

Structural embeddedness of students' professional expectations: the Czech Republic and Taiwan in comparative perspective

Daniel Münich^a, Petr Matějů^{b†}, Jana Straková^c and Michael L. Smith^{a,b} 

^aEconomics Institute, Czech Academy of Sciences (CERGE-EI), Prague, Czech Republic; ^bInstitute for Social and Economic Analyses, Prague, Czech Republic; ^cInstitute for Research and Development of Education, Faculty of Education, Charles University, Prague, Czech Republic

ABSTRACT

We compare the role of gender, socioeconomic background and measured ability on students' secondary school placement and professional expectations in Taiwan and the Czech Republic, two countries that have experienced substantial reforms in their educational systems in the context of political change and economic development. Using data from the international PISA 2006 survey of 15-year-olds, our analysis reveals that Czech academic upper-secondary schools are much more selective in terms of socioeconomic background and gender than comparable Taiwanese senior high schools. Controlling for measured ability and other factors, students' professional expectations are also more closely linked to socioeconomic background and gender in the Czech Republic than in Taiwan.

KEYWORDS

Educational inequality; occupational expectations; gender gap; Czech Republic; Taiwan

1. Introduction

In this study, we employ a two-country comparative case study design to closely examine the role of family and school factors on the professional career expectations of 15-year-old youth. Research has shown that occupational expectations crystallise during adolescence for both boys and girls and are strong predictors of subsequent educational decisions and career attainment (Mello 2008; Schoon and Polek 2011). The determinants of professional expectations are particularly important in emerging markets in Central Europe and Southeast Asia, where the institutional reform of educational systems has been a cornerstone of government strategies aiming at increasing economic competitiveness and skilled labour while also ensuring the equality of educational opportunities. While both countries of our study – the Czech Republic and Taiwan – are of similar size, have experienced recent democratisation (Gerry and Mickiewicz 2008 and Cheng and White 1990) and are at a similar stage of economic development, they operate educational systems that substantially differ in the diversification of their secondary school systems and the expansion of tertiary education. Because of these similarities and differences, the Czech and Taiwanese cases are particularly useful for analysing the role of secondary school system diversification on the expectations

CONTACT Michael L. Smith  Michael.smith@cerge-ei.cz

[†]Deceased

of students to attain tertiary education and pursue professional careers. While we recognise the risk of under-identification in a comparison of two countries, such a research design is both widely used in the comparative education literature (e.g. Kerckhoff 1977; König and Müller 1986; Maurice, Sellier, and Silvestre 1986) and has the advantage of richly describing the role of institutional characteristics under scrutiny.

Why compare the role of determinants of occupational expectations in these two countries? First, both countries were selected as examples of larger groups of quite different educational systems – what one might call the German model and the East Asian model. Scholars often regard educational systems based on the German model, including the Czech one, to be among the most stratified in the world (Ertl and Phillips 2000; Buchmann and Park 2009). This model is characterised by a highly differentiated system of secondary education offering vocationally specific apprenticeship programmes, which are dead-end tracks that provide pupils with focused labour market opportunities but not credentials needed for tertiary education. Germany, Austria, Switzerland, the Czech Republic, Slovakia and Hungary are similar in this regard, as well as having geographic, historical and other commonalities. However, generalisations can only go so far: educational system characteristics can vary within federal states, including Germany, while other countries, such as Hungary, have reformed their systems of secondary education over time, making it difficult to control for changes in institutional context. The Czech Republic, by contrast, is an ideal case study of this type of system because it has maintained the structure of its secondary education system intact in recent decades.

In a parallel fashion, Taiwan's educational system is directly based on the Japanese model practiced in many East Asian countries, such as Japan, South Korea, Singapore, Hong Kong and mainland China. That model is characterised by a more universal system emphasising general education, standardised testing, widespread after-school tutoring (Huang 2013) and high cultural demands for students' academic achievement made by parents and teachers. In contrast to the German model, the East Asian model does not have dead-end vocational tracks, as all types of secondary schools prepare pupils for potentially applying to tertiary education. For the purposes of this study, Taiwan is a useful case because it too has maintained the structure of its secondary education system intact in recent decades. In both Taiwan and the Czech Republic, many of the institutional conditions we examine here can be seen as reflecting the cultural and historical differences between their respective regions.

In addition, comparative case studies of the mediating role of institutional context are still of vital importance because large-N cross-national studies have not been able to quantify variance in educational system characteristics in a unified way. Pfeiffer (2008) found that highly differentiated educational systems, such as those with dead-end educational pathways at the secondary level, have higher degrees of educational inequality compared to other industrialised countries with less differentiated systems. However, broad categorisations of countries in terms of 'low', 'high' and 'very high' degrees of institutional differentiation are prone to error due to the lack of detail; if countries were categorised differently (the Czech system could be categorised as 'very high' rather than 'high'), such re-categorisations would fundamentally affect the conclusions reached. The advantage of a comparative case study approach is that we can provide a detailed analysis of which specific institutional characteristics matter most for educational inequality and occupational expectations, while also contrasting those characteristics between countries to provide a deeper understanding of the degree of institutional variation involved.

For the reasons mentioned above, we explore the two most important factors shaping pupils' occupational expectations: the *family-school* link and the *school-work* link. Our first goal is to assess the role of gender and socioeconomic status (SES) on the odds of attending academic secondary schools, which are the most natural path to tertiary education in both countries. Second, we assess the impact of academic upper-secondary school attendance, gender and SES on student's professional expectations. In particular, we assess specific roles the 'elite' upper-secondary schools (called *Gymnasia* in the Czech Republic and *Senior High-Schools* in Taiwan) play in the formation of career expectations (taken *per se* as well as a proxy for college plans) among 15-year-old pupils attending 9th and 10th grades in both countries. Findings from our assessment contribute to understanding the role of 'elite' secondary schools in the reproduction of inequality as well as to the effectiveness of policies aiming at achieving higher equity in education.

2. Theoretical background

In recent decades, countries around the world have undergone a historically unprecedented expansion of tertiary education from 'elite' to 'mass' systems (Schofer and Meyer 2005). While it was believed that such expansions in enrollment would grant a greater share of educational opportunities to pupils of lower SES, thus reducing educational inequalities (Breen et al. 2009), empirical studies have found that this is often not the case (Shavit and Blossfeld 1993).

In developed countries, the historically unique expansion of educational opportunities started decades ago and increased enrolment shares several times over (Shavit and Blossfeld 1993; Shavit and Müller 1998; LeVine, LeVine, and Schnell 2001). In Taiwan, the expansion of institutions of tertiary education began in the 1950s and 1960s, then paused in the 1970s under tight government regulation, and then continued its rapid expansion in the mid-1980s through a policy of decentralisation (Tsai and Shavit 2007). The impact of these reforms, combined with the previous approaches to educational expansion, was profound: in 1960, the few institutions of tertiary education that existed served fewer than 7000 students all together, whereas by the year 2000 over a million students attended Taiwanese colleges and universities. In the Czech Republic, by contrast, the expansion, started only after the collapse of communism, was much more modest in degree, and has stalled in recent years.

Our analysis is framed by three main theoretical concepts. First, theories developed by Boudon (1974), Mare (1981) and Raftery and Hout (1993), often framed as the *theory of maximally maintained inequality* (MMI), predicts that access to higher education among individuals from groups of lower SES can increase – and thus educational inequalities are reduced – only after enrolment rates for the most socioeconomically advantaged groups reach a saturation point – which may or may not be achieved, depending on the educational policies in place. Second, in contrast to MMI, the *theory of effectively maintained inequality* (EMI, Lucas 2001) predicts that inequalities can still persist or increase with educational expansion if the school system sorts pupils into different educational trajectories. The theory of EMI emphasises that at each level of education, qualitative differences or tracks may exist that more privileged families can utilise to ensure a higher quality education for their children, and thus greater life prospects compared with others.

The third relevant theoretical ground we build on is the notion of *structural* (institutional) *embeddedness of education inequality*, emphasising the role of institutional context in

educational and occupational destinations. Müller and Karle (1993) compared educational attainment in nine countries and showed that cross-national differences in educational systems may explain different effects of class background on children's educational attainment. Müller and Shavit (1998) developed a widely used classification of educational systems based on three dimensions related to institutional characteristics of secondary school systems: the degree of *standardization* (to what extent the quality of education is homogenous countrywide); the degree of *stratification* (degree of tracking at the upper-secondary level); and the degree of *vocational specificity* (the proportion of students leaving schools with occupationally specific skills). They argued that these three educational system characteristics are intertwined and significantly impact overall inequality in access to higher education.

The impact of secondary school system differentiation on the link between social background and educational attainment has been elaborated on in many empirical studies (e.g. Kerckhoff 1977, 1993, 2000, 2001; Buchmann and Ben 2002). These studies found that in highly stratified (or differentiated) secondary school systems, the presence of different tracks strengthens the impact of social background on the choice of a particular type of school net of other individual characteristics (e.g. ability), and thus leads to higher inequality in access to higher education and educational attainment.

Most recently, Buchmann and Park (2009) analyzed sociopsychological mechanisms in the role of institutional factors on the formation of pupils' occupational expectations, finding that in highly differentiated educational systems, socioeconomic status is highly predictive of the type of school a student attends. Their analysis of PISA 2003 data also found that students of lower-SES background were significantly less likely to attend secondary schools providing the most direct pathway to college or university, and that in countries with highly differentiated secondary school systems, the type of school students attend has a stronger impact on their expectations than in countries with less differentiated secondary school systems (Buchmann and Park 2009). Unfortunately, however, Buchmann and Park (2009) practically neglect the role of gender in their interpretation, even though their coefficients indicate a strong effect of gender on educational expectations in the Czech Republic and Hungary.

In this paper, we build our analytical strategy on these currents of research, and use the available empirical evidence to test two hypotheses:

- (1) Due to the different degrees of diversification of the upper-secondary school system, the effects of gender and SES on the odds of enrolment to academic secondary schools are significantly stronger in the Czech Republic than in Taiwan;
- (2) The higher degree of diversification of the upper-secondary school system in the Czech Republic generates stronger effects of both the SES background and gender on the formation of professional career orientations than in Taiwan.

Contrary to many other studies in this area, we build on detailed knowledge of the institutional and policy features that may contribute to inequalities in access to education in both countries.

3. Description of educational systems

In this section we review the educational systems in both countries, focusing on those characteristics most relevant for our analysis. In general, both systems have nine years

of compulsory education with very low dropout rates, and both make widespread use of traditional teaching methods and demanding academic content. Both countries operate upper-secondary schools offering both academic and vocational education tracks with high participation and completion rates. Both systems exhibit stratification, though to different degrees. While the Czech system sorts students at early ages into tracks of different study requirements, in the Taiwanese system stratification by school prestige is practiced only at the upper-secondary level (Tsai, Gates, and Chiu 1994; Tsai and Shavit 2007).

3.1. Compulsory education

Compulsory education in both countries starts at age 6 or 7 and lasts for 9 grades. In Taiwan, compulsory education is delivered via a 6-year *Elementary School*, followed by three years at *Junior High Schools* at the lower-secondary level. No tracking into selective lower-secondary school types is present in Taiwan. By contrast, in the Czech Republic, compulsory education includes five years of primary and four years of lower-secondary education. Mainstream *Basic Schools* serve all pupils during first five grades and about 90% of them through the 6th to 9th grades. *Multi-year Gymnasias*, which are 6- or 8-year schools to which pupils transfer after completing their 7th or 5th grade of basic school, respectively, enroll the remaining 10% of pupils at the lower-secondary level. Multi-year gymnasias are attended largely by students from families with higher SES; in 2009, for example, 54% of 9th grade Multi-year gymnasium students had at least one parent with tertiary education, compared to mere 16% among elementary school students.

3.2. Upper-secondary education

Both countries achieve very high participation rates at the upper-secondary level – above 95% of the respective age group. Both countries operate academic and vocational tracks. However, the structures, substance and permeability of the tracks differ substantially.

The Czech system of upper-secondary education has three tracks. Only two tracks lead to a school leaving examination *Maturita* (ISCED 3A) that entitles pupils to apply for tertiary education: four-year *Gymnasias*, which are academically oriented, and *Vocational Schools* (also called Technical Schools), providing vocationally oriented education. The third track, *Apprenticeship Programs*, is attended by the remaining pupils, typically lasts three years and is concluded by an *Apprenticeship Certificate* (ISCED 3C), which does not qualify them for tertiary school entry.¹ The share of the age cohort enrolled into this track was 45% and 35% in 2000 and 2012, respectively.

Taiwanese upper-secondary system also has three tracks but each makes their graduates eligible to apply for tertiary education. Thus, Czech Apprenticeship programmes do not have a counterpart in Taiwan. *Senior High Schools* last for three years and provide students with academic education, similar to Czech Gymnasias. *Senior Vocational Schools* also last for three years, but place heavier emphasis on more immediate labour market oriented vocational skills, like Czech Vocational Schools. In addition to these tracks, pupils can also attend 5-year *Junior Colleges* – the first three years of the curriculum being at the upper-secondary level, with the remaining two at the tertiary level – which provide professional education. Their curriculum is similar to that of Senior Vocational Schools but in addition Junior College students graduate with the equivalent of an associate degree and most of them enter

the workforce instead of additional tertiary studies. Students may also choose to continue their studies at a two-year *Technical Institute* or apply to tertiary institutions offering more advanced degrees. For more details of these and other aspects of the educational systems, see OECD (2012), Eurydice (2012) or NUFFIC (2012).

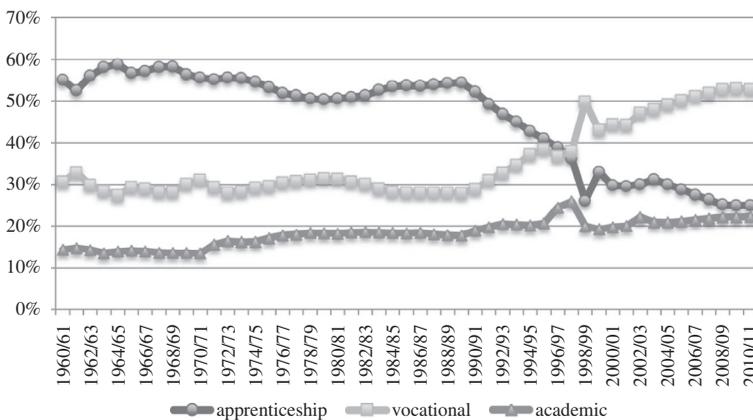
3.3. Trends

During the last two decades, the proportion of enrolment in different tracks at the upper-secondary level has been subject to substantial changes in both countries. In the Czech Republic, the proportion of pupils in both *Gymnasias* and *Multi-year Gymnasias* grew somewhat during the early-1990s but stagnated afterwards at 20%, while the enrolment rate to tertiary education almost quadrupled. The Czech Republic has the lowest proportion of pupils in academic programmes within the OECD. This development contrasts with Taiwan, where the proportion of pupils in Senior High Schools expanded during last two decades from 30 to 55% at the expense of enrolment into Senior Vocational Programmes (see Graphs 1 and 2).

The share of enrolment in Czech Vocational Schools grew more steadily from 20% in 1990 to 50% in 2010, while during the same period the enrolment share in Apprenticeship Schools decreased from 60% to less than 30%. Another outcome of these developments is that the proportion of pupils concluding upper-secondary education by the secondary school leaving examination (*maturita*), making them eligible for tertiary education, almost doubled from 40% in the early-1990s to 75% in 2011.

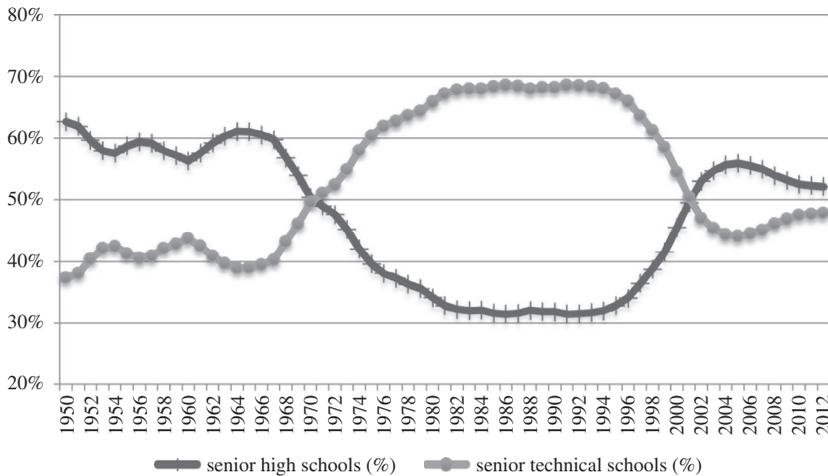
3.4. Tracking to upper-secondary education

As suggested above, the tracking of students to different school types starts earlier and is more intensive in the Czech Republic than in Taiwan. In the former, one of the most important educational transitions occurs at the end of the 5th grade, when about a fifth of students take an admissions test to very selective multi-year Gymnasias. Students usually prepare months in advance for entrance exams with their parents or attend special courses



Graph 1. Trends in participation in upper-secondary tracks in the Czech Republic.

Note that fluctuations during years 1996–2000 were caused by the extension of compulsory education by one year, from 8th to 9th grade.



Graph 2. Trends in participation in upper-secondary tracks in Taiwan.

organised by selective schools or private agencies. Those who do not get into multi-year Gymnasia continue in elementary school for grades 6–9.

At the end of the 9th grade, the transition to upper-secondary levels in the Czech Republic and Taiwan differs substantially. In the Czech Republic, there are no national criteria, and thus pupils apply freely to upper-secondary schools through school specific admission processes. Admission to Gymnasia is on average less selective compared to multi-year Gymnasia, though they are much more selective than vocational schools. With few exceptions, apprenticeship schools are considered the least desirable in terms of the job opportunities they provide, and thus admissions to them is non-selective due to spare capacity.

In Taiwan, 9th graders transfer to three school tracks (see Graph 2). Admission to senior high schools is selective and is fully determined by scoring in a *national senior high school entrance exam* held at the end of the 9th grade. Larger differences in the perceived quality of individual *senior high schools* fosters very intensive competition among applicants, who devote a lot of time and effort into advance preparation for the national exam; 34% of Taiwanese pupils participating in PISA 2006 attended such shadow education programmes for the exam, compared to 18% of Czech pupils. Taiwanese who apply for senior vocational schools take the national vocational school entrance exam. In case of both school types, public schools are more popular than private ones and later ones have been traditionally viewed as a backup option for those unable to score high enough for public schools.²

3.5. Transition to tertiary education

During the last two decades, tertiary education has expanded in both countries. In 2006, the net entry rate to tertiary education reached 50% in the Czech Republic (compared to 25% a decade earlier) and exceeded 90% in Taiwan. The tertiary system expanded much earlier in Taiwan compared to the Czech Republic, particularly due to the growth in the number of junior colleges. Thus by the mid-2000s, 41 and 43% of Taiwanese men and women aged 25–34, respectively, had achieved some form of tertiary education, compared to only 26% for Czech men and 22% for Czech women of the same cohort.

In the Czech Republic, the secondary school leaving examination (*Maturita*) is organised by individual secondary schools. Those who have passed the school leaving exam, that is, over 70% of the 18–19-year-old population, can apply for tertiary-level studies, namely at tertiary professional schools (ISCED 5B), or at higher education institutions (ISCED 5A and 6). Each tertiary education institution determines its own enrolment procedures including admission criteria. The probability of enrolling in tertiary education among Gymnasia graduates is much higher compared to vocational school graduates. Of all gymnasia graduates, almost 100% apply and 95% enroll, whereas only 65% of vocational school graduates apply and 50% are enrolled. Overall, women comprise 56% of newly registered students at the tertiary level.

A specific feature of the Czech tertiary system is that most (80%) BA graduates continue at MA programmes (often in the same academic department), as a BA degree is not considered by many to be a sufficient and relevant educational credential. Public schools are tuition-free and formula funded by the state with a quota imposed on the number of students funded, whereas private programmes represent a relatively small segment of total enrolment, particularly in business and administration, and charge annual tuition fees corresponding to about twice the average monthly salary. Financial support to students is minor, and there is no national system of student financial aid.

In Taiwan, all students completing upper-secondary education can apply for tertiary education and most do. Scoring high on the national university entrance exams is crucial for enrolment to tertiary education, especially to the most prestigious institutions. Entrance to university is administered via two alternative methods: recommendations or examinations. Those who participate in recommendations take the *National academic exam* and select a list of majors that they are applying to. Those who do not choose the recommendations process, or those failed with their applications, can participate in *National university entrance exams*. Graduates from vocational tracks are notably less likely to transition to tertiary education than their counterparts in the academic track. In 2010, 95% of graduates from senior high schools transferred to the tertiary level (girls – 96%; boys – 94%). Among senior vocational schools graduates, this was 82% (total), 84% (girls) and 81% (boys).

Institutions of higher education in Taiwan are also stratified by prestige as in the Czech Republic but also by function, distinguishing academic and vocational track. *Junior colleges* (enrolling pupils already after the 9th grade) provide vocational education. The academic track, *colleges*, *universities* and *graduate schools* pursue advanced study and educate professional personnel. In contrast to the Czech case, in Taiwan colleges and universities, both private and public, have been able to charge tuition fees since 1999. At the time of the PISA 2006 data collection, the average tuition fee at public colleges and universities in Taiwan was somewhat above the average monthly income (roughly 1,300 US\$ PPP), while private universities charged almost twice as much. Since 2005, Taiwan has had generous student financial assistance including parental income contingent grants, free-housing for students from low-income households, and government loans to students from middle and low-income families.

4. Data and methodology

Our empirical analysis is based on PISA 2006 data, representative samples of 15-year-old pupils in both countries. The data provide rich information on pupils' characteristics,

including literacy test scores, their parental and household background and information on the school attended. To secure representativeness, the data contain pupils from various grades, though the great majority of 15-year-olds in both countries come from the 9th and 10th grade. Data cover all school types discussed in the previous section. We use data from year 2006 because Taiwan did not participate in previous rounds of PISA (2003 and 2000) and data from 2009 do not provide information either on college plans nor on occupational aspirations. PISA 2006 data are unique for such an analysis because they provide information for both countries and survey pupils at an age that is important for their future educational path.

To test our hypothesis, we analyse two outcomes: (1) enrolment into a secondary academic programme and (2) pupil's aspirations for an employment career as a professional. We consider these as sequentially determined outcomes. Outcome (1) is jointly determined by an intentional choice (application to an academic programme) and the admission process, which depends both on personal traits and external factors. Outcome (2), professional career expectations, is a revealed preference of the pupil that is co-determined by the previous outcome (1). In PISA 2006, pupils were asked an open-ended question on their preferred occupation, operationalised in terms of the 4-digit 2008 ISCO (International Standard Classification of Occupations) scale.

Table 1 depicts the distribution of educational attainment of fathers among 10th graders in the 1st digit occupational ISCO groups. For the purpose of our analysis we classify three educational attainment groups: the attainment of less than upper-secondary education (i.e. anyone who did not receive the credentials needed to qualify for college studies), the attainment of upper-secondary education allowing for follow-up tertiary studies, and the attainment of any form of tertiary education. Professional occupations (i.e. ISCO major occupational group 2) are strongly associated with tertiary educational attainment. In particular, 78% of Czech fathers in professional occupations have a tertiary education and 52% in Taiwan. Other occupations, including ISCO major group 1 (*legislators and senior officials*) are dominated by people with medium or low education. Occupational ISCO major group 10 represents cases when occupational information is not reported. Because of this, on our analysis we will focus on pupils' aspirations of achieving 'professional occupations' (i.e. ISCO occupation group 2), which include all specialist or technical service occupations, and which almost always require a college degree.

Table 2 presents the occupational expectations of 15-year-old pupils across the same 10 categories as Table 1. We see much greater aspirations for professional occupations in Taiwan (42.8% of all 15-year-old pupils) compared to the rather low aspirations among Czechs (24.7%). Note that the relative difference in professional career expectations is about the same as the relative difference in enrolment into upper-secondary academic programmes between the two countries. This finding is in line with the results of Buchmann and Park (2009), who found pupils' occupational expectations more ambitious in countries with less differentiated school systems. We can also observe that there is much greater variation in professional expectations by gender in the Czech Republic (where twice as large of a share of girls compared to boys would pursue that path) than in Taiwan. Czech boys, it seems, are much more oriented towards manual trade or craft work, which is due to the strong influence of dead-end track apprenticeship programmes, which predominantly train boys in manual craftsmanship. Lastly, another feature distinguishing both countries is the large proportion (almost one-third) of Czech pupils not being able to specify their occupational expectations. In Taiwan, there are only 17% of such pupils.

Table 1. Distribution and educational structure of fathers' occupations among 10th graders (based on PISA 2006)(%).

Occupational group*	Within occupational group, Czech fathers with ...				
	Czech fathers, total	less than upper-secondary education	upper-secondary education	tertiary education	missing data on education
1	20.8	22.3	40.8	36.6	0.2
2	7.6	2.0	18.5	78.3	1.1
3	12.0	11.5	57.0	30.8	0.5
4	1.6	39.1	53.7	7.1	0.0
5	4.8	35.3	49.7	15.0	0.0
6	1.7	45.6	45.6	0.7	7.9
7	28.8	61.2	31.5	5.8	1.3
8	13.3	59.7	31.6	7.4	1.2
9	2.8	57.9	33.3	8.7	0.0
10	6.9	28.5	29.8	11.1	30.5
Total	100	38.3	36.9	21.7	3.0

Occupational group*	Within occupational group, Taiwanese fathers with ...				
	Taiwanese fathers, total	less than upper-secondary education	upper-secondary education	tertiary education	missing data on education
1	27.5	17.9	62.4	19.5	0.1
2	10.0	9.3	38.8	51.8	0.00
3	8.2	17.7	65.8	16.1	0.3
4	6.6	16.5	66.3	16.7	0.3
5	6.3	34.6	58.1	7.2	0.0
6	3.3	58.5	40.2	1.2	0.0
7	17.0	51.1	45.9	2.9	0.0
8	7.9	42.9	55.8	1.1	0.0
9	7.4	42.5	52.3	5.0	0.0
10	5.8	30.4	41.1	10.0	18.6
Total	100	29.5	54.3	15.0	1.1

*Occupational 1st digit ISCO codes: 1 – Legislators, senior officials and managers, 2 –Professionals, 3 – Technicians and associate professionals, 4- Clerks 5 – Service workers and shop & market sales workers, 6 – Skilled agricultural and fishery workers, 7 – Craft etc. trade workers, 8 – Plant and machine operators and assemblers, 9 – Elementary occupations, 10 – Do not know/n.a.

Table 2. Distribution of the occupational aspirations of 15-year-old pupils by gender in the Czech Republic and Taiwan (PISA 2006) (%).

Occupational group*	Czech boys	Czech girls	Czech pupils, all	Taiwanese boys	Taiwanese girls	Taiwanese pupils, all
1	8.0	6.5	7.4	11.6	11.2	11.4
2	17.2	34.6	24.7	41.7	44.0	42.8
3	12.6	10.1	11.6	11.0	11.7	11.4
4	0.4	4.8	2.3	3.0	4.8	3.9
5	3.5	11.0	6.8	5.7	11.5	8.5
6	0.8	1.8	1.3	0.2	0.1	0.2
7	17.1	1.1	10.1	3.2	0.9	2.1
8	2.9	0.2	1.7	0.7	0.1	0.4
9	0.3	0.2	0.2	0.6	0.3	0.5
10	37.2	29.6	33.9	22.2	15.3	18.9
Total	100.0	100.0	100.0	100.0	100.0	100.0

*Occupational 1st digit ISCO codes: 1 – Legislators, senior officials and managers, 2 –Professionals, 3 – Technicians and associate professionals, 4- Clerks 5 – Service workers and shop & market sales workers, 6 – Skilled agricultural and fishery workers, 7 – Craft etc. trade workers, 8 – Plant and machine operators and assemblers, 9 – Elementary occupations, 10 – Do not know/n.a.

Lastly, our analysis is restricted to 10th graders (i.e. those who had already made the transition to upper-secondary education). Given that the PISA surveys 15-year-olds, the pupils sampled typically attend 9th or 10th grade. In both countries, sorting into academic schools takes place between these two grades. Thus in order to observe whether or not pupils attend academic or other upper-secondary schools, we must restrict the analysis to 10th graders, which is common practice in research of this type.

5. Results

To investigate the relationships between the degree of secondary school system diversification, on the one hand, and the effect of gender and SES on student's secondary school placement and professional career expectations, we model the determination of binary outcome variables using parsimonious specification of logistic binomial models with a multiplex of explanatory variables. In particular, we model enrolment into an elective 'academic programme' as a binary outcome of pupil i (=1 if student i is enrolled into an academic programme, = 0 otherwise) determined by the following observables: plausible values of PISA test-scores in math and reading; parental occupational status, measured as the highest occupational status of either parent expressed in the format of the International Socio-Economic Index of Occupational Status, which is a widely accepted measure of occupational status in cross-national research (Ganzeboom, De Graaf, and Treiman 1992; Ganzeboom and Treiman 1996); a gender dummy variable (= 1 if female; = 0 if male); and mother's and father's level of educational attainment, measured in terms of dummy variables capturing three levels of educational attainment: tertiary education, complete upper-secondary (i.e. with credentials enabling further studies), and less than complete upper-secondary education, which is used as the reference category. Lastly, the model includes a stochastic term ϵ_1 capturing unobserved effects.

Similarly, we model the determination of 'professional expectations,' coded as 1 if aspiring for a professional career (otherwise = 0), via a binomial logistic binomial regression with the following explanatory variables: plausible values of PISA test-scores in math and reading; parental occupational status; a gender dummy variable (= 1 if female; = 0 if male); mother's and father's level of educational attainment; and whether the pupil attended an 'academic programme' or not. All explanatory variables in the 'academic programme' and the 'professional expectations' logistic regressions are coded in the same way. Lastly, the model includes a stochastic term ϵ_1 capturing unobserved effects.

5.1. Descriptive statistics

Table 3 presents means of variables from Models 1 and 2 in country-specific panels. We provide means and select standard deviations for both Czech and Taiwanese samples, as well as analytically relevant subsamples: pupils in academic schools enabling tertiary studies; pupils in non-academic schools; pupils with professional expectations; and pupils without professional expectations.

As expected, women are notably over-represented in academic programmes in the Czech Republic (65%) while the gender gap is nearly absent in Taiwan (46% of women). The gender gap in the Czech Republic is due to a mixture of effects: at younger ages when the first tracking appears, girls are on average better prepared to pass admission exams to multi-year

Gymnasia, while boys have higher inclination to technical fields and have wider options offered by the vocational schools track. An important role could be also played by higher aspirations and motivations of girls to attend prestigious multi-year Gymnasia. As noted earlier, Czech girls are similarly much more likely than boys to aspire to become professionals, while aspirations of both genders in Taiwan are more or less balanced.

Heterogeneity in test scores among all 15-year-olds has been described already.³ The picture is somewhat different when we take into account tracking and focus only on 10th graders (i.e. heterogeneity after tracking). In maths Taiwanese 10th graders perform on average better than Czechs by 23 points, while in reading Czechs and Taiwanese perform similarly (see Table 3). However, very different patterns emerge if we compare pupils separately by academic and non-academic programmes. Czechs in academic programmes outperform Taiwanese in both math and reading. While the difference in math is minor, the gap in reading is huge at 50 points. The average performance of Czechs in non-academic programmes is also higher than in Taiwan, by 9 points in maths and 20 points in reading. Better relative mean performance of Czechs (compared to Taiwanese) in individual types of programme compared to overall average performance is due to the notably higher selectivity of Czech academic programmes enrolling a rather small (20%) proportion of the most talented pupils, compared to the large cohort share (55%) enrolled in academic programmes in Taiwan. Drawing a notably smaller share of pupils from the upper tail of ability distribution in the Czech Republic, their average test scores are high. In other words, Czech pupils in highly selective Gymnasia show the highest average test score performance but given that they represent small proportion of the whole cohort, they contribute relatively little to the overall mean of all 10th graders in the Czech Republic.

Standard deviations of test scores in Table 3 document that Czech pupils are more heterogeneous in reading skills, while Taiwanese are more heterogeneous in maths skills. The comparison of overall- to within-school-type heterogeneities in test scores provides an insight on the extent to which selectivity is based on a particular type of literacy. The overall heterogeneity naturally always exceeds within heterogeneity but the differences are not substantial. It indicates that the selectivity into school types is co-driven by factors other than abilities. Also note that within-school-type heterogeneities are always lower in selective schools compared to non-selective ones, and that the difference is higher in maths in Taiwan and in reading in the Czech Republic. This could be due to the higher weight put on maths skills in the admissions process in Taiwan and on reading skills in the Czech Republic (Tsai, Smith, and Hauser 2017).

Recall that according to Table 1, the distribution of parental educational attainment in the pool of 10th graders is similar in both countries. The most represented are parents in the medium education group (full upper-secondary education) and its higher share in Taiwan is mostly at the expense of smaller share of the highly educated group. This makes the overall educational achievements of parents more evenly distributed in the Czech Republic. An interesting finding is that the proportion of mothers with higher education in the Czech Republic is on average the same as of fathers (22%), while in Taiwan, the proportion of fathers with higher education (15%) is notably higher than that of mothers (only 9%).

Overall, there seem to be strong associations between parental education and pupil's enrolment into academic programmes in both countries. Mother's education is more important than father's. In the Czech Republic, almost 50% of pupils in academic programmes have tertiary educated fathers, while a corresponding proportion in non-academic programmes

is only about 15% (note that the average proportion of fathers with tertiary education in the Czech Republic is only 22%). Proportions of tertiary educated fathers of Taiwanese pupils in academic programmes are much lower at 25% (compare to 15% share among all pupils).

Average occupational status (highest of either parent) is similar in both countries (49 points). However, there are notable differences between pupils in different programmes. The academic versus non-academic gap by parental occupational status in the Czech Republic is about 13 points and only 8 points in Taiwan. According to the standard deviations in Table 3, Taiwan exhibits somewhat higher heterogeneity of parental occupational status overall and also within both school types and within both groups of pupils by professional career expectations. These patterns support the observation of high heterogeneity of prestige among Taiwanese schools even within each school type.

Patterns of means in Table 3 comparing pupils with and without professional career expectations are similar to those comparing pupils enrolled in academic versus non-academic schools. However, it should be noted that discrepancies are smaller in the former group, suggesting that enrolment into an academic programme is determined by other personal and parental characteristics. Also note that in both countries, pupils without professional career expectations represent a more heterogeneous pool in terms of literacy performance.

5.2. Estimation results

Descriptive statistics in Table 3 documented similarities and (i.e. dummy variables for (1) whether he or she has enrolled in an academic programme and (2) whether the respondent has professional career expectations). We estimate Models 1 and 2 using appropriate subsamples of PISA pupils, namely 10th graders in upper-secondary education. As we have already explained, we exclude 9th graders because this group mixes pupils who are about to be tracked into academic and non-academic programmes shortly after PISA 2006 surveying.

Table 4 presents estimated odds-ratios of logistic Model 1 of enrolment into an academic program (Yes = 1, No = 0) for both the Czech Republic and Taiwan. Parameter estimates of odds-ratios significantly greater or smaller than one indicate that the corresponding variable is affecting enrolment into an academic programme in a positive or negative direction. To explore the robustness of estimates, we document the sensitivity of the estimates by presenting results from models in which some or all explanatory variables are included.

Reading and maths test scores have an expected positive impact on enrolment probability into academic programmes in both countries. The key determinants of enrolment probability are gender and parental education. Taiwanese girls are somewhat less likely to enroll in academic programmes when controlling for other observables. The situation of girls in the Czech Republic is just the opposite and much more advantageous compared to equally skilled boys with equally educated parents. The gender-related coefficient in the Czech Republic is almost 4, indicating that a girl is four times more likely to end up in academic programme than an equally disposed boy.

Parental educational attainment has a significant and strong impact on enrolment probability. The role of father's education is stronger than that of mothers' and educational effects are stronger in the Czech Republic than in Taiwan. For example, a pupil with a tertiary educated father is more than 3 times more likely to enrol into an academic programme than an equally skilled pupil with a low educated father. Interestingly, the parental occupational

Table 4. Estimated odds-ratios of logistic model of academic school programme enrolment.

	(I)	(II)	(III)	(IV)	(V)
<i>Czech Republic</i>					
Math score	1.01***		1.01***	1.01***	1.01***
Reading score	1.01***		1.01***	1.01***	1.01***
Female	3.98***	3.45***		4.09***	3.74***
Parental occupation	1.02***	1.05***	1.02***		1.06***
Father's education = upper secondary	1.61***	1.95***	1.64***	1.72***	
Father's education = tertiary	3.34***	3.58***	3.17***	4.34***	
Mother's education = upper secondary	1.95***	2.23***	1.95***	2.10***	
Mother's education = tertiary	2.95***	3.38***	2.76***	3.85***	
Constant	0.00***	0.00***	0.00***	0.00***	0.00***
Observations	3,587	3,587	3,587	3,645	3,587
<i>Taiwan</i>					
Math score	1.01***		1.01***	1.01***	1.01***
Reading score	1.01***		1.01***	1.01***	1.01***
Female	0.80***	0.84***		0.81***	0.79***
Parental occupation	1.01***	1.02***	1.01***		1.02***
Father's education = upper secondary	1.51***	1.72***	1.52***	1.61***	
Father's education = tertiary	2.35***	3.29***	2.36***	2.72***	
Mother's education = upper secondary	1.12***	1.45***	1.12***	1.20***	
Mother's education = tertiary	1.73***	2.67***	1.74***	2.06***	
Constant	0.00***	0.19***	0.00***	0.00***	0.00***
Observations	6,215	6,215	6,215	6,455	6,215

*** $p < 0.01$.** $p < 0.05$.* $p < 0.1$.

status has positive effect too, even when we control for parental education and test scores, and is roughly twice as high in the Czech Republic compared to Taiwan. These estimates are in line with the theory of effectively maintained inequality, since the family background of pupils (parental education and occupation) is a much more important determinant of enrolment into selective academic programmes preparing pupils for college, than pupil's skills.

Table 5 presents estimated odds-ratios of the logistic Model 2 of professional career expectations (Yes = 1, No = 0) in panels for the Czech Republic and Taiwan. The key finding is that the role of pupils' skills and gender in the formation of expectations is overwhelmed by the impact of parental background and enrolment into academic programmes. In particular, equally skilled pupils with the same parental background in the Czech Republic are twice as likely to expect a professional occupation requiring college education if enrolled into academic programmes. The impact of academic programme enrolment in the Czech Republic (odds ratio 2.08) is significantly greater than in Taiwan (1.37). The role of parental occupational status is an important determinant of enrolment into secondary school, but the role of occupational status in the formation of professional expectations is negligible.

The role of parental education as a factor determining professional expectations in Model 2 is much weaker than in Model 1. Note that Model 2 includes enrolment into an academic programme, which itself is strongly determined by parental education as documented by estimates of Model 1. Once we control for academic programme enrolment, parental education becomes a much less important determinant of professional career expectations. In other words, our estimates suggest that parental background is driving secondary school selection (choice and academic programme admission results) of pupils, and that the outcome of selection strongly affects expectations, but the direct impact of parental education on these expectations is weak.

Table 5. Estimated odds-ratios of logistic model of professional expectations.

	(I)	(II)	(III)	(IV)	(V)
<i>Czech Republic</i>					
Academic programme	2.08***	3.73***	2.39***	2.13***	2.07***
Math score	1.00		1.00***	1.00	1.00
Reading score	1.01***		1.01***	1.01***	1.01***
Female	1.72***	2.01***		1.71***	1.72***
Parental occupation	1.01***	1.02***	1.01***		1.01***
Father's education = upper-secondary	0.92***	1.01	0.92***	0.96	
Father's education = university	1.08**	1.11***	1.05	1.22***	
Mother's education = upper-secondary	1.13***	1.15***	1.12***	1.20***	
Mother's education = university	0.90***	0.89***	0.87***	1.04	
Constant	0.00***	0.06***	0.00***	0.00***	0.00***
Observations	3,587	3,587	3,587	3,645	3,587
<i>Taiwan</i>					
Academic programme	1.37***	2.09***	1.36***	1.36***	1.38***
Math score	1.00***		1.00***	1.00***	1.00***
Reading score	1.00***		1.00***	1.00***	1.00***
Female	1.08***	1.11***		1.10***	1.08***
Parental occupation	1.00***	1.00***	1.00***		1.00***
Father's education = upper-secondary	1.06***	1.08***	1.06***	1.08***	
Father's education = university	1.02	1.10***	1.02	1.04*	
Mother's education = upper-secondary	0.97***	1.02*	0.96***	0.98	
Mother's education = university	1.17***	1.27***	1.17***	1.23***	
Constant	0.04***	0.38***	0.04***	0.04***	0.04***
Observations	6,215	6,215	6,215	6,455	6,215

p-values in parentheses.

****p* < 0.01.

***p* < 0.05.

**p* < 0.1.

Conclusion

The secondary education of Czech and Taiwanese youth is a lasting and complex process. Some phenomena appearing in early school grades can strongly determine developments at later grades. Empirical evidence from the Czech Republic and Taiwan presented in our study, based on a thorough overview of institutional similarities and differences, confirms that theoretically predicted phenomena are present in both countries.

Parametric estimates of our first model, enrolment into academic and elite upper-secondary school programmes, show that controlling for pupils' skills, track placement at the secondary level is strongly determined by pupils' socioeconomic background. We found, however, that the effects of socioeconomic background variables (particularly mother's and father's education) on admission to academic secondary school programmes are much stronger in the Czech Republic than in Taiwan. The same holds for the effect of gender: in the Czech Republic girls have much greater advantage over boys than in Taiwan, where in fact their chances are almost equal. Later in their studies, success in this transition fosters their professional career expectations, net of the effect of their skills. The impact of secondary school programme more strongly shapes pupils' professional expectations in the Czech Republic than in Taiwan, though the effect is strong in both countries.

Our study deals with typical limitations of empirical research in this area. Individual-level data on pupils from the PISA survey are of a cross-sectional nature, and do not allow us to follow the passage of individual pupils through the schooling system including their sorting at key transition stages. Consequently, we cannot incorporate information on long-term outcomes of pupils in their adult life. Unfortunately, longitudinal data enabling this kind of

analysis is not available for either country. Further, although PISA data are relatively rich in information on pupils' characteristics and school environment, there are still unobserved effects that impact pupils' choices. While we are not able to identify the contributions of all effects involved, we estimate the lump sum net effect of being sorted into academic programmes.

Our research is comparative in nature and can be replicated for other countries. But doing so, one should be aware of numerous institutional differences between schooling systems and in particular those that determine the scale and scope of pupils' sorting and tracking. These details cannot be disentangled from PISA data and have to be gathered from various, commonly local sources.

Notes

1. A small share of apprenticeship students later opt for two-year follow-up studies to pass the *Maturita* exam, which entitles them to apply for tertiary education. However, only a third of apprentices take up this option.
2. In PISA 2006, the average achievements of private schools pupils were lower than in public schools in both countries (the difference was 23 score points in the Czech Republic and 48 score points in Taiwan). According to PISA 2006, there were 3.5% of Czech 15-year-olds in private schools while in Taiwan it was 35.0% of pupils (OECD 2007).
3. In the whole population of 15-year-old pupils, Taiwan exhibits somewhat lower inequalities in the achievement than the Czech Republic. In the Czech Republic, the total variance in student performance in reading expressed as a percentage of the average variance in student performance across OECD countries was 127%, while in Taiwan it was 73%. Total variance between schools expressed as a percentage of the total variance within the country was 59% in the Czech Republic and 44% in Taiwan. In mathematics the overall variance was relatively high in both countries: 128% in both Czech Republic and Taiwan. The between-school variance, however, was again much higher in the Czech Republic: 60 versus 47%.

Acknowledgment

Petr Matějů passed away on June 16, 2017. He approved the last revised version of this article, but passed away before its publication.

Disclosure statement

No potential conflict of interest was reported by the authors.

Funding

This work was supported by Czech Science Foundation [grant number GB14-36154G for the fourth author], [grant number P402/12/G130 for the third author] and [grant number P404/12/J006 for the first, second, and fourth authors].

ORCID

Michael L. Smith  <http://orcid.org/0000-0001-8125-2282>

References

- Boudon, R. 1974. *Education, Opportunity and Social Inequality: Changing Prospects in Western Society*. New York: John Wiley & Sons Inc.
- Breen, R., R. Luijkx, W. Müller, and R. Pollack. 2009. "Non-Persistent Inequality in Educational Attainment: Evidence from Eight European Countries." *American Journal of Sociology* 114: 1475–1521.
- Buchmann, C., and D. Ben. 2002. "Interpersonal Influences and Educational Aspirations in Twelve Countries: The Importance of Institutional Context." *Sociology of Education* 75: 99–122.
- Buchmann, C., and H. Park. 2009. "Stratification and the Formation of Expectations in Highly Differentiated Educational Systems." *Research in Social Stratification and Mobility* 27: 245–267.
- Cheng, L., and L. White. 1990. "Elite Transformation and Modern Change in Mainland China and Taiwan: Empirical Data and the Theory of Technocracy." *The China Quarterly* 121: 1–35.
- Ertl, H., and D. Phillips. 2000. "The Enduring Nature of the Tripartite System of Secondary Schooling in Germany: Some Explanations." *British Journal of Educational Studies* 48: 391–412.
- Eurydice. 2012. *Eurydice - the European Encyclopaedia on National Education Systems*. https://eacea.ec.europa.eu/education/eurydice/eurydice_en.php
- Ganzeboom, H. B., and D. J. Treiman. 1996. "Internationally Comparable Measures of Occupational Status for the 1988 International Standard Classification of Occupations." *Social Science Research* 25: 201–239.
- Ganzeboom, H. B., P. M. De Graaf, and D. J. Treiman. 1992. "A Standard International Socio-Economic Index of Occupational Status." *Social Science Research* 21: 1–56.
- Gerry, C. J., and T. M. Mickiewicz. 2008. "Inequality, Democracy and Taxation: Lessons from the Post-Communist Transition." *Europe-Asia Studies* 60 (1): 89–111.
- Huang, M.-H. 2013. "After-School Tutoring and the Distribution of Student Performance." *Comparative Education Review* 57 (4): 689–710.
- Kerckhoff, A. 1977. "The Realism of Educational Ambitions in England and the United States." *American Sociological Review* 42: 563–571.
- Kerckhoff, A. 1993. *Diverging Pathways: Social Structures and Career Deflections*. Cambridge: Cambridge University Press.
- Kerckhoff, A. 2000. "Transition from School to Work in Comparative Perspective." In *The Handbook of the Sociology of Education*, edited by M. T. Hallinan, 453–474. New York: Kluwer.
- Kerckhoff, A. 2001. "Education and Social Stratification Processes in Comparative Perspective." *Sociology of Education*, Extra issue: 3–18.
- König, W., and W. Müller. 1986. "Educational Systems and Labour Markets as Determinants of Worklife Mobility in France and West Germany: A Comparison of Men's Career Mobility, 1965–1970." *European Sociological Review* 2 (2): 73–96.
- LeVine, R. A., S. E. LeVine, and B. Schnell. 2001. "Improve the Women: Mass Schooling, Female Literacy, and Worldwide Social Change." *Harvard Education Review* 71: 1–51.
- Lucas, S. 2001. "Effectively Maintained Inequality: Education Transitions, Track Mobility, and Social Background Effects." *American Journal of Sociology* 106: 1642–1690.
- Mare, R. 1981. "Change and Stability in Educational Stratification." *American Sociological Review* 46: 72–87.
- Maurice, M., F. Sellier, and J. J. Silvestre. 1986. *The Social Foundations of Industrial Power: A Comparison of France and Germany*. Cambridge: MIT Press.
- Mello, Z. R. 2008. "Gender Variation in Developmental Trajectories of Educational and Occupational Expectations and Attainment from Adolescence to Adulthood." *Developmental Psychology* 44 (4): 1069–1080.
- Müller, W., and W. Karle. 1993. "Social Selection in Educational Systems in Europe." *European Sociological Review* 9: 1–23.
- Müller, W., and Y. Shavit. 1998. "The Institutional Embeddedness of the Stratification Process: A Comparative Study of Qualifications and Occupations in Thirteen Countries." In *From School to Work: A Comparative Study of Educational Qualifications and Occupational Destinations*, edited by Y. Shavit and W. Müller, 1–48. Oxford: Oxford University Press.

- NUFFIC. 2012. "Country Modules Taiwan and Czech Republic." <https://www.nuffic.nl/en/diploma-recognition/country-modules>.
- OECD. 2007. *PISA 2006: Science Competencies for Tomorrow's World*. vol. II. Paris: OECD.
- OECD. 2012. *Education at a Glance 2012*. Paris: OECD.
- Raftery, A., and M. Hout. 1993. "Maximally Maintained Inequality: Expansion, Reform, and Opportunity in Irish Education, 1921–75." *Sociology of Education* 66: 41–62.
- Schofer, E., and J. W. Meyer. 2005. "The Worldwide Expansion of Higher Education in the Twentieth Century." *American Sociological Review* 70 (6): 898–920.
- Schoon, I., and E. Polek. 2011. "Teenage Career Aspirations and Adult Career Attainment: The Role of Gender, Social Background and General Cognitive Ability." *International Journal of Behavioral Development* 35 (3): 210–217.
- Shavit, Y., and H. P. Blossfeld. 1993. *Persistent Inequality: Changing Educational Attainment in Thirteen Countries*. Boulder, CO: Westview.
- Shavit, Y., and W. Müller. 1998. *From School to Work: A Comparative Study of Educational Qualifications and Occupational Destinations*. New York: Oxford University Press.
- Tsai, S.-L., and Y. Shavit. 2007. "Taiwan: Higher Education-Expansion and Equality of Education Opportunity." In *Stratification in Higher Education: A Comparative Study*, edited by Y. Shavit, R. Arum and A. Gamoran, 140–164. Stanford: Stanford University Press.
- Tsai, S.-L., H. Gates, and H.-Y. Chiu. 1994. "Schooling Taiwan's Women: Educational Attainment in the mid-20th Century." *Sociology of Education* 67: 243–263.
- Tsai, S.-L., M. L. Smith, and R. M. Hauser. 2017. "Families, Schools, and Student Achievement Inequality: A Multilevel MIMIC Model Approach." *Sociology of Education* 90 (1): 64–88.