labor markets, and organizations. *Sociology of Education*, **74**, 19–34.

Brown, P. (2003). The opportunity trap: education and employment in a global economy. *European Educational Research Journal*, **2**, 141–179.

Brown, P. (2013). Education, opportunity and the prospects for social mobility. *British Journal of Sociology of Education*, **34**, 678–700.

Collins, R. (1979). *The Credential Society: An Historical Sociology of Education and Stratification*. New York: Academic Press.

Collins, R. (2011). Credential inflation and the future of universities. *Italian Journal of Sociology of Education*, **3**, 228–251.

Di Stasio, V. (2017). Who is ahead in the labor queue? Institutions' and employers' perspective on overeducation, undereducation, and horizontal mismatches. *Sociology of Education*, **90**, 109–126.

Di Stasio, V., Bol, T. and van de Werfhorst, H. G. (2016). What makes education positional? Institutions, overeducation and the competition for jobs. *Research in Social Stratification and Mobility*, **43**, 53–63.

DiPrete, T. A. *et al.* (2017). School-to-work linkages in the United States, Germany, and France. *American Journal of Sociology*, **122**, 1869–1938.

Doren, C. and Grodsky, E. (2016). What skills can buy: transmission of advantage through cognitive and noncognitive skills. *Sociology of Education*, **89**, 321–342.

Flisi, S. *et al.* (2017). Measuring occupational mismatch: over-education and overskill in Europe—evidence from PIAAC. *Social Indicators Research*, **131**, 1211–1249.

Ganzeboom H. B. G. 2010. International standard classification of occupation: ISCO-08 with ISEI-08 scores, available from: http://www.harryganzeboom.nl/isco08/isco08_with_isei.pdf, [accessed 1 December 2018].

Gesthuizen, M., Solga, H. and Kunster, R. (2011). Context matters: economic marginalization of low-educated workers in cross-national perspective. *European Sociological Review*, **27**, 264–280.

Hanushek, E. A. *et al.* (2015). Returns to skills around the world: evidence from PIAAC. *European Economic Review*, **73**, 103–130.

Hanushek, E. A. and Woessmann, L. 2015. *The Knowledge Capital of Nations: Education and the Economics of Growth*. Cambridge, MA: The MIT Press.

Heckman, J. J. *et al.* (2010). The rate of return to the high/scope perry preschool program. *Journal of Public Economics*, **94**, 114–128.

Heisig, J. P., Elbers, B. and Solga, H. (2020). Cross-national differences in social background effects on educational attainment and achievement: absolute vs. relative inequalities and the role of education systems. *Compare*, **50**, 165–184.

Heisig, J. P. and Schaeffer, M. (2019). Why you should always include a random slope for the lower-level variable involved in a cross-level interaction. *European Sociological Review*, **35**, 258–279.

Horowitz, J. (2018). Relative education and the advantage of a college degree. *American Sociological Review*, **83**, 771–801.

Kariya, T. 2011. Credential inflation and employment in 'Universal' higher education: enrolment, expansion and (in)-equity via privatisation in Japan. *Journal of Education and Work* **24**(1–2):69–94.

Kautz, T. *et al.* (2014). Fostering and Measuring Skills: Improving Cognitive and Non-Cognitive Skills to Promote Lifetime Success. OECD Education Working Papers, No. 110. Paris: OECD Publishing.

Kerckhoff, A. C., Raudenbush, S. W. and Glennie, E. (2001). Education, cognitive skill, and labor force outcomes. *Sociology of Education*, **74**, 1–24.

Levels, M., van der Velden, R. and Di Stasio, V. (2014). From school to fitting work: how education-to-job matching of European school leavers is related to educational system characteristics. *Acta Sociologica*, **57**, 341–361.

Mincer, J. (1958). Investment in human capital and personal income distribution. *Journal of Political Economy*, **66**, 281–302.

Mincer, J. 1974. *Schooling, Experience, and Earnings*. New York: National Bureau of Economic Research.

Murphy, R. 1988. *Social Closure: The Theory of Monopolization and Exclusion*. Oxford: Clarendon.

Nieto, S. and Ramos, R. (2017). Overeducation, skills and wage penalty: evidence for Spain using PIAAC data. *Social Indicators Research*, **134**, 219–236.

OECD. (2015). *Skills for social progress: the power of social and emotional skills*. In *OECD Skills Studies*. Paris: OECD Publishing. DOI: 10.1787/9789264226159-en.

OECD. (2016). *Skills Matter: Further Results from the Survey of Adult Skills*. Paris: OECD Publishing.

OECD. (2019). *The Survey of Adult Skills: Reader's Companion*. 3rd edn. Paris: OECD Publishing.

OECD. (2020). *Education at a Glance 2020: OECD Indicators*. Paris: OECD Publishing.

Ortiz, L. and Rodriguez-Menés, J. (2016). The positional value of education and its effect on general and technical fields of education: educational expansion and occupational returns to education in Spain. *European Sociological Review*, **32**, 216–237.

Posselt, J. R. and Grodsky, E. (2017). Graduate education and social stratification. *Annual Review of Sociology*, **43**, 353–378.

Rappleye, J. and Komatsu, H. (2021). Is knowledge capital theory degenerate? PIAAC, PISA, and economic growth. *Compare*, **51**, 240–258.

Rivera, L. A. (2011). Ivies, extracurriculars, and exclusion: elite employers' use of educational credentials. *Research in Social Stratification and Mobility*, **29**, 71–90.

Schofer, E., Ramirez, F. O. and Meyer, J. W. (2021). The societal consequences of higher education. *Sociology of Education*, **94**, 1–19.

Schultz, T. W. (1961). Investment in human capital. *American Economic Review*, **51**, 1–17.

Smyth, E. and McCoy, S. (2011). The dynamics of credentialism: Ireland from bust to boom (and back again). *Research in Social Stratification and Mobility*, **29**, 91–106.

Spence, M. (1973). Job market signaling. *The Quarterly Journal of Economics*, **87**, 355–374.

Tholen, G. (2017). Symbolic closure: towards a renewed sociological perspective on the relationship between higher education, credentials and the graduate labour market. *Sociology*, **51**, 1067–1083.

Thurow, L. C. 1975. *Generating Inequality*. New York: Basic Books.

Van de Werfhorst, H. G. (2009). Credential inflation and educational strategies: a comparison of the United States and the Netherlands. *Research in Social Stratification and Mobility*, **27**, 269–284.

Verhaest, D. and Van Der Velden, R. (2013). Cross-country differences in graduate overeducation. *European Sociological Review*, **29**, 642–653.

Weeden, K. A. (2002). Why do some occupations pay more than others? Social closure and earnings inequality in the United States. *American Journal of Sociology*, **108**, 55–101.ss

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