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Just Another level? Comparing Quantitative Patterns of Global School and Higher Education Expansion

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Abstract

The expansion of enrolment and attainment is a key theme in higher education research. In particular, research has examined cross-national determinants of higher education expansion while understanding expansion through the relationship between higher education and the labour market. Early work on higher education expansion established a key framework for classifying enrolment levels, but empirical studies on the global expansion of higher education are scarce. This study addresses this gap by comparing the existing patterns of higher education expansion to those experienced at other levels on the course to universal or near-universal access. We demonstrate that a model fitting universal access trajectories fits higher education as well as other levels of education, and, therefore, there is no prima facie reason to believe that its expansion will face ceilings or saturation levels based upon available evidence. Claims that are premised on such a ceiling should therefore consider empirical evidence for this assumption in their analysis. These findings contribute to discussions on higher education expansion as well as studies of higher education and the labour market.

Keywords

Higher education, post-secondary education, expansion, attainment, universalisation, labour market.

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1. Introduction

Formal institutions of education and learning are a defining feature of contemporary societies. Over a period not exceeding two centuries, most nation-states have witnessed rapid expansion of educational institutions and have accepted high enrolment levels as a normative standard. Most research on the expansion of education has focussed on primary and basic education through schooling. Spurred by global policy initiatives and civil society organizations, these studies have both examined determinants of enrolment within a national development framework as well as theorizing the accompanying social change (Hannum and Buchmann 2005; Levinson and Holland 1996; Boli, Ramirez, and Meyer 1985; Meyer, Ramirez, and Soysal 1992). Higher education literature has also devoted considerable attention to the expansion of enrolments (Trow 1973; Schofer and Meyer 2005), although generally without the attendant predisposition to universal enrolment as a normative goal. Indeed, a significant concern in research is whether enrolment may reach levels that are undesirable (i.e., over-qualification).

This paper utilizes large-scale, cross-national demographic data to analyse the trajectories of higher education expansion worldwide, understood to encompass both tertiary and non-tertiary post-secondary education. We argue that much research and policy has implicitly assumed that the trajectories of participation in higher education are fundamentally different from other levels of education, particularly with respect to ultimate ceilings on participation. Our analysis therefore compares the functional form of higher education expansion in enrolments across nations to those observed in the expansion of primary and basic education through to universal access. The general question is not whether higher education is different from lower levels of schooling, which it certainly is, but whether it follows a similar pattern of expansion. This inquiry entails the more specific question of whether the expansion of post-secondary and tertiary attainment is on a path towards universal participation—following the example of primary and secondary education, or on the contrary is showing signs of coming up against a 'ceiling' at some significantly lower level.

Our findings indicate that the expansion of higher education has in fact followed a quantitative pattern that is remarkably similar to those of lower levels of schooling. In particular, we find that a model using the same functional form fits the average expansion patterns at all levels equally well, the variation of individual countries around their average trend is similar as is the amount of variation between countries. The main difference between the levels of education is that the mean rate of expansion is slower at the higher education level. These findings are discussed in relation to their practical and theoretical significance.

The remainder of this article is structured as follows. In Section 2, we review both theoretical arguments about why one or the other should be expected *a priori*, and the limited attempts to date to examine these questions empirically. Section 3 describes the statistical model on which the analysis is based, as well as the data on which the results are estimated. The results are presented in Section 4, and their implications discussed in Section 5.

2. Literature Review

While absolute limits to expansion are seldom discussed directly in higher education literature, much research has approached the topic indirectly, either by debating whether such limits have already been reached (i.e. over-qualification) or through theorization of higher education expansion. We begin by discussing higher education expansion as it has been directly addressed in existing research literature and policy. We then analyse extant literature from two broad theoretical perspectives in order to generate expectations for long-term trends in higher education enrolment. The first—political economy perspectives—focuses on the education in the context of skills supply and labour market demand against the backdrop of a given policy and regulatory framework, with strong adherents highlighting 'the remarkable explanatory power of this simple supply-demand framework' (Autor 2014, 847) to explain changes in both incomes and higher education enrolments. The second—institutional perspectives—stresses the importance of shared rationalizations and social models in shaping behaviours, rather than functional concerns of the labour market. Each body of literature provides a unique set of concepts and insights, but ultimately both provide heterogeneous and nuanced expectations about the long-term trends in higher education.

2.1. Higher Education Expansion

Trow's (1973) seminal study of higher education provides a framework for considering the expansion of higher education systems from elite (less than 15% enrolment) to mass (16 to 50%) to universal access (greater than 50%United Nations 2000; UIS of higher education establishes some expectation that in the long-run, the expansion of higher education is likely to differ from other levels of education. However, Trow (1973, 7) also notes the tendency towards a broader normalization of higher education attainment, stating: 'when the proportion of the whole population comes to be about 50%, and in certain sectors of the society it is then of course much higher, attendance in higher education is increasingly seen as an obligation'. Trow's typology therefore leaves open the possibility for higher levels of enrolment, although establishing 50% as sufficiently 'universal'. Indeed, it is presumably with such a criterion in mind when Thomas and Hovdhaugen (2014, 6), for instance, assert that 'England and Norway are approaching "universal" levels of participation' in higher education.

Upper plausible limits to higher education attainment are also established in national and international policy documents. For example, the European Union has established a target attainment of 40% (European Commission 2010, 7), with many national targets ranging from 20 to 60 per cent (Blair 1999; Bradley et al. 2008; Government of China 2010; Obama 2009). Similarly, international declarations on higher education have not put forward access goals in the same terms as used in basic education (i.e. the targets of universal access in Education For All). Instead, they have prioritized equitable allocation of the existing enrolment capacity. Among international organisations, the OECD appears to be the most bullish, with Andreas Schleicher arguing 'We are moving to a world where tertiary education is where secondary education was 100 years ago' (quoted in Sharma (2015). While the preceding statement may be interpreted as strictly descriptive, the OECD's treatment of intergenerational educational mobility carries more normative overtones, since only continued expansion can reduce 'downward mobility' at the same time as reducing the dependence of children's education on that of their parents, both of which are presented as undesirable (OECD 2015).

The fact that in many policy documents the reasoning behind assuming either a desirable or feasible limit to higher education expansion is typically implicit, suggests that the reasons are seen as obvious. Indeed, it is easy to see some 'commonsensical' arguments from a policy perspective, such as the fact that higher education participation typically occurs beyond the age of legal majority, and there is therefore no prospect of it becoming compulsory eventually.

In summary, both foundational research on higher education expansion and policy are somewhat ambiguous on limits to expansion; both tend to establish realistic near-term limits (i.e., 20–60%) while the possibilities for long-term expansion are left open.

2.2. Political Economy Perspectives

A large body of literature and considerable debate have centred on the relationship between education and the labour market, examining the extent to which the supply of graduates (i.e. accumulated higher education completion) is well matched to the demand for skills. Early work on human capital theory (Becker 1964; Mincer 1958) established economic returns to education, providing a rationale for both individual and national investment in higher education. More recently, research has focussed on 'the skills premium' (Autor 2014), usually operationalized as the average increase in earnings for university graduates versus non-graduates.

The literature on 'over-education' or 'over-qualification' examines limits to higher education expansion by seeking to establish the extent to which university graduates take jobs that do not require a degree. This inquiry is empirically challenging, as it requires measurement through catalogues of job skill requirements (which lack detail and quickly become outdated), comparisons of the education of comparable jobholders, or self-assessment of skill requirements. For example, Mendes de Oliveira, Santos, and Kiker (2000) note that conventional statistical definitions of 'over-education' may be biased upwards if tertiary

degrees are required of new recruits even if a majority of existing job-holders lack them. Perhaps because of the challenges operationalizing overeducation, evidence from the literature is ambiguous, with one meta-analysis concluding 'the impacts of overeducation are likely to be non-trivial' (McGuinness 2006, 387). Most of the literature notes that findings vary across national contexts (Barone and Ortiz 2011; Reisel 2013) and increasing variability in the premium (Green and Zhu 2010; Figueiredo, Teixeira, and Rubery 2013). Brown, Lauder, and Ashton (2012) further argue that employers' ability to source skilled labour from low-income countries is leading to a long-term deterioration of the skills premium in high-income countries, as low-income, high-skills are able to undercut the cost of skills in high-income countries.

An embedded assumption in the 'over-education' literature is that there exists some limit to the demand for skilled labour and hence the desirable level of higher education attainment. However, perspectives such as endogenous growth theory and skill-biased technical change emphasise the elasticity of the demand for skilled labour, arguing that expanding higher education promises considerable potential for supporting economic growth even while lower levels of schooling are far from universal (Bloom et al. 2014), and that higher levels of human capital can increase demand for skilled labour (Lucas 1988; Barro and Sala-i-Martin 2004). A similar view is held by proponents of skill biased technical change, who argue that changes in technology tend to favour skilled over unskilled labour in the job market (David, Katz, and Krueger 1998). Thus, higher levels of technology will lead to a higher demand for skilled labour and increase the incentive for individuals to complete higher education. Supporting this position, Autor (2014) and Autor, Katz, and Kearney (2008) argue that advanced economies provide a healthy and growing skills premium on advanced labour, arguing that much of the secular increase in economic inequality observed by Piketty and Saez (2014) and others is actually attributable to the increasing skills premium. Given evidence of this increasing premium, the authors would expect higher education attainment to increase to meet the labour-market demand. In any case, even if the higher education sector is conceived of as a market responsive to price signals in principle, its limited transparency and information asymmetries (Weisbrod, Ballou, and Asch 2008) imply that the sector may face 'difficulties in correcting supply and demand mismatches' (Figueiredo et al. 2015, 3), resulting in a production of graduates over and beyond the needs of the labour market. Indeed, expansion of higher education does not even rely on the political will to fund it; strikingly, higher education enrolment rates are unrelated, or even negatively associated with the share of the education budget for higher education (Mimoun 2008; Bergh and Fink 2008).

In contrast to human capital theory, the credentialing perspective inverts the relationship between higher education and the labour market, claiming that the expansion of higher education enrolment is driven by supply rather than demand. Rather than meeting an unfulfilled demand for skilled labour, higher education is used to exclude individuals from occupations and perpetuate class advantage (Brown 1995; Collins 1979). The result is credential inflation, a 'cycle of rising educational attainment and rising occupational requirements' that threatens to continue 'until janitors need Ph.D.s' (Collins 2002, 25–29). However, Collins predicts an 'adjustment' of the labour market, noting historical declines in

school enrolments in Spain, Germany and France (Collins 2002, 30). To the extent that education is used to differentiate individuals, the credentialist theory expects some variation in attainment and therefore some limits to the expansion of higher education. However, rather than building up a pressure that is eventually released in a downward adjustment, credential inflation may on the contrary involve a 'point of no return' on the way to universalisation. Green (1980) offers a general argument for why education as a *system* is biased towards long-term expansion, but in addition notes that once a given credential becomes sufficiently common, it ceases to command a premium, but its absence begins to incur a penalty, as it becomes associated with the 'stigmatization of negative selection' (Solga 2002). Higher social classes maintain their distinction by advancing further up the education ladder (Raftery and Hout 1993; Lucas, Samuel 2001). Crucially, this does not rely on the existence of a higher formal attainment level, since such differentiation can still be created through institutional status (Parry 2011), higher levels of degree education (i.e. master's and doctorates), quality (Alphen 2012), or subject choice (Dias Lopes 2016)—even if such differentiation is by no means universal (Pinxten et al. 2014). As a consequence, the credentialist perspective does not provide a clear expectation of long-term enrolment trends.

2.3. Institutional Perspectives

Institutional perspectives emphasise the importance of shared rationalizations and social models in shaping human behaviour, often arguing that collective rationality is a stronger determinant of social behaviours than economic circumstances and rational choice (Meyer and Rowan 1977). The expansion of higher education has formed a core theme of institutional literature, with proponents arguing that its rapid expansion is rooted in the strongly engrained model of the university and its rationalization through universal principles such as truth, knowledge, autonomy, excellence (Frank and Meyer 2007; Meyer et al. 1977; Ramirez 2010; Ramirez and Tiplic 2014). Thus, in their cross-national study of higher education expansion, Schofer and Meyer (2005, 917) find that membership in international organizations—which they view as conduits of 'a common universalistic culture'—is a better predictor of national growth than the functional need for skilled labour due to economic development.

Using an institutional lens, Baker (2009; 2011) seeks to explain the why the 'diploma disease'—widespread overeducation among university graduates (Dore 1976)—has never materialized in most countries. According to Baker (2009, 166), 'as more waves of educated individuals flooded the workplace, increasingly in larger formal organisations, there were sustained shifts towards jobs with more managerial, communicative components, that yielded a spread of a kind of mass professionalization of work'.

This professionalization of the workplace created norms and values that established formal education as a legitimate means of differentiation and selection. From this perspective, the rapid increase in higher education enrolment is better explained by the shared coherency and rationality of these norms and values than by a functional shortage of skilled work. For the

same reason, there is little concern that changes in labour market will limit the expansion of higher education enrolment as long as these underlying principles continue to hold currency.

In addition, the institutional perspective provides an explanation for the observation 'that some of the wealthiest nations can have low tertiary graduation rates' (Andres and Pechar 2013, 1), including in particular the German-speaking countries. Crucially, while relatively low past and present tertiary participation in these countries can be explained in terms of institutional models of capitalist labour markets i.e. "varieties of capitalism" (Hall and Soskice 2001), this does not imply that significant tertiary expansion will occur in the future, as 'it is not clear whether the strong emphasis on upper secondary vocational training that unquestionably contributed to their economic success during the Fordist era of capitalist development is still a comparative advantage in an increasingly knowledge-based economy' (Andres and Pechar 2013, 12).

In considering the long-term trajectory of higher education enrolments, the institutionalist approach provides a challenge to the assumption that expansion is linked to or explained by economic and functional concerns, which it regards as common 'myths' or shared rationalizations. This perspective generally expects that higher education will expand where these rationalizations are accepted, even discussing 'the possibility of universal higher education' (Schofer and Meyer 2005, 898) as discourse on higher education becomes more uniform around the world.

2.4. Hybrid or Intermediary Theories

While literature from the political economy and institutional perspectives focus on the importance of skilled labour demand and normative models, respectively, other theories incorporate elements of both positions. This hybrid approach is best illustrated by Clark's (1960) foundational work on the 'cooling out function' of higher education. According to Clark, contemporary society embeds a mismatch or contradiction between 'encouragement to achieve and the realities of limited opportunity' (139). In other words, the normative emphasis on knowledge, education and achievement are limited to some extent by the realities of the labour market. The role of higher education is then to reconcile this contradiction through a process of 'soft denial' that includes establishing alternative means of success and a gradual process of disengagement from students' original aspirations.

Literature on screening and signalling takes a different approach to the labour market, asserting that in a competitive environment with limited information, employers rely and certain signals from applicants in order to screen the supply of labour (Spence 1973; Stiglitz 1975; Bills 2003). From this perspective, higher education signals increased levels of ability or motivation to employers, which influences hiring behaviour. Thus, the value of higher education is not tightly linked to the demand for skilled labour but rather is contingent upon its signalling value. This approach embeds aspects of both institutional perspectives (i.e. a shared 'professionalization or work' among employers) as well acknowledging competitive selection

of labour market. The signalling perspective would essentially expect expansion of higher education insofar as it continues to hold signalling value, which depends upon both employer's normative preferences as well as the prevalence of attainment among jobseekers. Similarly, a significant part of the earnings premium for schooling may be due to behavioural traits it imparts rather than skills or cognitive ability (Bowles, Gintis, and Osborne 2001), behaviours that can ensure an economic benefit of their own. In any case, some non-monetary benefits of higher education, such as improved health (independently of income), among many others (McMahon 2009), are non-competitive, and may therefore justify continued expansion independently of the labour market demand for graduates.

2.5. Synopsis of the Literature

The literature highlights differing expectations about the long-term trajectory of higher education enrolments. On the one hand, both political economy and institutional perspectives entertain the possibility of to universal (i.e., near 100%) levels, indicating that—in the long run—its trajectory might not differ significantly from those of primary and secondary education. Political economy perspective such as skill-biased technological change and endogenous growth suggest that increases in higher education will create more demand for skilled work, meaning that the labour market will become saturated with university graduates. Institutional theory generally views the rationalization of higher education in terms of skilled labour as a myth, and expects continued growth as long as this narrative is accepted. On the other hand, limits to the growth of higher education is a foundational assumption of literature on overeducation as well as an implicit acknowledgment in many policy documents.

The long-term trajectory of higher education is thus an empirical question, one which we propose to investigate with an expansive dataset and unique methodological approach.

3. Methods and Data

3.1. Analytic Strategy

Our approach is to model expansion at all levels of education (i.e. primary, lower-secondary, upper-secondary and post-secondary) using the same model specification and to compare the properties of the fitted models. We assess whether higher education follows the same model as these other levels through comparison of the structure of the residuals of each model (i.e. the difference between the expected and actual values), and the means and variances of the country-specific parameters that capture the rates of expansion. This comparison allows us to assess whether the pattern of higher education expansion has the same functional form as that of lower levels, or whether it merely differs in terms of the specific values of the parameters. Note that this does not involve directly estimating the specific *value* of a possible ceiling (which would be overambitious given the scarcity of observations of higher educational

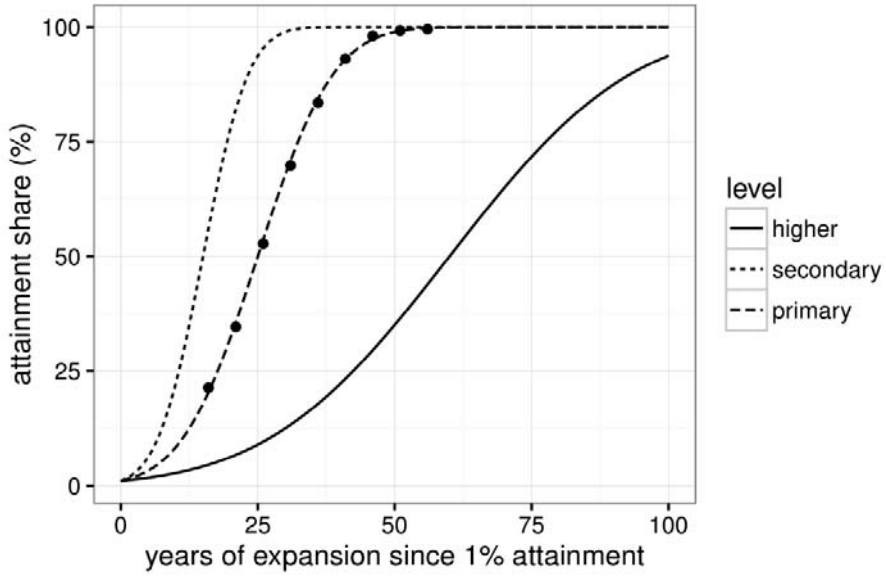
attainment above 50%), but assessing whether the observed expansion is consistent or inconsistent with the absence of a ceiling below universal attainment.

The functional form of our model treats the trajectory of attainment as a sigmoid function (i.e. an `S' curve from 0% to 100%—see Figure 1) representing the proportion of individuals aged 25–29 who have completed higher education. Evidence of a considerably lower fit or different trajectory would therefore be assessed through a poor model fit for higher education relative to lower levels, which would be evident through skewed or biased distribution of residuals.

We also contextualise the meaning of a 'constant rate' of growth given the s-shaped pattern typical of educational expansion. We must be able to assess whether a country that moves from 90% in the year 2000 to 95% in 2005 and to 98% in 2010 has slowed down more or less than the deceleration expected purely due to the ceiling effect at 100%. The analysis is performed on a transformed scale, *meaning the sigmoidal function above is transformed to a linear trajectory.* Thus, on the transformed scale, a country whose expansion is decelerating exactly in line with the expected ceiling effect is expanding linearly, i.e. at a constant rate, on the transformed scale. The validity of the transformation is borne out by the results, which show that the residuals closely follow a normal distribution around this idealised constant expansion rate, without obvious additional structure. Below, all references to 'expansion rate' refer to the transformed, linearized scale, not to the original percentage scale.

Figure 1 illustrates several features of the analysis. Firstly, it shows what is meant by a sigmoidal,'s-shaped', expansion trajectory. Secondly, it shows what it means for different trajectories to share the same functional specification, but differ in terms of the actual expansion rate parameter. In particular, this distinction shows that the notion of higher education following the same 'pattern' of expansion does not require its expansion to similar in practical terms, as observed at a given stage. Thirdly, by overlaying a select empirical example, female secondary enrolment in the Republic of Korea, it shows that the specific functional form is a reasonable 'idealised' trajectory. Not all empirical examples conform to the idealized trajectory with so little noise, nor do they illustrate the full trajectory (i.e. from 0% to 100%). It is more common that the observations for a given country/level/gender fit part of the sigmoid curve with some deviation.

Figure 1: Illustrative stylised expansion trajectories with a shared functional form, but distinct expansion rate parameters. Dots: female lower secondary attainment in the Republic of Korea.



3.2. Data

The empirical historic expansion patterns are estimated on a recent set of global reconstructed time series of completed educational attainment (Goujon et al. 2016). These are disaggregated by country, year in the range 1970-2010, gender, 5-year age groups, and six education levels: none, incomplete primary, primary, lower secondary, upper secondary, and post-secondary. The latter is an aggregate category that includes, but is explicitly not limited to, tertiary education. These time series were reconstructed from the most recent available large-scale cross-sectional baseline data (Bauer et al. 2012). In most cases, that means either censuses or standard international household surveys, such as the DHS. In the present exercise, 157 countries were included, covering a vast majority of the global population, and most exclusions are small (island) states. More problematic is the fact that, since the baseline data build on censuses and large-scale surveys, a minimum level of security and state capacity is normally required for countries to be included. Conversely, this means that 'failed states' and countries suffering from violent conflict are underrepresented in the data. Assuming these countries also exhibit below-average rates of educational expansion, this means that overall and regional trends are biased upwards to some extent in their absence. However, there is no reason to expect the missing countries to affect the results concerning the degree of similarity between higher education and lower levels of schooling.

The consolidated and harmonised baseline data were backprojected along cohort lines, accounting for educational mortality differentials. As an illustration of the basic principle, and

ignoring said mortality selection, the share of 50-year-olds with at least upper secondary education in the year 2000 informs us of the likely share of *40*-year-olds in 1990. Where possible, these backprojections were validated against historic data sources (Speringer et al. 2015). Crucially for present purposes, the reconstruction of the attainment time series only requires assumed educational mortality differentials, and imposes no assumptions regarding the historic trajectories of attainment expansion. *In other words, while the reconstructed trajectories are partly model-based, our analysis of their form does not simply recover assumptions that went into the reconstruction.*

Typical durations and graduation ages for different attainment levels unfortunately do not line up with this grid. In order to ensure that most late attainment is captured, completed primary attainment is observed at age 15-19, completed lower secondary at age 20-24, and completed upper secondary and higher education by 25-29. The latter is likely to underestimate the amount of higher education attainment somewhat, but an even higher reference age would come at the cost of an even greater time lag and less current observational data.

3.3. Model

Overview

We model the share of the population ever reaching or exceeding a given attainment level. This is done separately by country, and gender, but with 'shrinkage' within a Bayesian framework (with weakly informative priors) (Gelman and Hill 2007; Jeff 2006). The mean expansion trajectories are modelled as random walks with drift (and potential mean reversion) and independent noise at a probit-transformed scale. The trend parameters are estimated based on reconstructed attainment histories.

Additional complexity is layered over this basic model. Gender convergence is specified such that at each time step, the predicted values for both genders are shifted towards their joint average. An additional level of independent errors of small magnitude that do not persist in the random walk and do not enter the gender convergence is allowed in fitting the observed data, in order to account for exogenous errors at the level of data, rather than in the underlying educational process.

Technical details

Formally, the core model can be cast in a formula as:

$$y_{c,t,g} = \Phi(\lambda_{c,t,g} + \epsilon_{c,t,g})$$

$$\lambda_{c,t,g} = \lambda_{c,t-1,g} + \tau_{c,g} + u_{c,t,g} - \theta u_{c,t-1,g},$$

where $y_{c,t,g}$ is the share between zero and one reaching a given attainment level in country c at time t among gender g, $\lambda_{c,t,g}$ is the predictor of y at the transformed scale, Φ the cumulative density function of the standard normal distribution, performing the linearizing transformation, the ϵ are the 'data error' layer, and the u the random 'shocks' to attainment, where the scale of the ϵ is set to an order-of-magnitude smaller scale than that of the u *a priori*, so that the latter are identified as the 'residuals' in the analyses below. The λ follow a random walk, starting from the last position at each step, but potentially retracing a share θ of the previous period's shock. The main parameters of interest are the τ, that capture the country-and-gender-specific 'drift' in the random walk, in other words: the 'expansion rate'.

The above basic model is complicated further by the presence of gender convergence, which is defined through the expression:

$$\lambda'_{c,t,g=i} = \nu_{c,t} \times \lambda'_{c,t,g=i} + (1 - \nu_{c,t}) \times \lambda'_{c,t,g=-i},$$

and replacing λ with λ' in the definition of y.

Note that this model is purely structural: there are no explanatory variables other than a constant country-specific trend.

The Bayesian estimation framework employed here requires the specification of prior distributions for all parameters. Here, vague priors are specified that only incorporate knowledge of the order-of-magnitude of various effects, as well as logical bounds. *In other words, the assumed priors do not drive the results that the error variances and variance of country-specific expansion rate parameters is similar across different levels of education.*

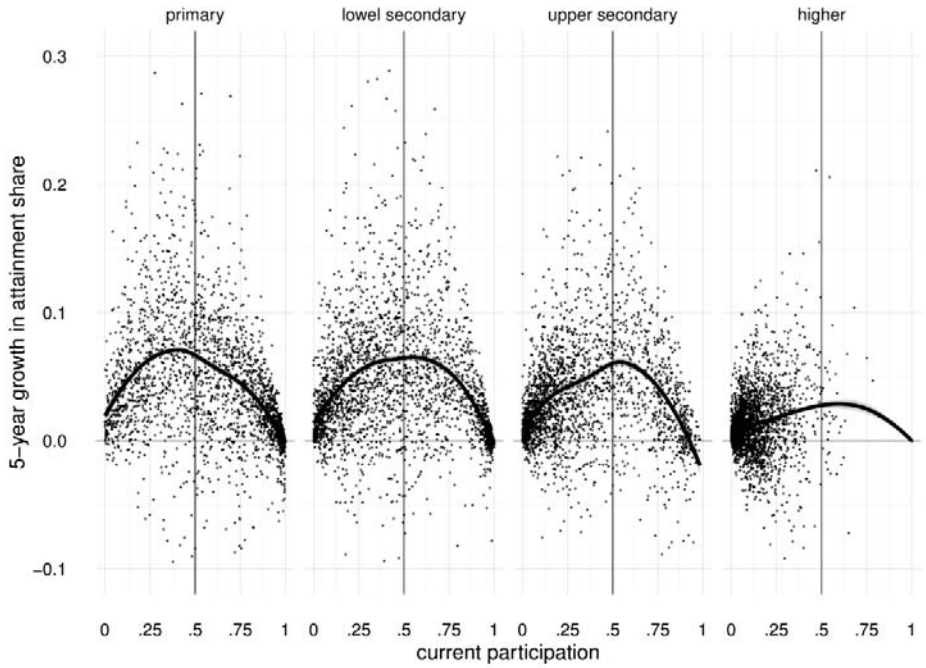
The mean-reversion effect θ has a Beta(1.5, 1.5) prior in the interval (0, 1). The empirical gender convergence factor ν is level and country specific, with prior Beta(1, 5), to ensure a value in the interval (0, 1), strongly skewed towards smaller values. True initial levels are given conceptually uninformative 'flat' priors, but restricted to the interval (-4, 4) to ensure a proper posterior. The idiosyncratic shocks at the probit scale, i.e. the gender, level, year, and country specific epsilons, are i.i.d. draws from a Gaussian distribution with zero mean and standard error σ_ϵ. The additional errors stem from a Gaussian N(0, 0.05) distribution. The (gender, level, and country specific) drift parameters have Gaussian priors centred on regional means (themselves drawn from a Gaussian N(0, 1) distribution), with standard error σ_{trend}. The hyper-priors on variance parameters σ_ϵ and σ_{trend} are Gaussian with mean zero and variance 0.2.

4. Results

4.1. Expansion Steps

The 5-yearly growth steps in attainment at expansion stage and education level are shown in Figure 2. As expected, these expansion steps are small at very low levels of attainment and as the limit of universal attainment is approached (i.e. 0 and 100%), and larger in between. In terms of the trajectory of attainments over time, this pattern results in the `slow, fast, slow' expansion curves already shown, and formalised in the sigmoidal model.

Figure 2: 5-yearly increases in attainment by level and stage of expansion. Smoothed 'loess' means shown as solid lines. Growth set to 0 at 100% higher education attainment.



Note that the peak in mean expansion steps at the percentage scale is related to the ultimate ceiling. If the proposed model with ultimate universal attainment fits a given level of education, growth will peak at approximately 50% enrolment. Conversely, if the maximum growth rate occurred at less than 50%, this would signify that the ceiling for the given level of education is less than 100%. The mean step size for primary through upper secondary schooling is more-or-less symmetrical, and growth is indeed accelerating up to around 40%–60%, and decelerating once this threshold is crossed. To the extent that higher education follows the same expansion pattern as lower levels of schooling, we would likewise expect mean growth to peak at around half the ultimate ceiling for higher education attainment. In other words, if we expect higher education attainment to 'top-out' at 70%, it would be

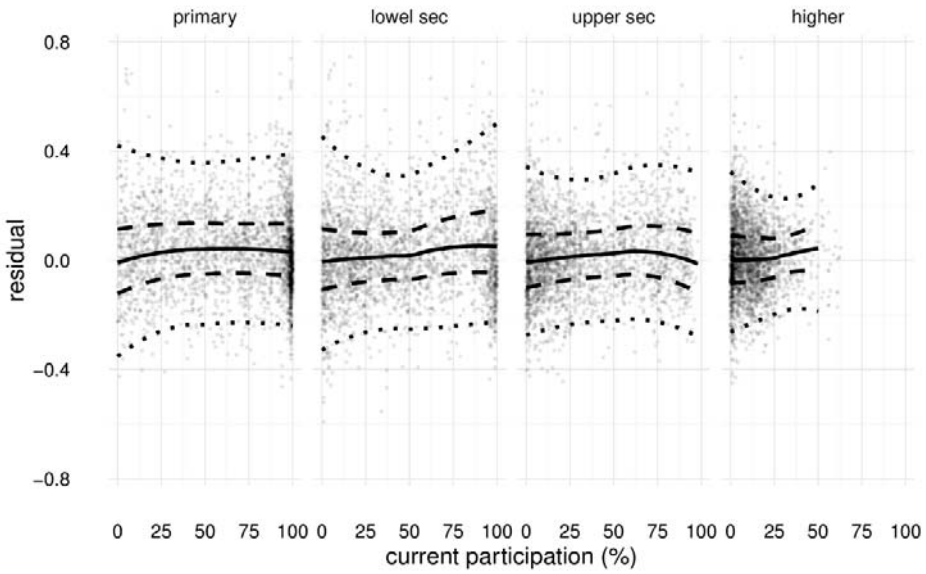
reasonable to expect higher education growth to peak at around 30%–40%. However, Figure 2 shows absolutely no evidence of higher education growth peaking below 50%. As noted before, this certainly does not prove it will eventually become universal, but this pattern is perfectly consistent with the pattern exhibited by lower levels of schooling that have reached universal or near-universal enrolment.

4.2. Distribution of Residuals

The first step in the analysis of the model must be whether it provides an appropriate fit to the data. For our purposes, a single summary measure of the residual distribution will not do, instead we require a more careful examination of their actual distribution. Whether our model fits higher education expansion 'equally well' is therefore assessed by whether *structure* of the residuals is equal, i.e. whether they a) follow a random, normal distribution at different stages of expansion, and b) is similar across education levels. If this can be shown, then we can conclude that the functional form encoded in the model specification does indeed capture the essential shape of the underlying long-term trajectory, and does so for all education levels.

The residuals at each education level, sorted by the current attainment share of the associated observation, are shown in Figure 3, together with smoothed intervals containing 50% and 95% of the residuals respectively. While the latter are intrinsically more variable, they still clearly exhibit a fairly consistent magnitude across education levels. The more robustly estimated inner bounds are remarkably similar in magnitude at all levels. This sits comfortably with the estimated standard deviations of the residuals at different levels, which are $0.17, 0.17, 0.15,$ and 0.13 for primary through higher. Moreover, both the quantiles and the smoothed medians are essentially constant across different stages of expansion. As explained above, this confirms that the specification of the model fits, and that sigmoid-shaped trajectories at the original percentage scale can be thought of as representing expansion at a 'constant rate'. If this were not the case, and the typical curvature at the top of the expansion curve were more concave than implied by the probit model for example, i.e. if the levelling-off of expansion occurred later and more abruptly, then the residuals in Figure 3 would be systematically biased upwards at later stages of expansion.

Figure 3: Residuals by education level and stage of expansion. Quantiles shown: median (solid line), 0.25 and 0.75 (dashed), 0.025 and 0.975 (dotted).



Looking at the post-secondary and tertiary level specifically, note that the smoothed quantiles are omitted above 50% participation on account of their lacking robustness on such a small number of observations. However, it is already evident as that threshold is approached that the residuals exhibit an upward drift. This is explained by positive selection: unlike secondary schooling, higher education around 50% does include countries who experienced an unexpected boost and were pushed into that range from below, but none who experienced an unexpected shock and dropped into that range from above, simply because there are no countries above that range in the data. In other words, the avantgarde in higher educational expansion only includes lucky draws, but no unlucky ones.

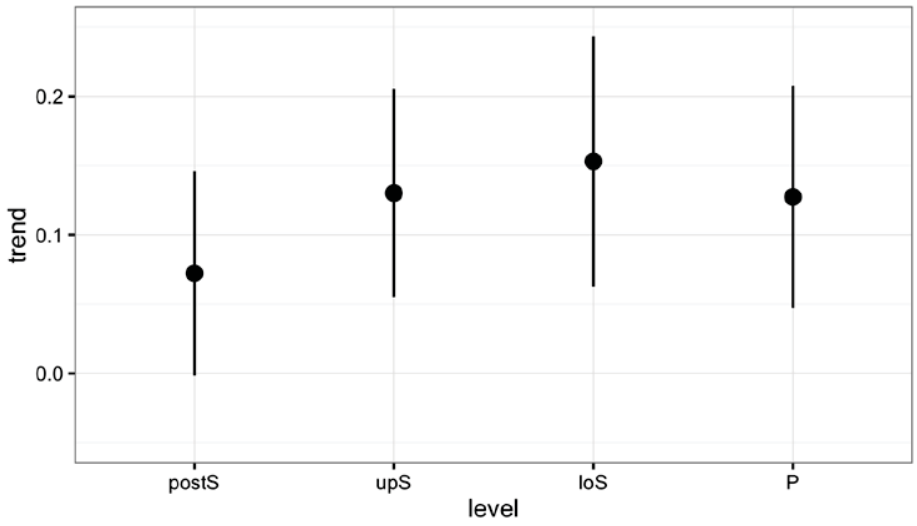
4.3. Distribution of Expansion Rates

While the above analysis of the residuals already establishes that higher education follows the same pattern of expansion as lower levels of schooling, the similarities actually go further. The mean expansion rate and bounds for the country-specific expansion rates at different levels are displayed in Figure 4, which shows that the spread of the rates at the higher education level is highly consistent with other levels. In other words, there is no more variation between countries at this level than there is at other levels of education. Unsurprisingly, however, the *mean* rate of expansion is indeed slower, the higher the level of education.

The primary expansion rates appear to break this pattern of a monotone decline in mean expansion rates with increasing education level. However, similarly to logistic regression, the

present model must ignore data points that are very close to 0% or 100%, because these values correspond to negative infinity and positive infinity on the transformed scale. Accordingly, countries whose primary participation was close to universal throughout the observed period do enter the estimation for the primary level rates. Conversely, countries that are late to universalise primary schooling are overrepresented, which creates a selection bias towards slower primary expansion rates.

Figure 4: Distribution of country-and-gender-specific expansion rate parameters by level. Mean (dot) and +/- 2 standard deviations (bars) shown.



Remarkably, the distributions of expansion rates at different levels display considerable overlap. In other words, relatively speaking, a considerable number of countries are expanding higher education at a faster rate than many countries are expanding secondary or even primary schooling.

Consider what it would mean to ‘speed up’ the higher education expansion trajectories, by uniformly shifting all country-specific expansion rates upwards. Informally, this may be thought of as re-scaling the time axis, similarly to calculations in ‘dog years’. Together, the above analyses imply that such *a simple uniform speed-up would make the global ensemble of higher education expansion trajectories practically indistinguishable from the upper secondary trajectories* or (with a different speed-up factor) lower secondary or primary schooling trajectories. This is the sense in which we conclude that the quantitative pattern of the expansion of higher education attainment is ‘the same, only slower’ as that of lower levels of schooling.

4.4. Correlation Structure

There is no limit to explicit and implicit structural model characteristics that could be compared across levels, although the analysis of the distributions of the estimated expansion rates and residuals shown above is clearly the most important. Among the possible secondary analyses, the correlations of expansion rates and residuals between levels are of greatest interest, shown in Table 1 and Table 2 respectively. The former shows the extent to which countries where upper secondary attainment is expanding rapidly/slowly are likely to also have rapid/slow expansion trajectories at lower secondary or higher education, for instance. The latter shows the extent to which countries experience 'shocks' or 'booms' in their expansion trajectories that affect multiple levels at once, or whether each level experiences its idiosyncratic random deviations from the expected mean trajectory.

Table 1: Cross-level correlations between expansion rates. Redundant symmetrical entries omitted

	higher	upper sec	lower sec	primary
higher	1	0.86	0.68	0.52
upper sec	.	1	0.66	0.44
lower sec	.	.	1	0.55
primary	.	.	.	1

Source: Authors' calculations

The moderately large cross-level correlations between expansion rates (Table 1) show that, unsurprisingly, there is a tendency for countries to be leading or lagging in educational expansion overall, but there are quite a few cases where one level is expanding relatively rapidly, but another relatively slowly compared to other countries. What stands out is that the expansion rate of higher education is very highly correlated with that of upper secondary schooling. Higher in fact than upper secondary expansion correlates with lower secondary expansion. This is far from obvious *a priori*: the two secondary levels are often (although certainly not always) part of the same system and share physical buildings and even teaching staff, and the expansion of higher education is often so far behind that of schooling that it is rarely constrained by the availability of eligible entrants completing the lower level.

Table 2: Cross-level correlations between residuals. Redundant symmetrical entries omitted.

	higher	upper sec	lower sec	primary
higher	1	0.14	0.10	0.08
upper sec	.	1	0.17	0.11
lower sec	.	.	1	0.15
primary	.	.	.	1

Source: Authors' calculations

With respect to the cross-level correlations between residuals (Table 2), it is evident that there is nothing remarkable about higher education, which seamlessly fits with the correlation pattern prevalent among lower levels. That pattern itself predictably shows less correlation between levels further apart. Remarkably, however, the overall level of correlation is low. This finding suggests either that positive and negative 'shocks' tend to affect specific levels rather than the education sector as a whole, or that positive correlation from sector-wide shocks is partly offset by negative correlation induced by shifting spending priorities, for example, where one level is pushed at the expense of another.

5. Discussion and Conclusion

It appears to be true that 'higher education is the next secondary education'—in a well-defined technical sense in terms of the quantitative pattern of the expansion of formal attainment. One implication is that there is no evidence at this level of analysis of higher education participation topping out well below truly universal participation.

This assessment is descriptive, not normative. Under the assumption that higher education only will become universal if this would actually be beneficial, the two could not be disentangled. However, as the literature review shows, there are arguments for expecting continued expansion regardless of whether it is beneficial at the individual or aggregate level.

Moreover, a finding that higher education has to date not significantly deviated from the path set out by lower levels of schooling previously clearly does not rule out a divergence in the future. It does mean, however, that expectations of such a divergence carry a heavy burden-of-proof, because higher education is evidently not intrinsically *sui generis* in terms of its expansion trajectory. If we do *not* believe higher education will become (close to) truly universal, we need to be rather more precise in specifying at what point—and why!—we would expect the expansion dynamic to undergo a fundamental change. This would provide an opportunity to study in greater detail how different inflationary or limiting factors dominate along different parts of the trajectory. What carries participation from 70% to 90% may be very different from the factors that created the lift from 30% to 50%. As an illustrative sketch of such an argument, it may be that economic demand creates lift-off, class competition creates rapid expansion, and world institutions create universal coverage. Systematically structuring the study of the determinants of further higher education expansion by the level of participation already achieved would be prerequisite for a convincing argument as to why higher education is reacting similarly to inflationary pressures at low and medium levels of expansion, but may nevertheless be expected to react differently to the forces crucial at the top.

Given the relatively slow rate of higher education expansion, it might be tempting to dismiss that challenge as purely speculative and simply quote John Maynard Keynes ('In the

long run we are all dead.'). However, while at the global level we may indeed be more than a hundred years away from close to universal levels, this is not true at the country level. Only very few countries currently exhibit higher education attainment shares exceeding 50% in the relevant age group, but their number is set to increase rapidly. If there is a ceiling to higher education expansion in the range of 60–80%, we will see clear evidence of it within the next 20–30 years. Moreover, it would be a Eurocentric fallacy to conceive of educational attainment levels as expanding more-or-less sequentially, and in distinct eras. In India, for example, the phases of rapid expansion at different levels are happening much more concurrently.

In order to interpret the implications, recall that expansion of attainment shares, as indicative of expanding participation rates, must not be confused with expansion in terms of absolute numbers. In particular, perceived 'massification' of post-secondary and tertiary education in many Western European countries occurred at participation rates that—from today's perspective—were still rather moderate, because large baby-boomer cohorts entered the relevant age group at the time. In general, perceptions of whether absolute growth has slowed, even from within the sector, are of limited relevance to the present question of where participation *rates* are headed.

To the higher education literature, this paper contributes the first analysis that compares higher education enrolment to the trajectories of other levels of education (i.e. primary and secondary) on the course of their expansion to universal access. As discussed above, literature from a variety of theoretical literature raises the prospect of universal or near-universal access to higher education. For example, proponents of skill-biased technical change, endogenous growth, and institutional theories argue that higher education may could reach universal levels either due to changes in the labour market or the coherency of its institutional model. These perspectives so gain some support from these findings, as they suggest that such a pattern of expansion is entirely possible based upon current trends and historical patterns of enrolment at other levels. Findings are more ambiguous with respect to other perspectives, as literature on over-qualification, credentialism and screening/signalling suggest some upper-limits on enrolment, our results would indicate these limits are not yet reached in most countries. Advocates of these positions would likely argue that they may be reached in the future or in certain contexts, but there is no evidence of widespread or systematic ceilings on enrolments to date.

Similar quantitative patterns of expansion obviously do not deny that higher education is very different from school in other ways. Indeed, even the slower average rate of expansion *by itself* has substantive implications in relation to other social dynamics that differ from those of more rapidly-expanding levels of schooling. For example, note that the length of a generation varies (over time or between social groups) by less than the difference in the rate of expansion between levels of education. This fact alone implies different intergenerational dynamics: fast primary expansion is much more likely to be inequality-reducing, for example, because most of the new beneficiaries necessarily come from families where the parents themselves did not complete primary. By contrast, higher education expansion—*on account of its slower average*

pace—leaves much more room for it to be largely monopolised by the children of more educated households.

In conclusion, then, accepting the *similarity* of higher education expansion dynamics to those of lower levels of schooling as a starting point, rather than our *a priori* knowledge of their many differences, does not imply their differences are mere 'noise', but on the contrary, paves the way for new ways of thinking about the *distinctiveness* of higher education.

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