Trends in Educational Mobility: How Does China Compare to Europe and the United States?*

Rob Gruijters
Department of Sociology
University of Oxford

Tak Wing Chan
Department of Social Science
UCL Institute of Education

John Ermisch
Department of Sociology
University of Oxford

November 18, 2018

Abstract

Despite impressive rise in school enrollment rates over the past few decades, there are concerns about growing inequality of educational opportunity in China. In this paper, we examine the level and trend of educational mobility in China, and compare them to those of Germany, the Netherlands, the UK and the US. Educational mobility is defined as the association between parents' and children's educational attainment. We show that China's economic boom has been accompanied by a large decline in relative educational mobility chances, as measured by odds ratios. To elaborate, relative rates of educational mobility in China were, by international standards, quite high for those who grew up under state socialism. For the most recent cohorts, however, educational mobility rates have dropped to a level that is comparable to those of European countries, though it is still higher than the US level.

1

1 Introduction

One of the most important social changes in China over the past few decades is the massive expansion of its educational system (Treiman, 2013). Since the launch of the market reform in the late 1970s, educational qualifications have become increasingly important for achieving economic success. Basic nine-year education has become almost universal even in the most remote regions, and the number of higher education entrants has increased from 0.9 million in 1995 to 10.9 million in 2015 (National Bureau of Statistics of China, 2016, Table 21-7).[1] The achievements of the Chinese school system were highlighted in 2010, when a sample of Shanghai students topped the global PISA rankings in all three subjects of mathematics, science and reading.

Scholars have, however, noted that these success stories mask large socio-economic gaps in educational opportunity, particularly between rural and urban areas. There are also indications that inequality in educational attainment has widened in recent years (Wu, 2010; Yeung, 2013; Zhou *et al.*, 1998). Wang *et al.* (2011) attribute this to the market-oriented reforms, which have made senior high school and college virtually unaffordable for low-income families. But these studies consider China in isolation. So we do not know how China compares with other countries.

In this paper, we examine educational mobility in China, Germany, the Netherlands, the UK and the US. Educational mobility is defined as the net association between parents' and children's education. Our analyses contribute to the literature on educational stratification in China (e.g. Li, 2006; Wu, 2010; Yeung, 2013) by providing an international benchmark, and to the comparative literature on the trends in educational inequality (e.g. Blossfeld *et al.*, 2016; Breen *et al.*, 2009; Pfeffer, 2008) by adding the distinctive case of China. We start by briefly describing the key characteristics of the education system of the five countries. We then provide descriptive statistics on educational attainment across birth cohorts, followed by an analysis of educational mobility.

2 Institutional features of education systems

Education systems can vary on a number of dimensions. In this study, we focus on four of them, namely (1) horizontal differentiation, (2) centralization of funding and resources, (3) standardization of curricula and tests, and (4) marketization. Each of these dimensions has important implications for

---

[1]Source: `http://www.stats.gov.cn/tjsj/ndsj/2016/indexeh.htm`

educational mobility (Pfeffer, 2008; Schütz *et al.*, 2008; Van de Werfhorst and Mijs, 2010)

Horizontal differentiation refers to the sorting of students into different tracks (Van de Werfhorst and Mijs, 2010), which are typically vocational tracks which prepare students for working-class jobs, and more prestigious academic tracks which prepare students for university. The opposite of tracking is the comprehensive education model, in which students of different abilities and interests are taught in the same schools and classrooms for as long as possible. It is generally found that horizontal differentiation reduces educational mobility, because high status parents are in a better position to ensure their child chooses the 'right' educational track (Brunello and Checchi, 2007; Pfeffer, 2008).

Education systems also differ in the degree of centralization of funding and other school resources, such as teacher training and allocation. Greater disparities in the quality of teaching and facilities are often found in decentralized systems. As a result of parental influence, admission criteria and residential segregation, students from less advantaged backgrounds tend to be clustered in lower-quality schools, even in nominally comprehensive school systems (Triventi *et al.*, 2016). Thus, we expect that decentralization of funding and resources is associated with less educational mobility.

The centralization of curricula and testing is also referred to as standardization (Van de Werfhorst and Mijs, 2010). The opposite of standardization is school autonomy, in which there are no nationally enforced educational standards. While excessive standardization is often criticized for limiting teacher's independence and creating a test-oriented learning culture, moderate levels of standardization, particularly in examinations, have been shown to reduce the influence of social origin on student performance (Schütz *et al.*, 2008; Wößmann, 2003).

Finally, marketization describes the extent to which the cost of education is borne by parents and students in the form of tuition fees. It also refers to the existence of private schools and colleges alongside public ones. A high degree of marketization is likely to reduce educational mobility (Schütz *et al.*, 2008).

2.1 The Chinese education system

China's education system is characterized by a linear sequence of educational stages. Children start primary school at the age of six or seven. Similar to the US, primary school, which takes six years, is followed by junior high school (JHS, three years), senior high school (SHS, three years), and junior college (three years) or university (four years). At the high school level, a

distinction can be made between vocational high schools, general high schools and prestigious 'key point' high schools.

Historically, education policy in China was tightly controlled by the central government (Ross and Pepper, 1997; Tsang, 2000). Under state socialism (1949–1978) the emphasis was on basic education, in line with the state's objective of levelling social inequality. Previous studies have shown that educational inequality was exceptionally low in this period (Deng and Treiman, 1997; Zhou *et al.*, 1998).

The market transition that began in 1978 brought about a radical break in educational policy. The ideological goals of the Maoist period were replaced by a system oriented towards efficiency and growth (Tsang, 2000). This involved a gradual marketization of the educational system as well as an increased emphasis on standardized tests for entry into advanced levels of education (Hannum *et al.*, 2011). Enrollment rates have increased rapidly since the early 1980s, and basic education (primary and JHS) is now almost universal (Treiman, 2013). A second wave of reforms in the late 1990s rapidly expanded access to higher education, which had been very limited up to that point (Yeung, 2013). r The emphasis on nationwide testing and curricula has resulted in an exceptionally high degree of standardization. But school resources are decentralized following the educational finance reforms of the 1980s. This has led to massive and persistent regional differences in the availability and quality of education, particularly between rural and urban areas. Under the policy of household registration (*hukou*), rural children cannot attend urban schools, even if their parents have migrated to urban areas. It is only at the tertiary level that rural and urban students attend the same colleges, although regional quotas continue to disadvantage rural children (Wu, 2012).

2.2   The German education system

Education in Germany is largely run funded by regional governments (*Bundesländer*). It is characterized by a strong and early differentiation between vocational and academic tracks. Compulsory education starts relatively late, at the age of 7. After four years (around age 11), children are sorted into three types of secondary school, according to their grades. The most basic level (*Hauptschule*) takes five years and has a strong vocational focus. The middle level (*Realschule*) takes six years and provides access to advanced vocational and administrative degrees, including lower tier tertiary degrees (*Fachhochschule*). Only the *Gymnasium*, which takes eight or nine years and attracts about a third of all high school students, prepares students for the university entrance qualification (*Abitur*).

A distinctive aspect of the German education system is its strong emphasis on vocational training. Following the *Hauptschule* or *Realschule*, most students enter the 'dual system' of part-time schooling combined with an apprenticeship at a workplace (Schneider, 2008b). This type of vocational training typically takes three years, and leads to a specific occupational qualification. While the dual system is considered part of (upper) secondary schooling, the German system also offers a variety of post-secondary vocational degrees. Advanced vocational training is offered at technical colleges (*Fachschulen*) and vocational academies (*Berufsakademien*). It is sometimes argued that Germany's strong vocational tradition alleviates some of the negative effects of tracking, because it provides less academically oriented students an alternative path to advanced qualifications and high-status jobs (Brunello and Checchi, 2007).

Finally, Germany has a dual higher education system, which distinguishes between polytechnics (*Fachhochschulen*) and traditional universities. Although tertiary education is (almost) free of charge, university attendance is comparatively low (see Figures 1 and 2 below).

2.3 The Dutch education system

In the Netherlands, schooling is compulsory between the ages of 5 and 16. Children finish primary school at the age of 12, at which point they are sorted into different secondary tracks, based on teacher recommendations and standardized test scores (the CITO test). Although the structure of secondary education has been reformed several times in recent decades, its basic tenets have remained the same. Over half of all students attend pre-vocational secondary education (VMBO), which is further divided into different tracks. VMBO schools provide 4-year courses in four sectors (commerce, health, agriculture and technology), combined with a more general curriculum. Pre-vocational education is typically followed by a vocational degree (MBO), although some students also proceed to grade 4 of the next level of secondary education (HAVO). HAVO takes five years and provides direct access to polytechnic colleges (HBO). The highest level of secondary education (VWO) takes six years and prepares students for university education. HAVO and VWO are normally offered by the same schools, and the first one or two years of these tracks are typically combined (Luijkx and de Heus, 2008). Similar to Germany, the Netherlands has a binary system of higher education, which distinguishes between polytechnics (HBO) and academic universities (WO). Currently around 24% of all secondary students proceed to HBO, and 15% to university. There is little difference in quality or prestige between tertiary institutions, and most universities take all applicants with

the required qualifications.

Although there are a significant number of private schools in the Netherlands, they are typically confessional in nature, and are funded by the state. They also follow the same curriculum as ordinary public schools. Education, including higher education, is mostly free or highly subsidized. The wide range of secondary and vocational degrees offered by the Dutch education system ensures that very few students leave the school system with no qualification. Moreover, student mobility across tracks and levels have become more common in recent years (Luijkx and de Heus, 2008).

2.4 The English education system

The four home nations of the UK, i.e. England, Wales, Scotland and Northern Ireland, have similar but not identical education systems. Given the numerical dominance of England (about 84% of the UK population live in England), we will describe the English system in this Section.

Primary school starts at the age of five and continues until age 11, followed by (lower) secondary education, which takes five years (first to fifth form). Historically, many students leave the education system at this point, with or without one or more 'GCSEs'. Upper secondary education, GCE Advanced level ('A-level') prepares students for universities. As Figure 2 shows, the share of students obtaining A-levels and postsecondary qualifications has increased steadily across cohorts.

In contrast to the Dutch and German systems, England does not have a strong tradition of vocational education (Schneider, 2008b). There used to be tracking in which students were educated in either grammar, secondary modern, or technical schools. But this tripartite system was replaced by comprehensive schools in the mid-1960s. However, some selective grammar schools still exist and some 8–10% of secondary students attend private (sometimes boarding) schools, which generally charge substantial fees (Schneider, 2008a). All schools technically follow the same national curriculum and provide access to higher education, although within-school ability tracking exists.

England has a unified higher education sector, but universities differ considerably in quality, prestige and entry requirements. University enrollment has increased rapidly in recent decades, and is currently around 35% (Boliver, 2011).

2.5 The US education system

The US education system is radically different from its European and Chinese counterparts, mainly because of the more limited role of the federal state.

Table 1: Features of the education system in the five countries

	Horizontal differentiation (tracking)	Centralization of funding	Standardization of curricula and testing	Marketization
China	Moderate	Very low	Very high	Moderate
Germany	Very high	High	Low	Very low
Netherlands	Very high	Very high	Moderate	Very low
United Kingdom	Low	High	High	High
United States	Moderate	Very low	Low	Very high

Education is primarily the responsibility of state and local governments, resulting in large regional disparities in educational policy and funding (Karen, 2002). Moreover, the private sector plays an important role, particularly in higher education. Many colleges are run on a for-profit basis, and even public colleges typically charge considerable fees.

Education typically starts with one year of kindergarten, followed by five years of elementary school, three years of junior high school and three or four years of senior high school, although considerable regional variation exists. Unlike Germany or the Netherlands, there are no formal tracks in high school. But quality differences between schools as well as informal tracking within schools lead to a considerable degree of horizontal differentiation in secondary education (Lucas, 2001). Differentiation is even higher in post-secondary education, which ranges from 2-year vocational or community colleges to prestigious Ivy-league universities. Post-secondary and college attendance is traditionally higher in the US than in Europe (see Table 1).

The implications of the US education system for educational mobility are ambiguous. On the one hand, the US education system offers a high degree of flexibility and openness. On the other hand, marketization and regional differences imply that children from lower socio-economic backgrounds typically attend inferior schools and have higher dropout rates.

2.6 Summary

A summary of the institutional characteristics of our five cases is provided in Table 1. Compared to four Western countries, China's education system is highly standardized, with a strong emphasis on centralized testing for progression to higher levels. The funding of education is, however, very decentralized, which has led to large regional differences in the quality and availability of schooling. Private education remains rare in China, although

Table 2: Data sources

Country	Data source	Year	N
China	China Family Panel Studies	2012	23,565
Germany	European Social Survey	2008–16	8,452
Netherlands	European Social Survey	2008–16	5,482
United Kingdom	European Social Survey	2010–16	4,973
United States	Panel Study of Income Dynamics	2009	10,170

tuition fees for (senior) high school and university have increased sharply since the mid-1990s (Wang *et al.*, 2011). In the following sections, we will explore how this translates into levels and trends in educational mobility.

3 Method

3.1 Data and sample

We draw on data from three recent, large scale and high quality surveys that provide comparable measures of educational attainment. For China, we use the second (2012) wave of the China Family Panel Studies (CFPS). The CFPS is a large biennial household panel survey of the Chinese population, managed by a team of researchers at Peking University. For Germany, the Netherlands and the UK, we rely on the European Social Survey (ESS), which is a repeated cross-sectional survey of the European population that takes place every other year. We use waves 4–8 of the ESS (2008–2016), as they contain uniform measures of respondents' and parents' education. For the US, we use the 2009 wave of Panel Study of Income Dynamics (PSID), which provides data on the educational attainment of the main respondents (household head and his/her spouse or cohabiting partner) and their parents.

In each survey, we restrict our sample to native-born individuals who were born between 1946 and 1985, provided that they were at least 25 years old at the time of the survey. We group the respondents into four 10-year birth cohorts: 1946–55, 1956–65, 1966–75 and 1976–85. The oldest cohort started their education shortly after the Second World War. The youngest respondents would have graduated from university in the early years of the 21st century. Sample sizes range from 4,973 for the UK to 23,565 for China (see Table 2). All analyses use post-stratification weights to correct for sampling design and non-response.

3.2 Analytical approach

We use parental education as a proxy for social origin. Although parental education is not the only aspect of social origin that is relevant for children's educational attainment, it is causally prior to other family background variables, such as social class and household income, and is strongly correlated with them (Pfeffer, 2008). Previous studies, in China or elsewhere, that include multiple indicators of social origin generally find that education has the strongest independent effect (Buis, 2013; Shavit *et al.*, 2007; Yeung, 2013). This is because parental education not only proxies for socio-economic status, but also reflects intangible resources that are available in a household (Bukodi and Goldthorpe, 2013).

We use two sets of analytical tools in this paper, the first of which are ordered logit models. Recent applications of ordered logit models in educational inequality research include Breen *et al.* (2009) and Torche (2010). These models provide a parsimonious measure of inequality in educational attainment, so long as the educational outcomes can be ranked from low to high, even if they do not follow a single sequence of stages (Torche, 2010). This is important as there are parallel educational tracks in many European school systems.

Secondly, we analyse the data as three-way origin by destination by cohort contingency tables, using loglinear and logmultiplicative models. These models provide formal tests of whether the origin–destination association has changed over cohorts. Moreover, using the uniform-difference or unidiff model (Erikson and Goldthorpe, 1992; Xie, 1992), we will have a one-number summary of the change in the origin–destination association across cohorts (Pfeffer, 2008).

There is an ongoing debate about how reliable it is to make group comparisons using non-linear probability models (NLPM), such as ordered logit or loglinear models. It is well known that NLPM parameters are estimated *up to scale* only. And since the response variable might be more variable in some groups than others, the underlying scale might be different across groups. This makes group comparisons based on NLPM problematic, even if the unobserved source of variation in the response variable is uncorrelated with the predictor of interest (Allison, 1999; Mood, 2010; Breen *et al.*, 2014). In the present context, this means that it is unreliable to use NLPM to make claims about whether the association between social origin and educational attainment is higher (or lower) in some cohorts (or countries) compared to others. However, Kuha and Mills (2018, p. 1) argue that 'these concerns are usually misplaced', especially if the response variable concerned is truly categorical in nature, in which case 'the causal effects and descriptive associ-

ations are inherently group dependent and can be compared as long as they are correctly estimated' (see also Buis, 2017; Rohwer, 2012). In any case, we believe the between-country and between-cohort differences that we report below are too large to be attributed entirely to unobserved heterogeneity.

3.3 Measures

An important challenge for us is to develop a set of educational categories that would support cross-national comparison on the one hand, and is sensitive to the idiosyncratic features of each country's education system on the other. Given the large differences in the education system of the five countries, these are to some degree incompatible goals. We proceed pragmatically. In the main text, we use a four-fold educational classification that is identical for the five countries. In Appendix B, we report supplementary analyses for the Western countries that are based on more detailed classification schemes that differentiate intermediate educational levels. Broadly speaking, the results of the supplementary analyses are very similar to those reported in the main text.

Our starting point is the ESS version of the International Standard Classification of Education (ES-ISCED), which has been implemented in the ESS since 2008 (European Social Survey, 2014). A cross-national validation exercise shows that the ES-ISCED is better at predicting various outcomes, such as income, than alternative measures of educational attainment, including the original ISCED scale (Schneider, 2010). The ES-ISCED has six categories, namely (1) 'less than lower secondary', (2) 'lower secondary', (3) 'lower tier upper secondary', (4) 'upper tier upper secondary', (5) 'advanced vocational / sub-degree', and (6) 'tertiary'.

The ES-ISCED categories are already coded for Germany, the Netherlands and the UK. We try to map the Chinese and US educational categories onto this framework, as shown in Appendix A. But since category (3) 'lower tier upper secondary' and category (5) 'advanced vocational' do not exist in the Chinese education system, we merge category (2) with category (3) and category (4) with category (5). We use the four-fold educational classification shown in Table 3 for all countries in the analyses in the main text. Parental education is also coded to this four-fold educational classification. In cases where there is information of both father's and mother's education, we refer to the higher level of the two.

All ordered logit models below control for the respondent's gender. Although gender is an important aspect of educational stratification and is of interest in itself, gender difference in educational mobility is not the focus of this study. Finally, a feature of social stratification that is unique to China

Table 3: Four-fold educational classification

1	Primary
2	Lower-secondary or lower-tier upper-secondary
3	Upper-tier upper secondary or advanced vocational
4	Tertiary (bachelor degree or above)

is its household registration system, *hukou* (Wu, 2012). Given the radically different levels of socio-economic development and public service provision in rural and urban China, and also because of the barriers to geographic mobility, we analyse the data for rural and urban China separately.

4 Results

4.1 Educational attainment

Figure 1 reports, for the five countries and the four cohorts separately, the distribution of the respondents by parental education. Two points are immediately obvious. First, there are very large cross-national differences. Consider, for example, those respondents born between 1946 and 1955 (see the first column of each panel): 93% of those in rural China and 79% of those in urban China are from the lowest origin category (i.e. their parents have no more than primary qualifications). In Germany, the US, the Netherlands and the UK, the corresponding figures are 1%, 9%, 32% and 67% respectively.

Secondly, all countries have seen large change over time. For rural and urban China, the share of respondents from the lowest origin category drops progressively across cohorts, reaching 59% and 21% respectively for those born in 1976–85. For the Netherlands and the UK, this also drops to 4% and 23% respectively. For the US and, especially, Germany, there are very few people from the bottom origin category even in the first cohort. So most of the change in the distribution by social origin takes place further up the educational ladder. Thus, the share of respondents with tertiary-educated parents goes from 21% to 40% in the US, and from 9% to 23% in Germany.

Figure 2 reports the distribution of the respondents by their own educational attainment. Again, we see large cross-national differences and, except for the US and Germany, large change over cohorts. The pace of change is especially remarkable in urban China. Thus, only 9% of the urban Chinese from the 1946–55 cohort have tertiary qualifications. But for the 1976–85 cohort, this figure rises to 54%, surpassing the level of Germany (29%), the UK (37%), the US (38%) and the Netherlands (42%).
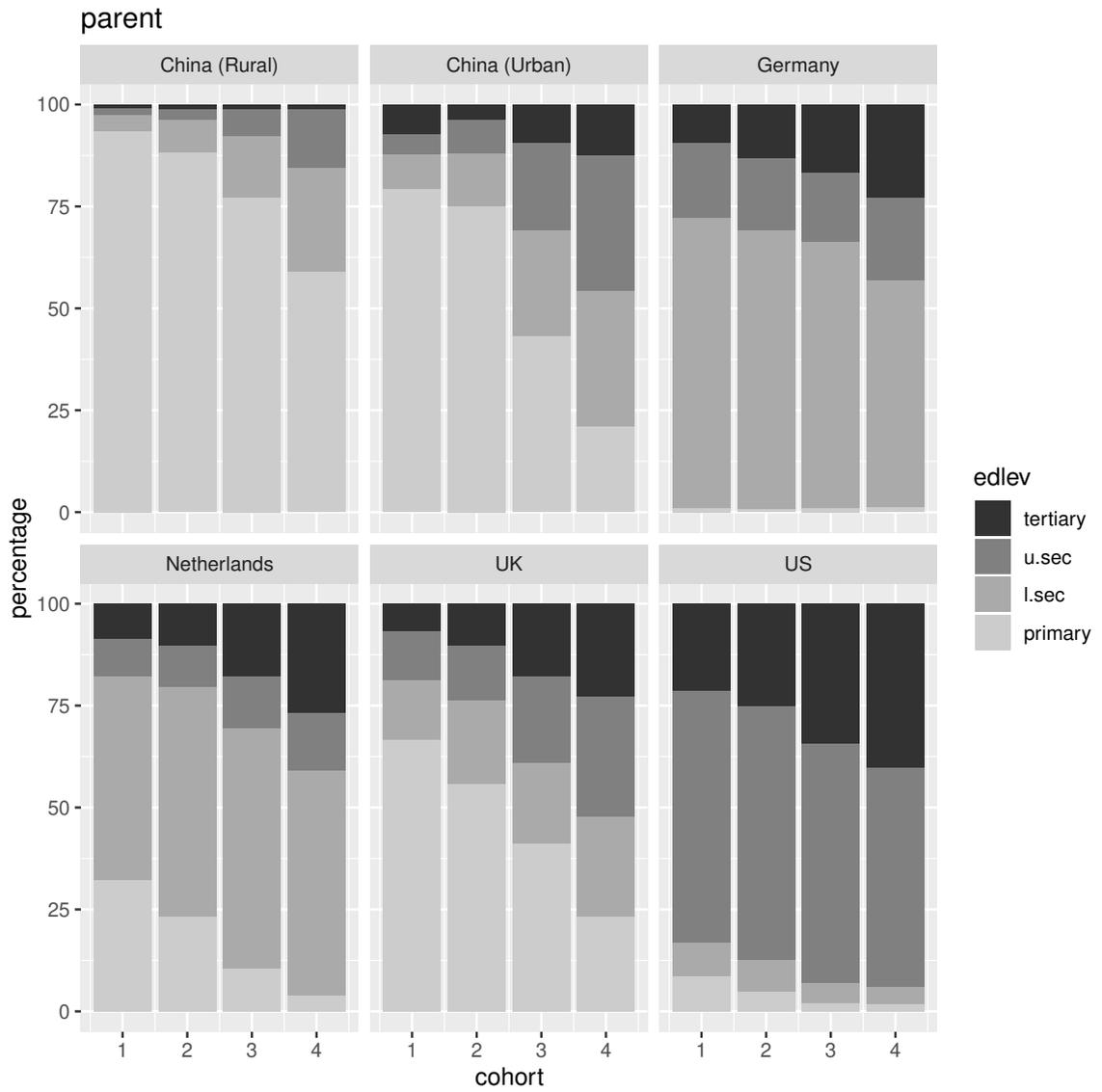
Figure 1: Distribution of respondents by parental education by country and cohort
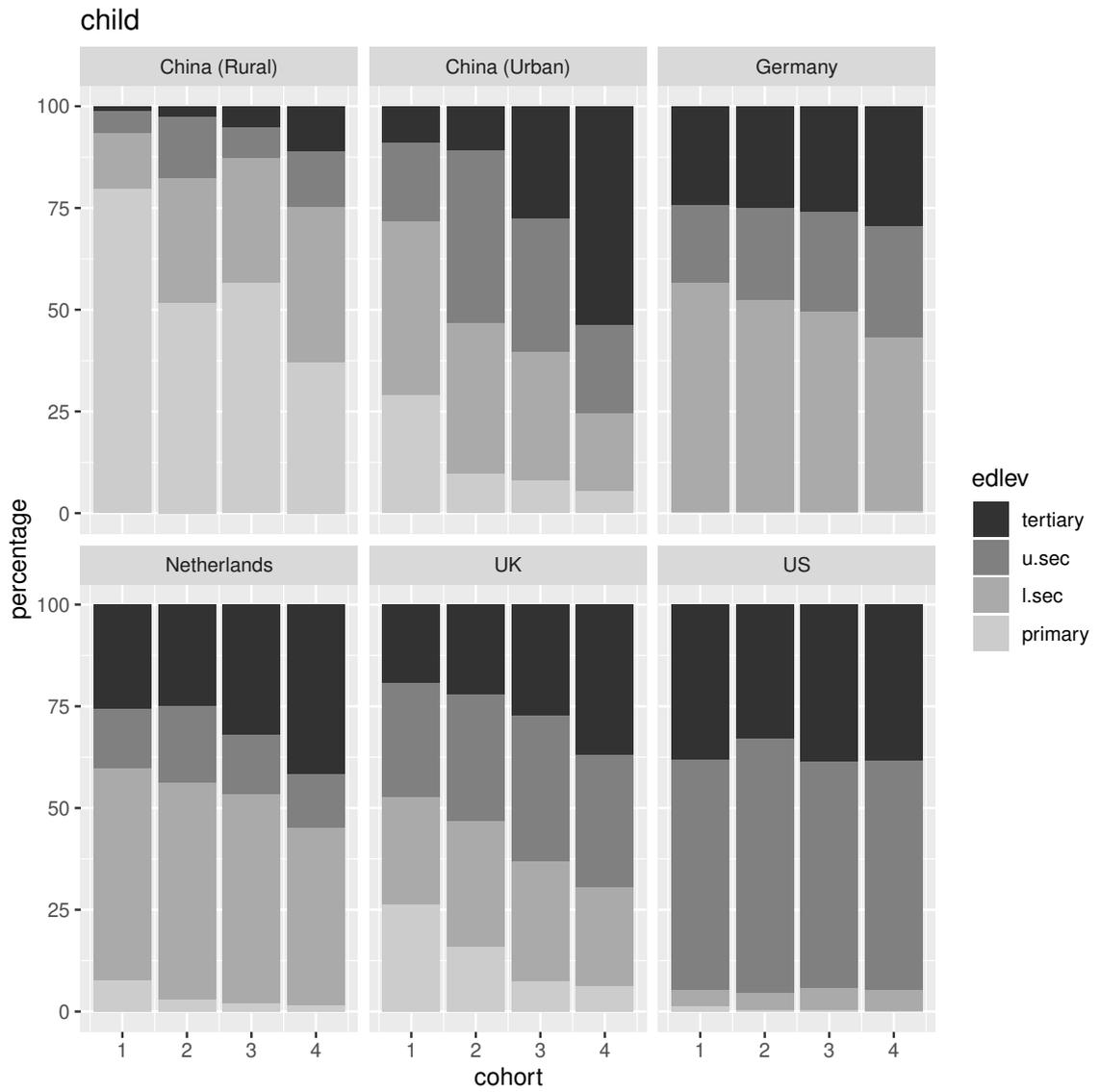
child

Figure 2: Distribution of respondents by their own education by country and cohort

13

Overall, we observe a strong upgrading of education across cohorts. This is, of course, due to the educational expansion in the second half of the 20th century. The cross-national differences in Figures 1 and 2 reflect well known structural and institutional characteristics of the education systems of the five countries. For example, while a substantial number of Brits leave school with no qualifications, this is quite uncommon in Germany or the Netherlands. Compared to the rest of the world, Americans used to have higher levels of educational attainment, because the US led the world in educational expansion at the secondary and tertiary levels (Goldin and Katz, 2008). Figures 1 and 2 show that many European countries are catching up with the US. But the most striking feature of these two figures is the very rapid educational expansion in (especially urban) China over the past few decades.

4.2   Educational mobility: ordered logit models

To gauge the association between parents' and children's educational attainment, we fit ordered logistic regression models to the data for each country and cohort separately. These models control for the respondent's gender. But we are primarily interested in the estimates for parental education, which are entered as dummies.

Figure 3 plots the cohort trends of the parameters of interest. Although there are interesting exceptions, generally speaking, the flat dotted line, representing the reference category of tertiary education, is at the top of each panel. Below it is the line representing upper secondary origin, followed by the line for lower secondary origin and, finally, that for primary origin. This simply means that, as expected, respondents from lower social origins are generally at a greater disadvantage in educational attainment.

The most interesting exception to this general pattern concerns the first cohort of rural Chinese (see top-left panel of Figure 3), where respondents with tertiary-educated parents have, on average, the worst educational outcome.[2] Given that very few rural Chinese from the first two cohorts have tertiary-educated parents (see Figure 1), there is a risk of over-interpreting this unusual pattern. But it is also worth noting that the first two cohorts of Chinese grew up during the Maoist period. Many of them have experienced severe disruption of education as a result of the social and political turmoil of that period, such as the Cultural Revolution. Under Mao, political loyalty was often prized over technical expertise; intellectuals were frequently

---

[2]Note, however, that only the estimate for upper secondary origin is significantly different from the reference category. We do not show the confidence intervals in Figure 3 because that would make the Figure unreadable.

treated as politically suspect. All these factors might contribute to the unusual pattern (Deng and Treiman, 1997; Zhou *et al.*, 1998).

We are interested in how the association between social origin and educational attainment has changed over cohorts. This can be inferred from the slope of the cohort trend lines in Figure 3. A flat line would suggest that the gap between the relevant origin category and the reference category has remained stable, i.e. persistent inequality. An upward sloping trend line would imply that the gap is getting smaller, i.e. a weakening association. Conversely, a downward sloping line would imply that the relevant origin–destination association is getting stronger.

Figure 3 shows that the pattern for China is strikingly different to those observed for the four Western countries. Overall, the cohort trend lines for Germany, the Netherlands, the UK and the US are generally flat. So there is no evidence that educational mobility has risen or fallen for these countries. In China, however, the trend lines all have clear negative slopes. This means that, across cohorts, the association between parental origin and educational attainment is getting stronger. For the younger cohorts of Chinese who grew up during the market reform period, educational mobility has become harder to achieve.

4.3 Educational mobility: loglinear analysis

We now examine the data with loglinear and logmultiplicative models. To elaborate, we arrange the data for each country as a 3-way contingency table which cross-classifies the respondents according to their origin (O, i.e. parent's education), destination (D, i.e. their own education) and cohort (C). To each contingency table, we first fit the conditional independence model (con.ind), which can be represented as follows.

$$\log F_{ijk} = \lambda + \lambda_i^O + \lambda_j^D + \lambda_k^C + \lambda_{ik}^{OC} + \lambda_{jk}^{DC}. \qquad \text{(con.ind)}$$

In the equation above, i indexes origin, j indexes destination and k indexes cohort. F_{ijk} is the expected frequency of the ijk-th cell. It says that conditional on the grand mean (λ), the marginal distributions of O, D and C (λ_i^O, λ_j^D, λ_k^C), and also on the OC and DC associations (λ_{ik}^{OC}, λ_{jk}^{DC}), destination is independent of origin (hence no λ_{ij}^{OD} term in the model). Table 4 shows that this model does not fit the data at all in all five countries.

The second model that we fit is the constant social fluidity model (csf), which is basically the conditional independence model plus the λ_{ij}^{OD} term. Thus, the csf model takes into account the dependence of the respondent's educational attainment on his/her parents' education. But it also requires
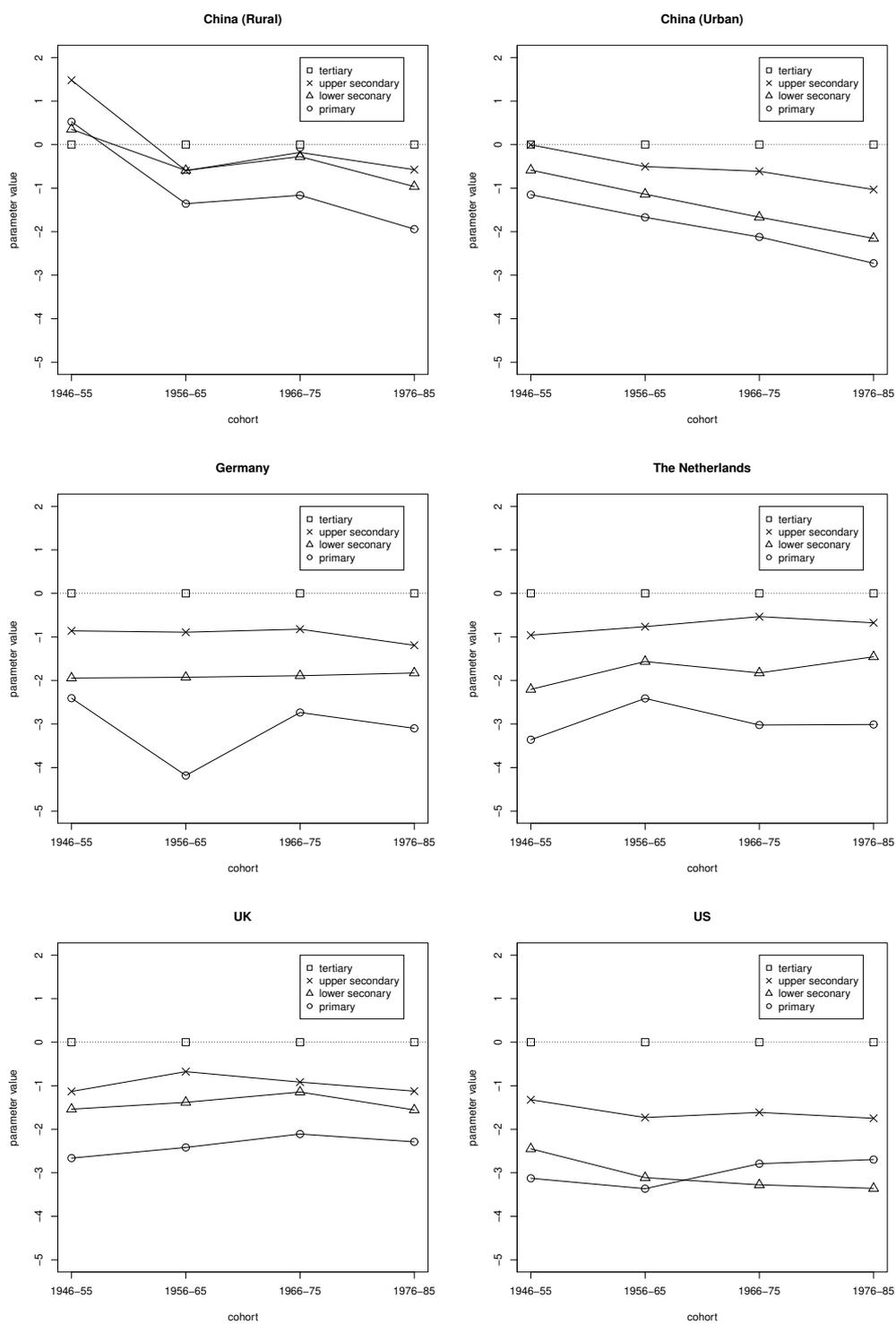
Figure 3: Ordered logit parameter estimates by country and cohort

Table 4: Goodness of fit of loglinear and logmultiplicative models fitted to origin by destination by cohort tables

country	model	G^2	df	p	model comparison	G^2	df	p
CN(R)	con.ind	745.08	36	.000				
	csf	104.85	27	.000	con.ind-csf	640.24	9	.000
	unidiff	57.61	24	.000	csf-unidiff	47.24	3	.000
CN(U)	con.ind	377.84	36	.000				
	csf	54.75	27	.001	con.ind-csf	323.09	9	.000
	unidiff	37.96	24	.035	csf-unidiff	16.80	3	.001
DE	con.ind	1144.03	36	.000				
	csf	37.55	27	.085	con.ind-csf	1106.48	9	.000
	unidiff	37.22	24	.042	csf-unidiff	0.33	3	.954
NL	con.ind	956.97	36	.000				
	csf	44.95	27	.016	con.ind-csf	921.02	9	.000
	unidiff	32.00	24	.127	csf-unidiff	12.95	3	.005
UK	con.ind	827.54	36	.000				
	csf	23.68	27	.648	con.ind-csf	803.87	9	.000
	unidiff	23.14	24	.512	csf-unidiff	0.54	3	.910
US	con.ind	1710.00	36	.000				
	csf	29.76	27	.325	con.ind-csf	1680.23	9	.000
	unidiff	25.45	24	..382	csf-unidiff	4.32	3	.229

the OD association to be strictly constant across cohorts (hence constant social fluidity). This is evident from the absence of the three-way interaction, λ_{ijk}^{ODC}, term in the csf model.

$$\log F_{ijk} = \lambda + \lambda_i^O + \lambda_j^D + \lambda_k^C + \lambda_{ik}^{OC} + \lambda_{jk}^{DC} + \lambda_{ij}^{OD}. \tag{csf}$$

Table 4 shows that we cannot reject the constant social fluidity model for the UK, the US and Germany ($p > .05$ for these three countries). Thus, for these three countries, our loglinear analyses confirm the results reported in section 4.2, that there was no change across cohorts in the association between parents' and children's educational attainment. For China and the Netherlands, however, although the constant social fluidity model represents a large improvement over the conditional independence model, it still does not fit the data by the conventional criterion of 5% type I error.

To investigate further, we fit the uniform difference or unidiff model to the data. The unidiff model requires that the *pattern* of the OD association to be the same across cohorts. But, unlike the csf model, it allows the *strength* of that association to vary between cohorts by a scalar, ϕ_k. The unidiff model can be represented as follows.

$$\log F_{ijk} = \lambda + \lambda_i^O + \lambda_j^D + \lambda_k^C + \lambda_{ik}^{OC} + \lambda_{jk}^{DC} + \phi_k \lambda_{ij}^{OD}. \tag{unidiff}$$

Table 4 shows that the unidiff model actually fits the data for the Netherlands, but not those for rural or urban China. However, when compared to the csf model, the unidiff model does represent a significant improvement in fit in all three cases. Given these results, we report in Figure 4 the estimates of the unidiff parameter, along with their 95% confidence interval. Because of the unusual pattern concerning the first cohort of rural Chinese (see Figure 3), we use the last birth cohort as the reference category for ϕ_k (i.e. $\phi_4 = 0$) in Figure 4. Given this parameterisation, a negative ϕ_k parameter would imply that the OD association is weaker for cohort k as compared to that of the last cohort.

It is clear that for Germany, the UK and the US, the strength of the association between parent's and child's education, as measured by ϕ_k, has not changed significantly by cohort (the relevant confidence intervals cross the horizontal dotted line). This is consistent with the observations that, for these three countries, the csf model fits the data and that the unidiff model does not improve on the csf model.

In the Netherlands, however, there is evidence that, when compared to the fourth cohort, the OD association is significantly stronger in the first and the third cohort, but not in the second cohort. So the pattern for the Netherlands is best described as trendless fluctuation.
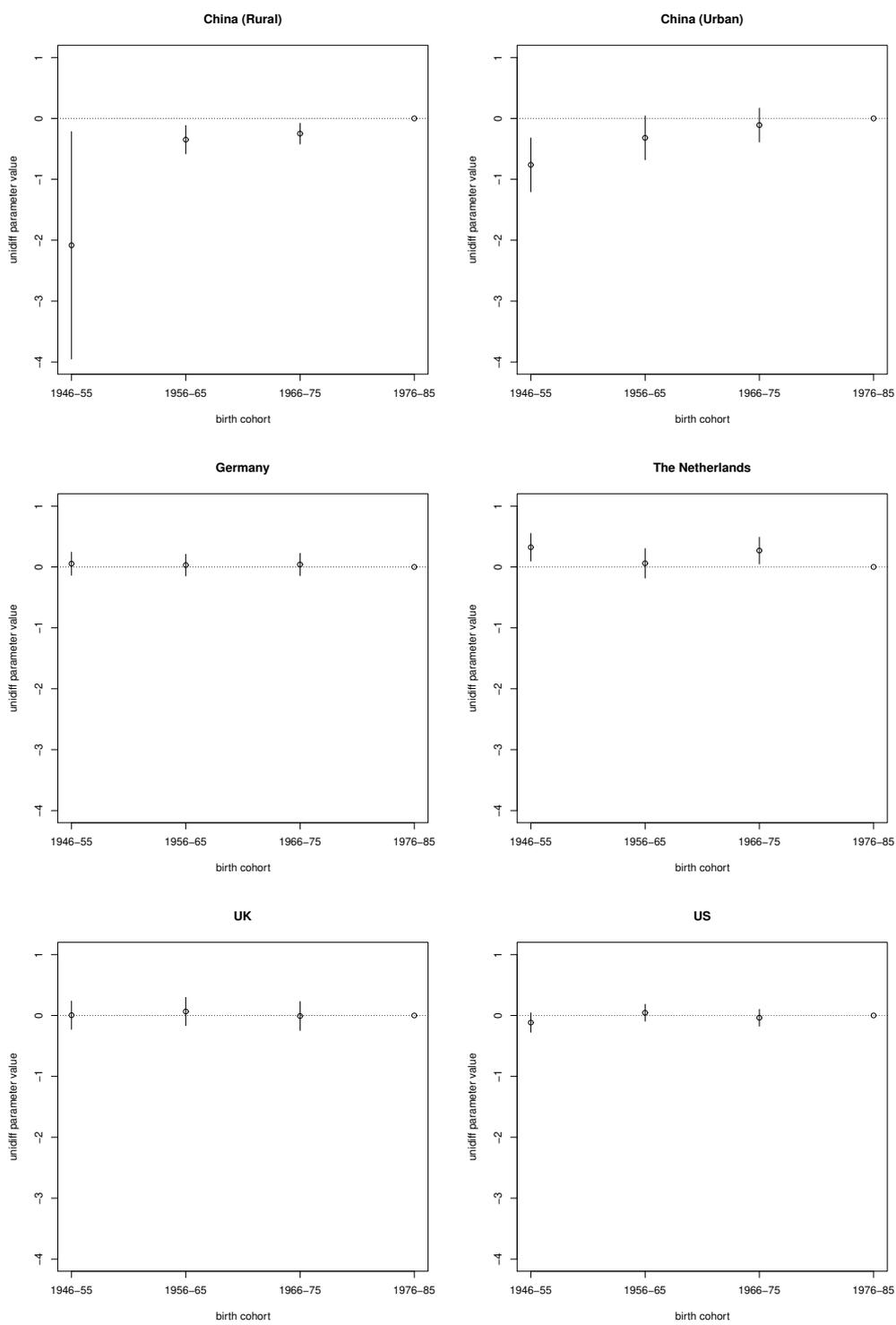
Figure 4: Unidiff parameter estimates by country and cohort

The pattern for rural and urban China cannot be more different: ϕ_k consistently becomes less negative, implying that the association between parents' and children's education gets progressively stronger over cohorts. This result is consistent with the ordered logit results reported in Section 4.2. Quite opposite to the pattern of persistent inequality for Germany, the UK and the US, or the pattern of trendless fluctuation for the Netherlands, we have seen declining intergenerational educational mobility in China.

So far, we have been analysing the data for each country separately, and the results speak to the cohort trends *within* country. But it is also important to ask how the countries compare with each other. To this end, we stack the three-way origin by destination by cohort tables together, and reanalyse the data using the last cohort of urban Chinese as the reference category. Figure 5 shows the estimated unidiff parameters for Germany, the Netherlands, the UK and the US by cohort. In each panel, we also report the unidiff parameters for urban Chinese.

Consistent with what we have seen above, Figure 5 shows that although the OD association has stayed roughly constant in the Western countries, it has been going up in China. Moreover, while the OD association for the last cohort of urban Chinese is still significantly below that for the US, it is at the level for Germany, the Netherlands and the UK. In other words, there is more educational mobility in urban China than in America. But the Chinese rates are broadly comparable to the European level.

4.4 Why has educational inequality increased in China?

In comparative education research, the finding of sustained increase in inequality of educational outcome is rare, particularly during a period of economic growth and educational expansion. Torche (2010) reports increasing class inequality in educational attainment in four Latin American countries during the 1980s. But that was a decade of deep economic crisis for those countries, and many children from poor households were pulled out of school so that they could work and contribute to the household income. Perhaps more similar to the Chinese case is the experience of post-communist Russia. Gerber (2000) finds that enrollment in Russia declined during the chaotic transition period, while inequality increased. In China, at the beginning of the market reform, as the radical educational policies of the Cultural Revolution were reversed, there was a temporary decline in (rural) enrollment rates (Treiman, 2013). But the market transition in China is very different from that in Russia. For one thing, income inequality in China actually fell in the initial few years of the market reform (Khan *et al.*, 1992). In any case, this argument could not explain why educational inequality continues to rise
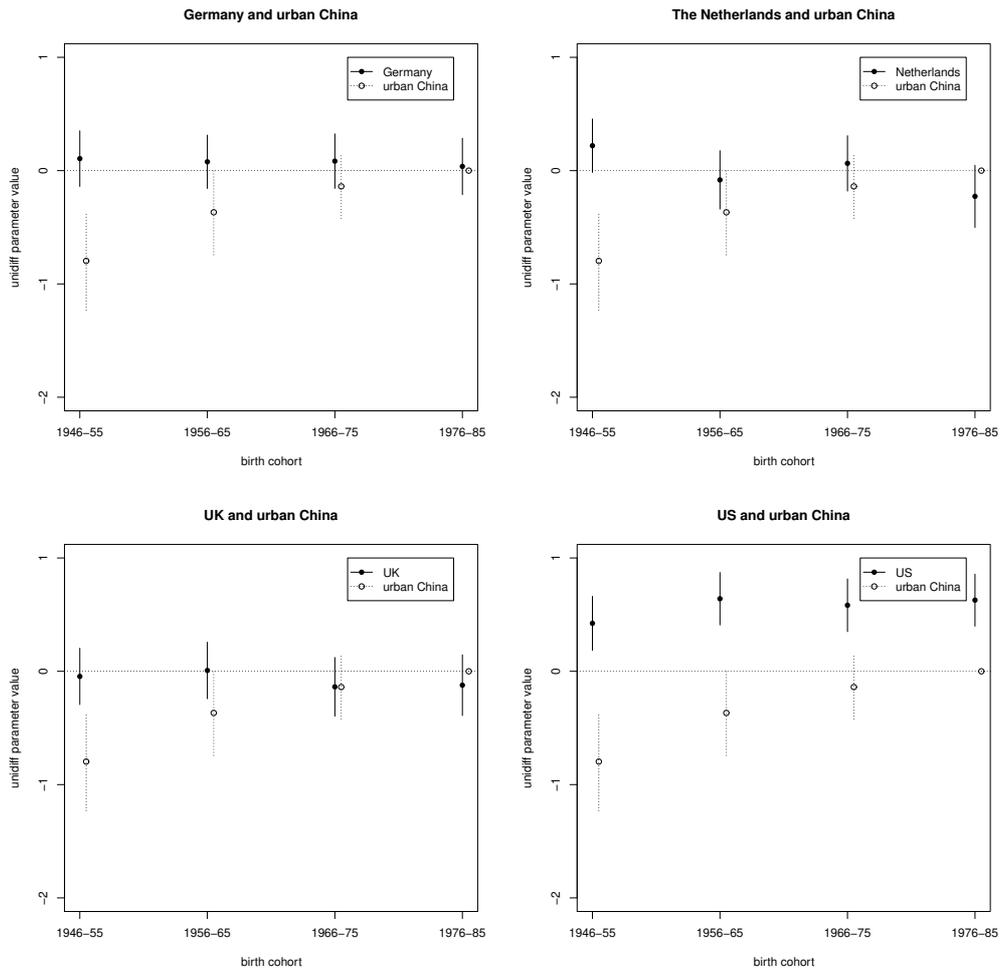
20

Figure 5: Unidiff parameter estimates of Western countries and urban China by cohort

for the 1976–1985 cohort, who grew up in a period of rapid economic growth and educational expansion.

How could inequality increase even as overall access to education improves? The Maximally Maintained Inequality (MMI) hypothesis states that children from more advantaged social origins tend to be the first to take advantage of the opportunities provided by educational expansion (Raftery and Hout, 1993). Equalization of opportunities will only occur when the demand from more advantaged groups has been saturated at that level.

In Maoist China, access to education at the upper secondary or tertiary level has long been suppressed, even for children with highly educated parents. For example, in analysis not shown in this paper, we find that, for the 1956–65 cohort, only about half of the respondents whose parents had senior high school qualifications went on to complete senior high school themselves. Also, under state socialism (1949–1977), the economic returns to education were very low, and the state actively sought to level class differences in access to education (Zhou *et al.*, 1998).

This changed with the start of the market transition in 1978. As part of Deng Xiaoping's call to 'respect knowledge and talent', the egalitarian goals of the Maoist period were replaced by the principle of efficiency. Market-based educational policies, such as the introduction of selective 'key point' schools and the increase in tuition fees for senior high school and college (from the mid-1990s onwards) made access to schooling considerably more unequal. Moreover, the market transition process was accompanied by a sharp rise in income inequality (Xie and Zhou, 2014) as well as rapidly increasing returns to education (Zhou, 2014). These broader increases in socio-economic inequality is mirrored by the rise of inequality in education opportunity.

Increasing regional and rural-urban differences in the availability and quality of education may have also contributed to the decline in educational mobility. The expansion of advanced education that is considered necessary to build a new class of cadres and technical experts has a strong urban bias. In combination with admissions criteria that favour local residents, this creates a structural disadvantage for rural students (Tam and Jiang, 2015). Moreover, the decentralization of educational financing that took place in the early 1980s increased regional disparities in educational spending, exacerbating regional inequality in access to and quality of education. For example, Golley and Kong (2013) find that children born in Beijing, Shanghai or Tianjin were 35 times more likely to attend college than children born in rural areas (see also Hannum and Wang, 2006).

5 Summary and discussion

This paper compares the level and trend of educational mobility in China with those in Germany, the Netherlands, the UK and the US. In brief, our findings can be summarized as stable (or persistent) mobility rates in Europe and the US, and declining mobility in China. The pattern of persistent inequality in European countries contradicts Breen *et al.* (2009), who find a gradual decline in class-based educational inequality across cohorts for most European countries in the 20th century, including Germany, the Netherlands and the UK. There could be several reasons for this discrepancy. First, whereas Breen *et al.* (2009) look at cohorts born between 1908 and 1964, our cohorts were born between 1946 and 1985. For the two birth cohorts that overlap with our study (1945–54 and 1955–64) Breen *et al.* find no clear decline in educational inequality (p. 1495). Second, we look at inequality based on parental education rather than parental class. Parental education is a stronger predictor than class, because it is strongly correlated with material as well as immaterial resources available in the household Shavit *et al.* (2007). Previous studies have found that the effect of education has been more persistent than that of social class Buis (2013).

In the Chinese case, we observe a sustained increase in inequality of education outcomes. In the comparative literature on educational inequality, which now covers most of the industrialized world, such a finding is highly unusual, particularly during periods of robust economic growth and educational expansion (see e.g. Blossfeld *et al.*, 2016; Pfeffer, 2008). The reason for this finding should be sought in China's recent history, i.e. the transformation from a relatively egalitarian socialist system (1949–1978) to a highly unequal market system (1978–present). Previous studies confirm that advantaged groups benefit disproportionately from the educational reforms and expansion that followed the market transition (Deng and Treiman, 1997; Zhou *et al.*, 1998). We show that inequality increase even further for the 'second market generation', which come of age during from the early 1990s, mirroring broader increases in socio-economic inequality during this period (Xie and Zhou, 2014).

This finding, which is consistent with other recent research (Wu, 2010; Yeung, 2013) is probably due to a combination of factors. First, market-based educational reforms, such as the introduction of tuition fees for senior high school and college in the 1990s, increase the importance of parental resources for children's educational success. Also, increasing returns to education strengthens the correlation between parental education and other aspects of social origin (especially income) over time. Second, the decentralization of educational funding in the 1980s increased regional disparities in

the availability and quality of schools. As a result, children from rural and poorer backgrounds tend to leave the education system before they reach the more advanced educational stages. In addition, there is longstanding discrimination against people with rural *hukou*. All these factors lead to a situation in which educational expansion at the tertiary level mainly benefits already privileged urban residents (Tam and Jiang, 2015). Any effort to counter the trend of rising educational inequality in China should therefore focus on reducing attrition and improving access to quality education in rural and less developed areas.

Our findings contribute to the comparative study on educational inequality in a number of ways. By adding the case of China, we expand the comparative literature that has so far focused on OECD countries (Blossfeld *et al.*, 2016; Breen *et al.*, 2009; Pfeffer, 2008). Moreover, our finding of increasing inequality challenges arguments such as Maximally Maintained Inequality (MMI) (Raftery and Hout, 1993) and Effectively Maintained Inequality (EMI) (Lucas, 2001), which set out to explain the persistence of inequality. Future theoretical development should consider situations in which educational inequality can increase over sustained periods of time, particularly in transitional societies.

That said, a number of limitations should be taken into account when interpreting our results. First, the trends described in this article refer to inequality based on parental education. Other aspects of social origin, such as region of birth, family structure and parents' occupational status, may have additional effects on children's educational outcomes. Furthermore, the harmonization of educational credentials necessarily involves a degree of compromise, which may mask important differences in the quality of particular educational degrees in different countries. In China, differentiation within nominally the same level of education (for example, between rural and urban schools) may be larger than in Europe where regional inequality is generally smaller.

References

Allison, P. D. (1999). Comparing logit and probit coefficients across groups. *Sociological Methods and Research*, **28**(2), 186–208.

Blossfeld, P. N., Blossfeld, G. J., and Blossfeld, H.-P. (2016). Changes in educational inequality in cross-national perspective. In M. J. Shanahan, J. T. Mortimer, and M. K. Johnson, editors, *Handbook of the Life Course*, volume II. Springer.

Boliver, V. (2011). Expansion, differentiation, and the persistence of social class inequalities in British higher education. *Higher Education*, **61**(3), 229–242.

Breen, R., Luijkx, R., Müller, W., and Pollak, R. (2009). Non-persistent inequality in educational attainment: evidence from eight European countries. *American Journal of Sociology*, **114**(5), 1775–1810.

Breen, R., Holm, A., and Karlson, K. B. (2014). Correlations and nonliner probability models. *Sociological Methods and Research*, **43**(4), 571–605.

Brunello, G. and Checchi, D. (2007). Does schooling tracking affect equality of opportunity? New international evidence. *Economic Policy*, **22**, 781–861.

Buis, M. L. (2013). The composition of family background: the influence of the economic and cultural resources of both parents on the offspring's educational attainment in the Netherlands between 1939 and 1991. *European Sociological Review*, **29**(3), 593–602.

Buis, M. L. (2017). Logisitic regression: what can we do what we think we can do? manuscript.

Bukodi, E. and Goldthorpe, J. H. (2013). Decomposing 'social origin': the effects of parents' class, status, and education on the educational attainment of their children. *European Sociological Review*, **29**(5), 1024–1039.

Deng, Z. and Treiman, D. J. (1997). The impact of the Cultural Revolution on trends in educational attainment in the People's Republic of China. *American Journal of Sociology*, **103**(2), 391–428.

Erikson, R. and Goldthorpe, J. H. (1992). *The Constant Flux: A Study of Class Mobility in Industrial Societies*. Clarendon Press, Oxford.

Gerber, T. P. (2000). Educational stratification in contemporary Russia: Stability and change in the face of economic and institutional crisis. *Sociology of Education*, **73**, 219–246.

Goldin, C. and Katz, L. F. (2008). *The Race Between Education and Technology*. Belknap Press, Cambridge, MA.

Golley, J. and Kong, S. T. (2013). Inequality in intergenerational mobility of education in China. *China and World Economy*, **21**(2), 15–37.

Hannum, E. and Wang, M. (2006). Geography and educational inequality in China. *China Economic Review*, **17**, 253–265.

Hannum, E., An, X., and Cherng, H.-Y. S. (2011). Examinations and educational opportunity in China: mobility and bottlenecks for the rural poor. *Oxford Review of Education*, **37**(2), 267–305.

Karen, D. (2002). Changes in access to higher education in the United States: 1980–1992. *Sociology of Education*, **75**(3), 191–210.

Khan, A. R., Griffin, K., Riskin, C., and Zhao, R. (1992). Household income and its distribution in China. *China Quarterly*, **132**, 1029–1061.

Kuha, J. and Mills, C. (2018). On group comparisons with logistic regression models. *Sociological Methods and Research*, pages 1–28.

Li, C. (2006). Sociopolitical change and inequality in educational mobility: impact of family background and institutional factors on educational attainment (1940–2001). *Chinese Sociology and Anthropology*, **38**(4), 6–36.

Lucas, S. R. (2001). Effectively maintained inequality: education transitions, track mobility, and social background effects. *American Journal of Sociology*, **106**(6), 1642–1690.

Luijkx, R. and de Heus, M. (2008). The educational system of the Netherlands. In *The International Classification of Education (ISCED-97). An Evaluation of content and criterion validity for 15 European Countries*, pages 47–75.

Mood, C. (2010). Logistic regression: why we cannot do what we think we can do, and what we can do about it. *European Sociological Review*, **26**(1), 67–82.

Pfeffer, F. T. (2008). Persistent inequality in educational attainment and its institutional context. *European Sociological Review*, **24**(5), 543–565.

Raftery, A. E. and Hout, M. (1993). Maximally maintained inequality: expansion, reform, and opportunity in Irish education, 1921–75. *Sociology of Education*, **66**(1), 41–62.

Rohwer, G. (2012). Estimating effects with logit models. NEPS working paper 10, National Educational Panel Study, Bamberg.

Ross, H. and Pepper, S. (1997). *Radicalism and Educational Reform in Twentieth-Century China: The Search for An Ideal Developmental Model.* Cambridge University Press, Cambridge.

Schneider, S. L. (2008a). The application of the ISCED-97 to the UK's educational qualifications. In *The International Classification of Education (ISCED-97). An Evaluation of content and criterion validity for 15 European Countries*, pages 281–300.

Schneider, S. L. (2008b). Applying the ISCED-97 to the German educational qualifications. https://doi.org/10.13140/RG.2.1.5139.2403.

Schneider, S. L. (2010). Nominal comparability is not enough: (in)equivalence of construct validity of cross-national measures of educational attainment in the European Social Survey. *Research in Social Stratification and Mobility*, **28**(3), 343–357.

Schütz, G., Ursprung, H., and Wößmann, L. (2008). Education policy and equality of opportunity. *Kyklos*, **61**(2), 279–308.

Shavit, Y., Arum, R., and Gamoran, A., editors (2007). *Stratification in Higher Education: A Comparative Study.* Stanford University Press, Stanford.

Tam, T. and Jiang, J. (2015). Divergent urban-rural trends in college attendance: state policy bias and structural exclusion in China. *Sociology of Education*, **88**(2), 160–180.

Torche, F. (2010). Economic crisis and inequality of educational opportunity in Latin America. *Sociology of Education*, **83**(2), 85–110.

Treiman, D. J. (2013). Trends in educational attainment in China. *Chinese Sociological Review*, **45**(3), 3–25.

Triventi, M., Kulic, N., Skopek, J., and Blossfeld, H.-P. (2016). Models of secondary education and social inequality. In *Models of Secondary Education and Social Inequality: An International Comparison.* Edward Elgar, Cheltenham.

Tsang, M. (2000). Education and national development in China since 1949: oscillating policies and enduring dilemmas. *China Review*, pages 579–618.

Van de Werfhorst, H. G. and Mijs, J. J. B. (2010). Achievement inequality and the institutional structure of educational systems: a comparative perspective. *Annual Review of Sociology*, **36**, 407–428.

Wang, X., Liu, C., Zhang, L., Luo, R., Glauben, T., Shi, Y., Rozelle, S., and Sharbono, B. (2011). College education and the poor in China: documenting the hurdles to educational attainment and college matriculation. *Asia Pacific Education Review*, **12**, 533–546.

Wößmann, L. (2003). Schooling resources, educational institutions and student performance: the international evidence. *Oxford Bulletin of Economics and Statistics*, **65**(2), 117–170.

Wu, X. (2010). Economic transition, school expansion and educational inequality in China, 1990–2000. *Research in Social Stratification and Mobility*, **28**, 91–108.

Wu, X. (2012). The household registration system and rural–urban educational inequality in contemporary China. *Chinese Sociological Review*, **44**(2), 31–51.

Xie, Y. (1992). The log-multiplicative layer effect model for comparing mobility tables. *American Sociological Review*, **57**(3), 380–395.

Xie, Y. and Zhou, X. (2014). Income inequality in today's China. *Proceedings of the National Academy of Scinece*, **111**(19), 6928–6933.

Yeung, W.-J. J. (2013). Higher education expansion and social stratification in China. *Chinese Sociological Review*, **45**(4), 54–80.

Zhou, X. (2014). Increasing returns to education, changing labor force structure, and the rise of earnings inequality in urban China, 1996–2010. *Social Forces*, **93**(2), 429–455.

Zhou, X., Moen, P., and Tuma, N. B. (1998). Educational stratification in urban China: 1949–94. *Sociology of Education*, **71**(3), 199–222.

A   Educational classification

Table 5: Harmonization of educational credentials across countries

	ES-ISCED	China	Germany	Netherlands	UK	US	6-level	4-level
(1)	less than lower sec.	primary or less	less than lower sec.	less than lower sec.	less than lower sec.	elementary or less	less than lower sec.	less than lower sec
(2)	lower secondary	junior high school	Hauptschule, Realschule	VMBO	GCSE	junior high school	lower secondary	lower sec.
(3)	lower-tier upper sec.	NA	Lehre, Berufs-fachschule	MBO	apprenticeship	NA	lower-tier upper sec.	
(4)	upper-tier upper sec.	senior high school	FH-reife, Arbitur	HAVO, VWO	A-levels	senior high school	upper-tier upper sec.	upper sec.
(5)	adv. vocational	NA	Meister Fachakademie	MBO-plus	HE-diploma	associate-degree, some college	adv. vocational	
(6)	tertiary	Junior college, university	FH, University	HBO, University	University	University	tertiary	tertiary

B Supplementary analysis

In the main text, we use a four-fold educational classification for all countries. For the respondents of the Western countries (though not for their parents), we can differentiate some intermediate qualifications. So we have repeated our analyses using the full six-fold classification for Germany, the Netherlands and the UK and, for the US, a five-fold classification (there is no lower-tier upper secondary qualification in the US). The results for the ordered logit analyses and the loglinear analysis are shown in Figures 6 and 7 respectively. When compared to the relevant panels of Figures 3 and 4, it is clear that using the more detailed educational classification leads to results that are very similar to reported those in the main text.
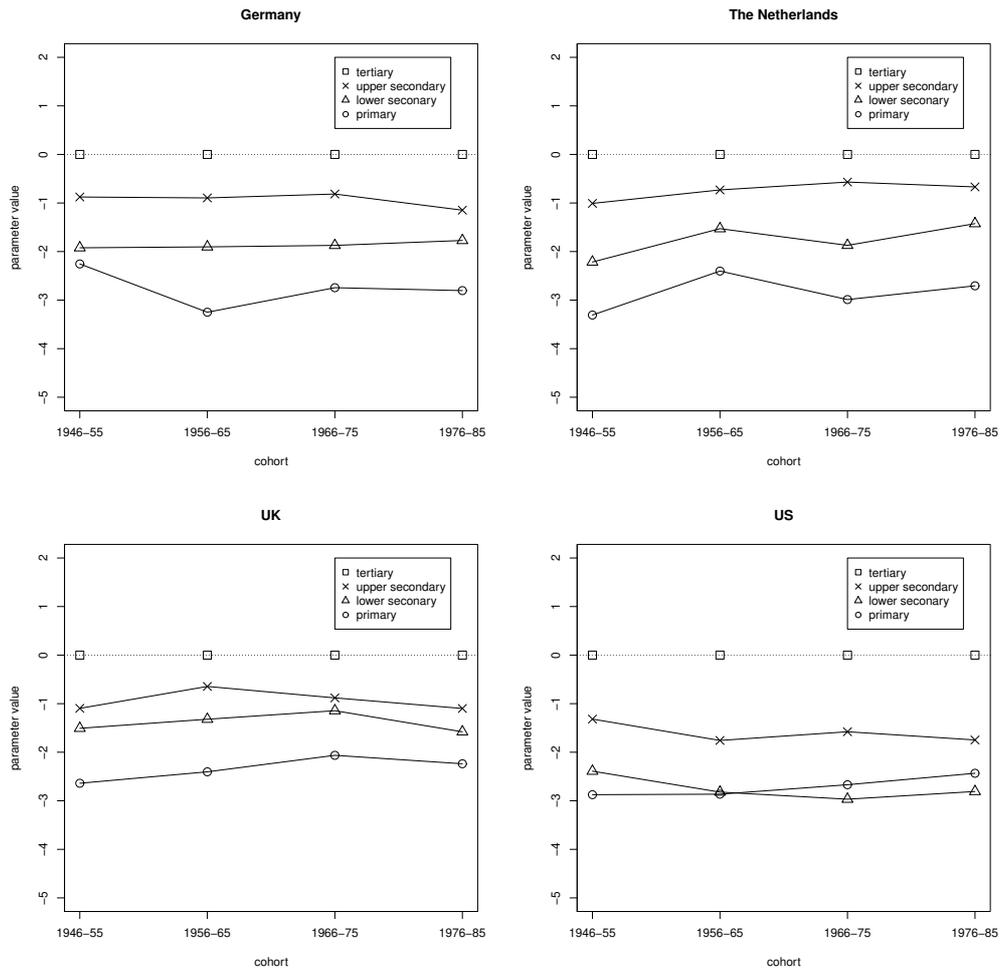
Figure 6: Ordered logit parameter estimates for Germany, the Netherlands, the UK and the US, using more detailed educational classification
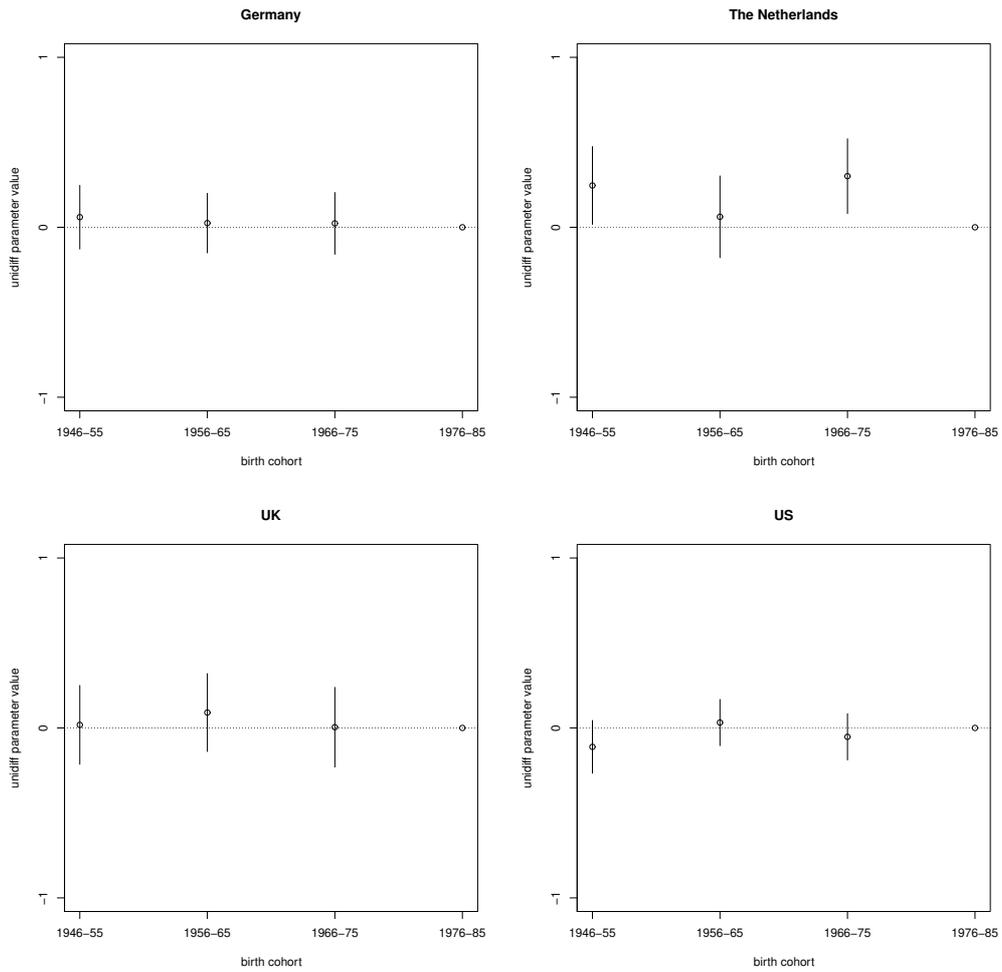
Figure 7: Unidiff parameter estimates for Germany, the Netherlands, the UK and the US, using more detailed educational classification