

## **Efficiency and equity of schooling in transition**

### **THE ROLE OF SCHOOL CHOICE, COMPETITION, TRANSPARENCY and ACCOUNTABILITY**

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*This represents a draft of the symposia presentation. Using the case of the Czech Republic, I will point to particular efficiency and equity issues at the upper-secondary level of schooling. The issues to be presented, although very important, are not easy to quantify and prove empirically and I will provide special statistics obtained from various academically oriented research projects.*

#### **Presentation outline**

1. Brief necessary background about the Czech schooling system.
2. Supply/demand gap filled by entry of non-state schools: increasing access to education.
3. 3-tracks schooling system and demand & supply discrepancies introducing problem of students & schools (mis)matches.
4. School admission scheme can increase both inequality and inefficiency and bias information about demand for schooling.
5. Sizeable demographic changes can lead to regional inequity.

Figure 1:

# Education System of the Czech Republic

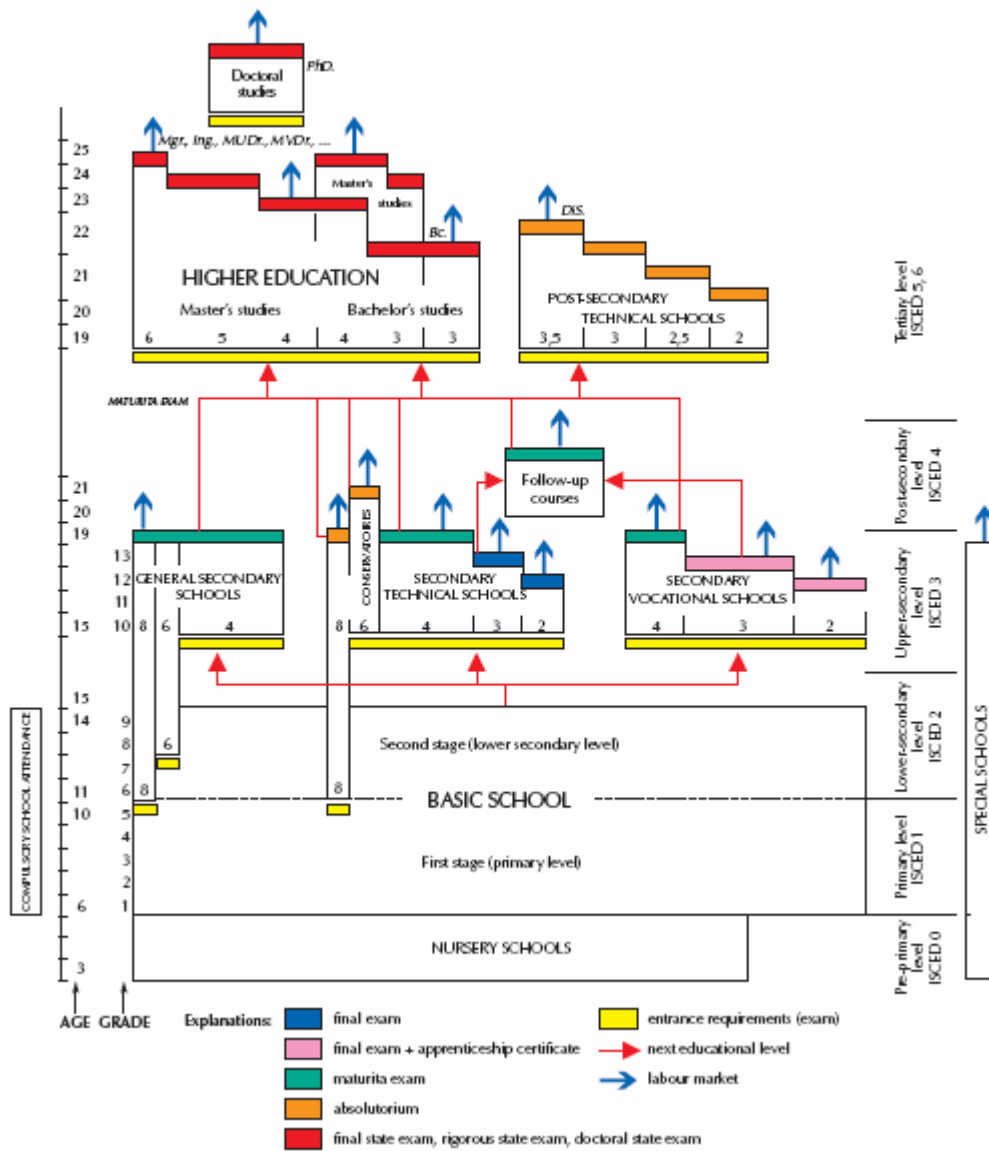
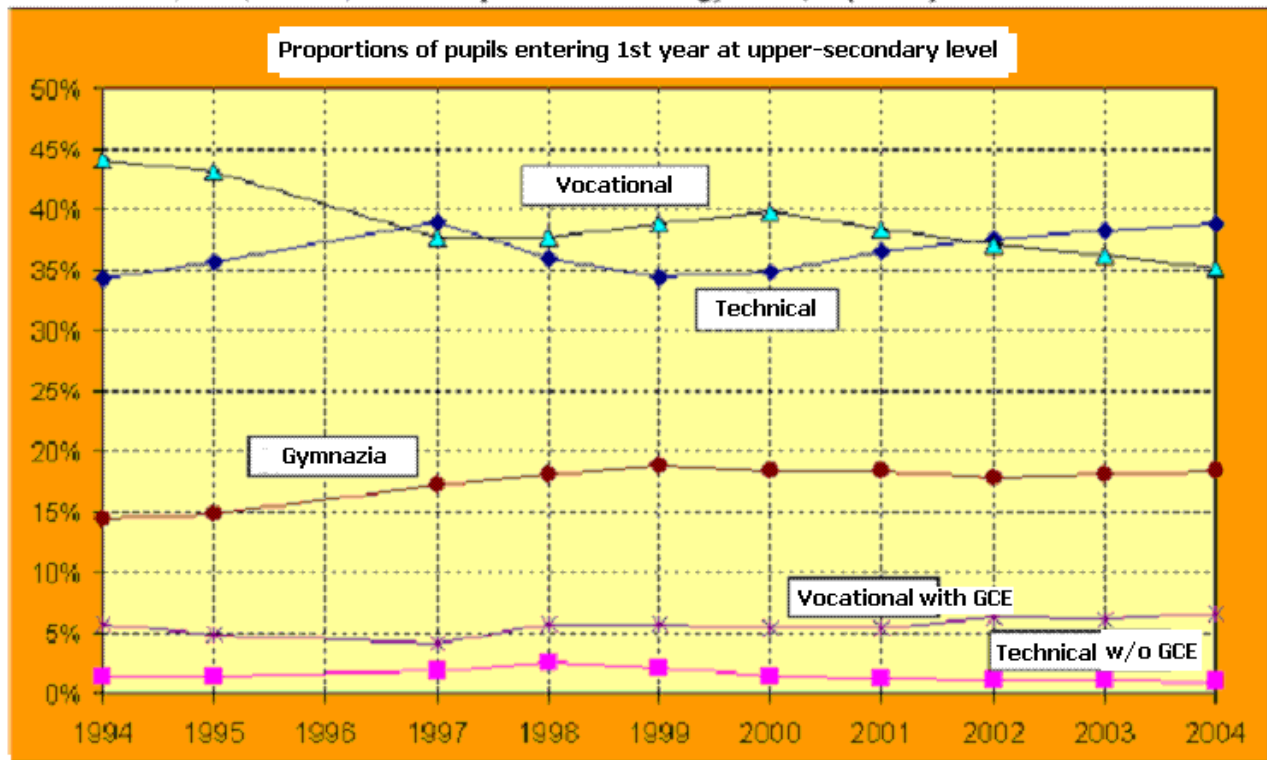




Figure 3:

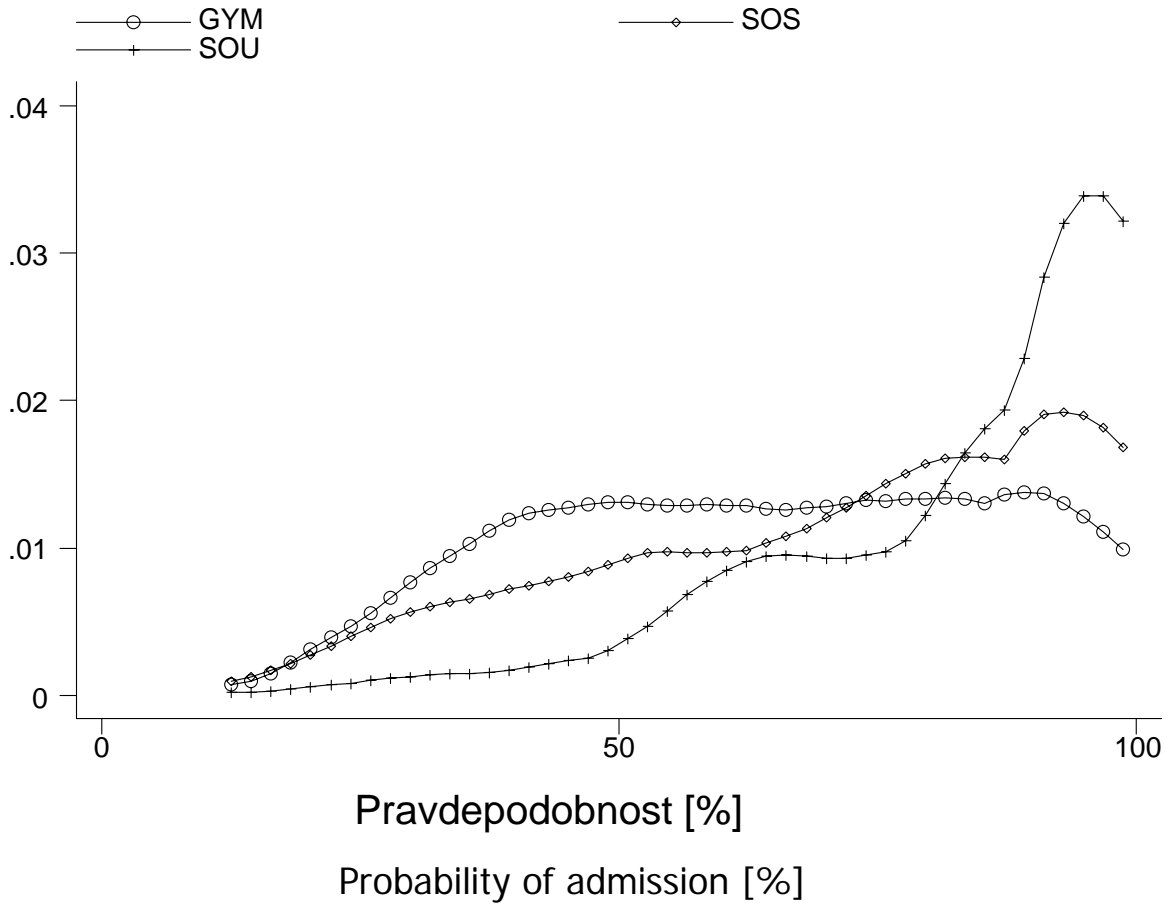


*Note:* Dominance of vocational schools has declined, but slowly. Share of gymnazia grew, but slowly and is still too low.

**Figure 4: Distribution of admission probability [x-axis: admitted/applicants in %] for each of three secondary school types (mid 1990s).**

**Notes:**

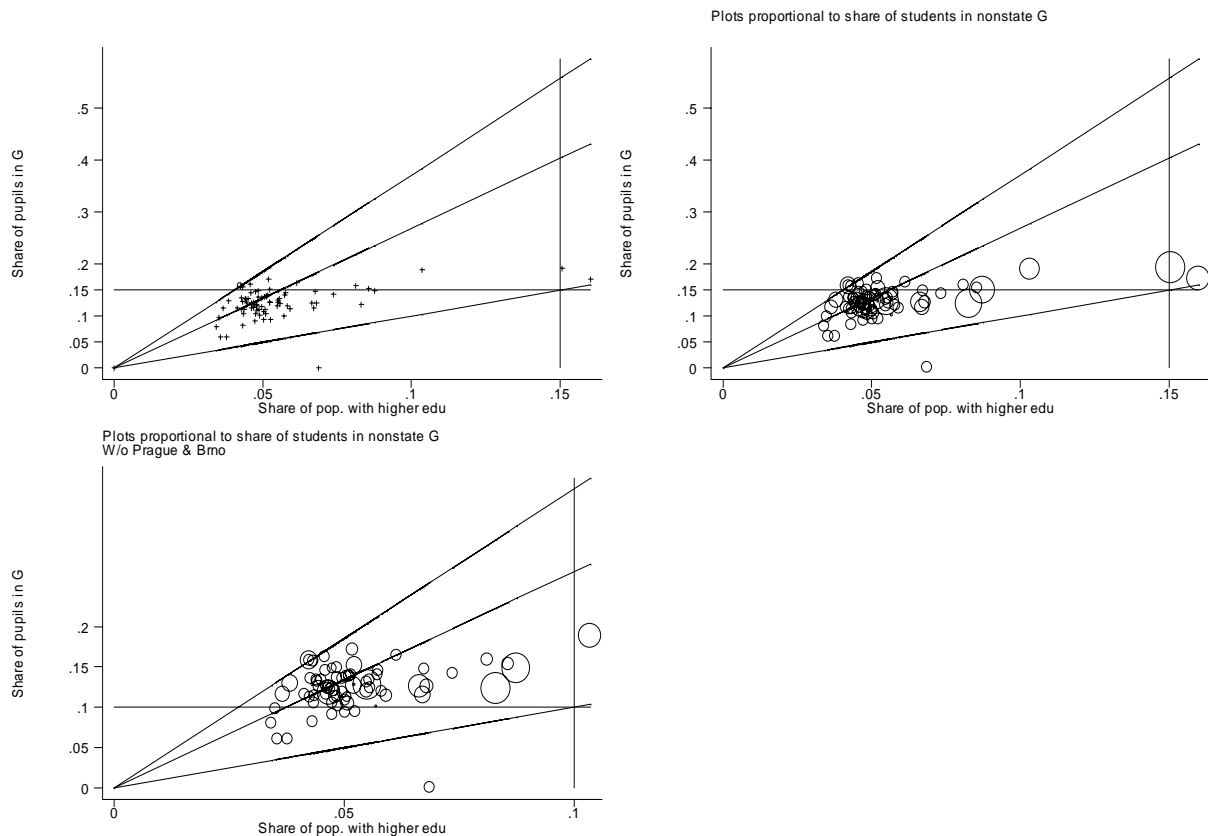
- ⇒ Admission probability into vocational centres is very close to certainty (100%)
- ⇒ Admission probability to vocational schools is very heterogenous
- ⇒ Admission probability to gymnasia is low: supply gap (+latent=non-revealed demand)



## Imbalances between supply of and demand filled by entry of non-state schools

In late 1980s, communist regime left upper secondary system of schooling with structural imbalances. Voucher type of funding irrespective of school ownership gave rise to non-state schools. Non-state schools started filling supply gaps.

**Figure 2.1: Three versions of identical district level plots comparing share of population with tertiary education (horizontal axis) and share of age cohort enrolled by public gymnasias in early 1990s. Lines depict proportional relationships.**



**Comment:** Empirically, education of parents is highly correlated with study aptitude of their children. In early 1990s, across 76 districts, the share of pupils enrolled by gymnasias was proportional to the share of tertiary educated parents. It indicates supply/demand imbalances (spatial) and unequal access to education across regions.

**Explanation:** During decades of communism, the proportion of population with tertiary education grew in 12 university districts as graduates found jobs and established their families there. Growing demand for higher education among parents did not translate into supply of gymnasias schools. Largest relative gap appeared in largest cities (Prague & Brno) causing very high absolute supply gap. Non-state gymnasias started filling the gap in early 1990s.

**Conclusion:** Per-pupil financing and non-state schools can help filling supply-demand gap and increase access to desired education.

**Table 2: Comparing students enrolled by state and private upper-secondary schools**

School	Mother's edu	Father's edu	Grade	Share with PC
<b>Gymnasia</b>				
Public	3.08	3.14	1.35	0.53
Private	3.20	3.32	1.47	0.63
<b>Technical schools</b>				
Public	2.59	2.65	1.50	0.40
Private	2.65	2.71	1.58	0.45

**Legend:**

Education: 3 ~ upper-secondary edu with GCE, 4 ~ tertiary education

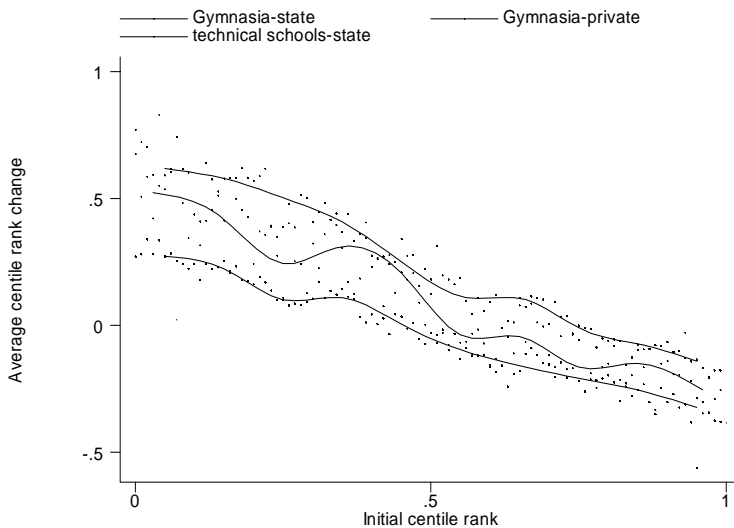
Grade at admission: 1~better, 2~weaker

Share with PC: proportion of pupils with PC at home

**Comments:** Compared to public gymnasia and technical schools pupils, private schools pupils have in average lower study aptitude and more educated parents (smarter?, wealthier?, willing to pay?).

**Conclusion:** Private schools filling supply gap served pupils who would otherwise end-up in public a public school of inferior school type. Public funding of education at private schools can increase access to education and decrease inequity.

**Figure 2.2: Pupils' initial skills and skills gained across school types.**



**Legend:**

- ⇒ Horizontal axis: centile rank of initial skills (at the admission to upper-secondary school).
- ⇒ Vertical axis: average centile rank change during studies measured at graduation.
- ⇒ Top line represents state gymnasia (highest value added), middle line private gymnasia and bottom line state technical schools (low value added).

**Finding:** Public gymnasia outperform non-state gymnasia (in terms of student's rank improvement) but non-state gymnasia are still better than available state technical schools (the only would-be alternative for non-state gymnasia students if these gymnasia would not exist). Note that vocational schools are not included due to lack of data (not collected!)

**Conclusion:** under some conditions, publicly financed private schooling can widen access to better education.

### **3-tracks schooling system and demand & supply discrepancies introduce problem of students & schools (mis)match**

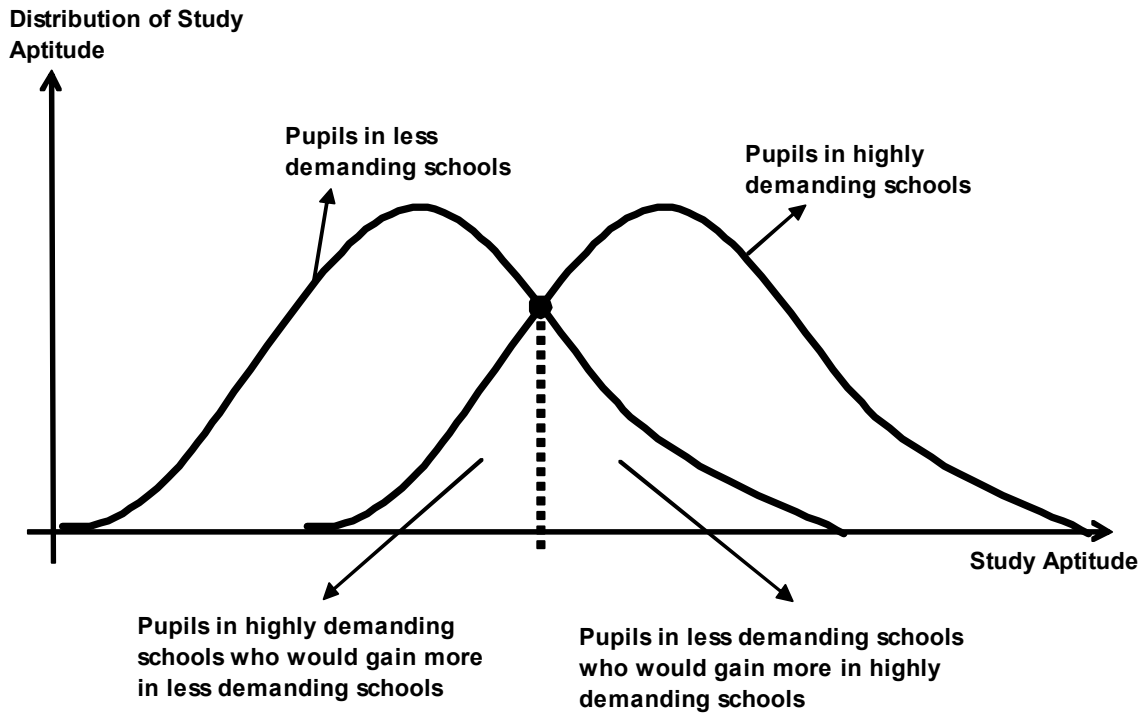
**Motivation:** Matching of students to individual schools when students proceed to higher level of schooling is important factor determining both efficiency (through competition of schools for students) and equity. Interestingly, there is lack of comparative information about legal and effective mechanisms driving pupils-schools matching in most European countries. Transitions to higher educational level (primary - lower-secondary – upper-secondary - tertiary) are commonly associated with **unequal access** to schooling and inevitably an important source of **growing skill inequality** within age cohorts. Unequal access to schools is positively related to the incidence of oversubscription to some schools. This is because admission to oversubscribed schools is based on pupil's skills and/or ability/willingness to pay. Highly skilled (or wealthy) pupils are enrolling better or more demanding schools and **skill/economic inequality is amplified**. Oversubscriptions are more common in systems with administratively imposed barriers<sup>1</sup> on expansion/closures of individual schools, school types or vocational fields. Oversubscriptions are more likely to appear if schools are more heterogenous in terms of their quality and/or type/field, and if pupils are spatially/administratively restricted in their school choices. On the other hand, positive assorted matching between students' skills and differently demanding (study requirements) school leads to higher value added and therefore **higher efficiency**. In the same time, transitions to higher schooling levels are fostering school competition and their **efficiency** if it is not legally precluded.

Aforementioned barriers **weaken** competition and therefore **efficiency**. Barriers strengthen sorting of pupils by skills, ability to pay, or residence and decrease equity. Summing-up, removing barriers, one can **stimulate both efficiency and equity**. The actual effect is not granted, however, because it depends on a mix of other, country specific factors.

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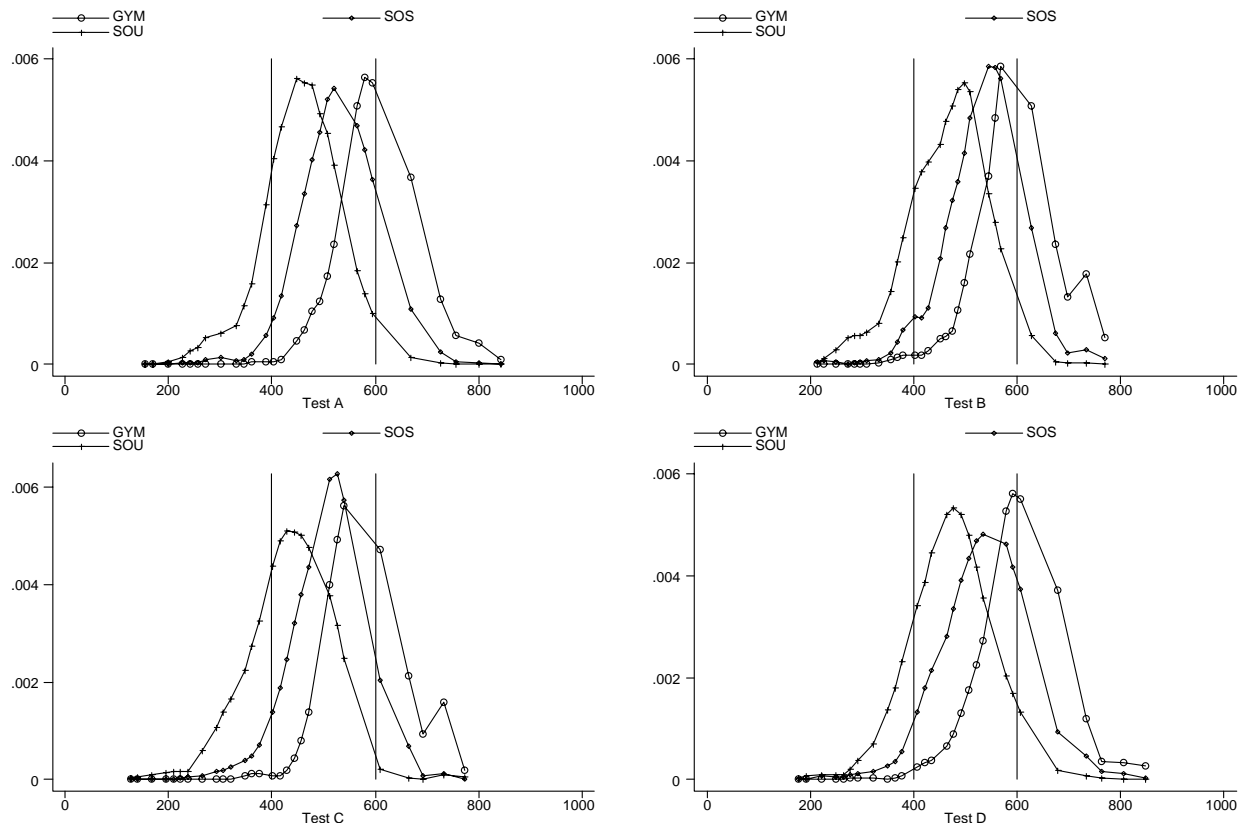
<sup>1</sup> Implementation of these barriers is based on various, well or poorly grounded policy intentions or interest groups interests.

**Figure 3.1: Theoretical case**



**Note:** The overlap can be due to supply & demand imbalances, spatial mismatch, imperfect information, etc. plus specific preferences of some pupils.

**Figure 3.2: Distribution of PISA 2003 test scores (A-Math, B-Problem Solving, C-reading, D-Natural Sciences) of 15-years old Czech pupils entering upper-secondary schools (GYM-gymnasia, SOS-technical schools, SOU-vocational schools).**



**Notes:**

3 tracks of upper secondary schools viewed not only as three different school types but also as three qualitative levels.

**Comments:**

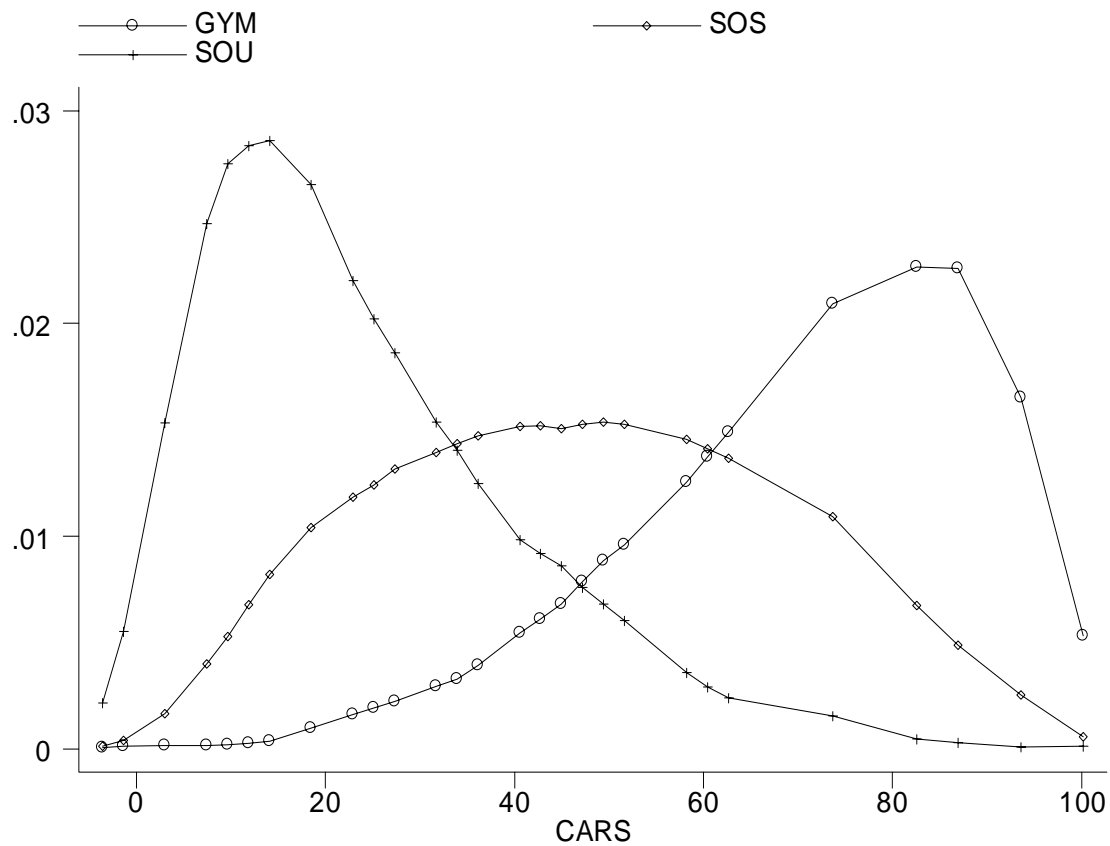
- ⇒ Distributions show different means but substantial overlap of skills distributions.
- ⇒ Many pupils entering vocational schools are skill-comparable with gymnasia.
- ⇒ Many pupils entering vocational schools are skill-comparable with technical schools pupils.
- ⇒ 8-years Gymnasia pupils appear as 2<sup>nd</sup> peak

**Conclusion:** Overlaps in skills distributions suggest possible imbalances between supply& demand or study aptitude and opportunity to study. Possible sources of mismatches are explored bellow.

## Other empirical evidence on demand & supply mismatch based on PISA 2003 survey of 15 years old pupils in the Czech Republic

**Figure 3.3: Distribution of pupils' CARS across school types**

(CARS = Composite Average Rank Score = average rank in all 3-4 PISA 2003 tests passed)



**Finding:** Observably (CARS) identical pupils end-up in qualitatively different school types.

**Table 3.1.a: Share of pupils in school type A who outperform at least 25% of pupils enrolled by (superior) school type B.**

School A vs. B	→ Voc vs. Tech	Voc vs. Gym	Tech vs. Gym
Boys in			
small towns	0.327	0.027	0.329
big towns	0.398	0.065	0.401
Girls			
small towns	0.153	0.022	0.201
big towns	0.146	0.026	0.247

**Comment:**

Very high discrepancy between skills and school types exists in case of boys at vocational and technical schools.

**Table 3.1.b: Share of boys enrol by school type and municipality size**

School type	Small towns	Big towns
Gym	0.31	0.37
Technical	0.40	0.51
Vocational	0.74	0.76

**Comment:** Boys end-up disproportional in inferior vocational schools.

**Table 3.1.c: Average centile rank of pupils by CARS**

(CARS = Composite Average Rank Score = average rank in all 3-4 PISA 2003 tests passed)

School Type	Boys	Girls
Gym	76	> 69
Technical	54	> 43
Vocational	26	> 19
Total	50.5	≈ 49.5

**Comment:**

- ⇒ Average boy in any of the three school tracks performs better than average girl.
- ⇒ However, boys are disproportional enrolled in inferior vocational schools.
- ⇒ Different sorting of genders creates illusion that boys are in average more skilled. The illusion comes from unequal sorting of genders in the 3 track system (total average is not average of averages but size weighted average of averages).

**Table 3.2.a: Share of parents who preferred other school (w/o unfavourable conditions)**

School type	Small towns		Big towns	
	Boys	Girls	Boys	Girls
Gymnasium	0.13	0.09	0.08	0.11
Technical	0.17	0.23	0.14	0.24
Vocational	0.30	0.34	0.22	0.37

**Table 3.2.b: Share of parents who preferred other school (which was not available)**

School type	Small Towns		Big Towns	
	Boys	Girls	Boys	Girls
Gymnasium	0.12	0.06	0.06	0.06
Technical	0.10	0.15	0.08	0.17
Vocational	0.21	0.27	0.16	0.25

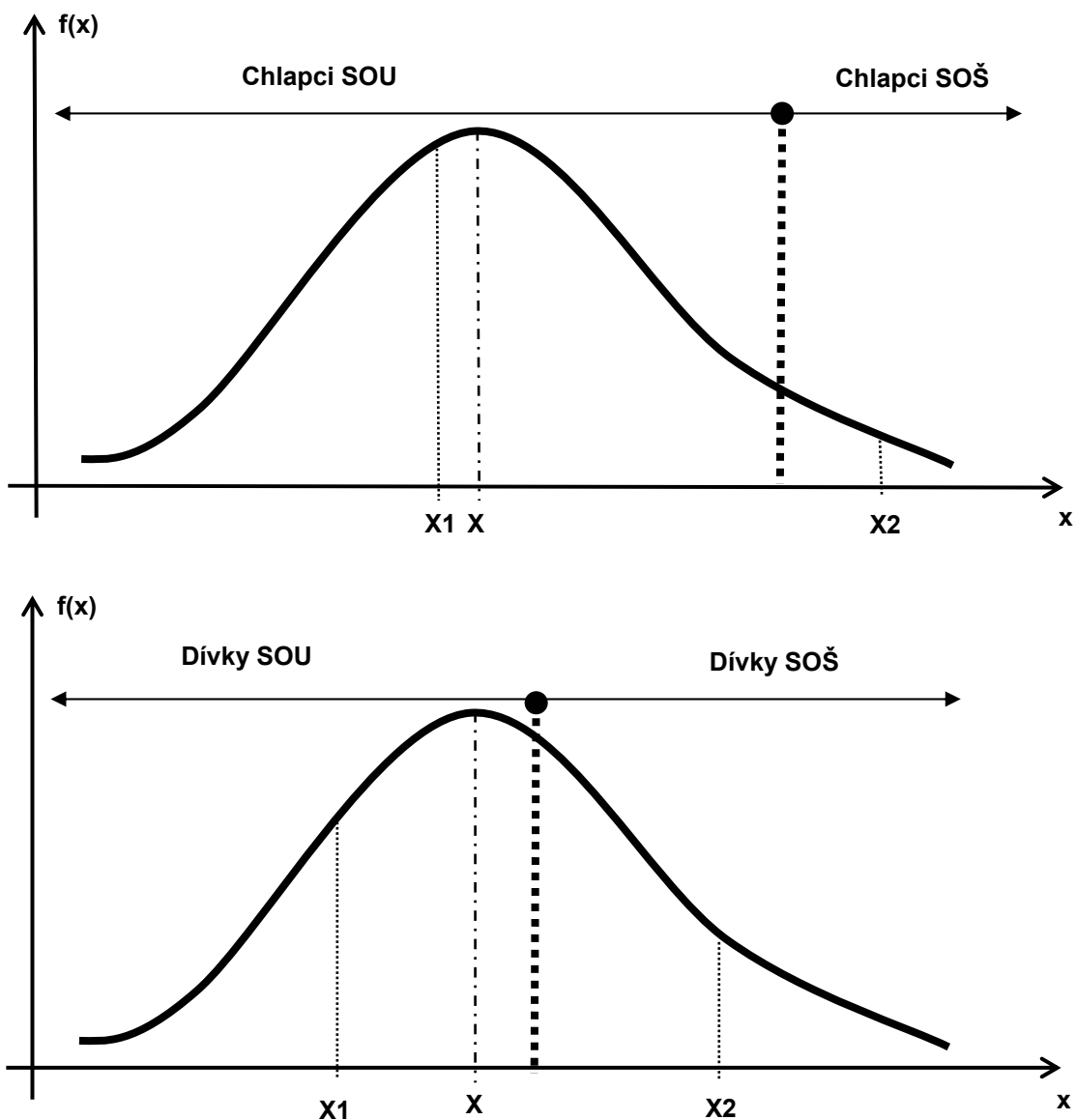
**Table 3.2.c: Share of parents who preferred other school (which was not available) by study aptitude, municipal size, school type.**

Quartile	Small towns		Big towns	
	Boys	Girls	Boys	Girls
Gymnasia				
1	-	0.00	-	-
2	-	0.03	-	0.07
3	0.11	0.10	0.03	0.04
4	0.15	0.06	0.09	0.07
Technical				
1	0.12	0.21	0.10	0.17
2	0.14	0.12	0.10	0.19
3	0.08	0.11	0.09	0.21
4	0.03	0.03	0.05	0.04
Vocational				
1	0.18	0.25	0.11	0.27
2	0.24	0.46	0.20	-
3	0.34	-	0.31	-
4	-	-	-	-

Note: - stands for insufficient number of observations.

Figure 3.4: *Probably will be skipped in the presentation.*

Example of group specific average test scores with identical distribution function  $f(x)$  for boys and girls in case of unequal sorting of genders to vocational schools and professional schools.



Průměr  $X_2$  chlapci SOŠ  $>$   $X_2$  dívky SOŠ  
Průměr  $X_1$  chlapci SOU  $>$   $X_1$  dívky SOU  
Průměr  $X$  chlapci SOU&SOŠ  $=$   $X$  dívky SOU&SOŠ

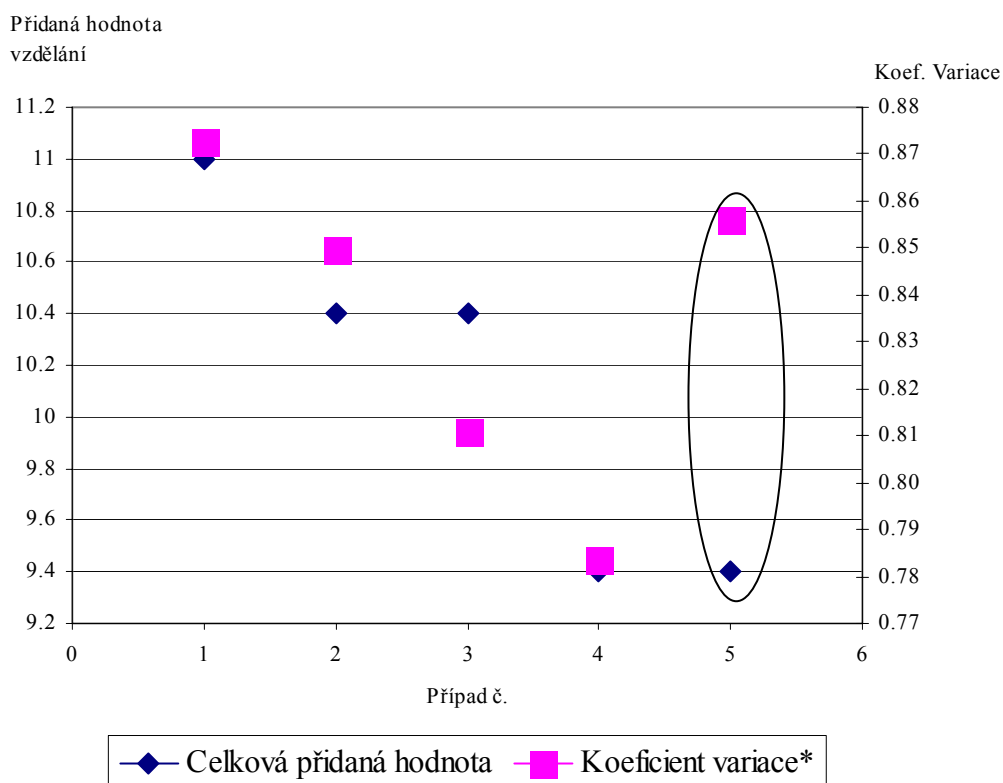
**Transition to higher school level, determined by admission scheme can increase both inequality and inefficiency and bias demand signals.**

Positive assorted matching between students' skills and differently demanding school (meaning study requirements) leads to higher skill value added and therefore **higher efficiency**. On the other hand, assorted matching naturally **increases inequality** in outcomes. There is a trade-off between efficiency and equity and actual situation depends on actual institutional setup.

**Simple theoretical example:** showing the trade-off between **efficiency** (value added) and **inequality** (inequality in outcomes) for various cases of matching heterogenous students (study aptitude) with differently demanding schools.

Case no.--> Skills->	1		2		3		4		5	
	Initial	Terminal	Initial	Terminal	Initial	Terminal	Initial	Terminal	Initial	Terminal
<b>Study demand</b>										
2	5	10	5	10	4	8	4	8	5	10
1.8	4	7.2	3	5.4	3	5.4	2	3.6	2	3.6
1.6	3	4.8	2	3.2	5	8	3	4.8	1	1.6
1.4	2	2.8	4	5.6	2	2.8	5	7	4	5.6
1.2	1	1.2	1	1.2	1	1.2	0	0	3	3.6
1	0	0	0	0	0	0	1	1	0	0
<b>Total skills</b>	15	26	15	25.4	15	25.4	15	24.4	15	24.4
<b>Total skills value added</b>		11		10.4		10.4		9.4		9.4
<b>Coefficient of variance*</b>		0.87		0.85		0.81		0.78		0.86

\*=*std. deviation/average*



**Comments:** The relationship between education **value added** and **equality** in outcomes is not necessarily negative one. Matching no.5 indicates possible existence of inferior case (high inequality in outcomes and low efficiency).

**Conclusion:** the way students and schools match is important determinant of efficiency and equity. Inferior cases could exist, calling for policy intervention.



### Example from the Czech Republic:

Actual mis(match) is an outcome of complex demand & supply process pairing pupils to schools. In the 1<sup>st</sup> round, students apply and go through admission (frequently entry exam) to just one school. In case of rejection, they repeat the process in 2<sup>nd</sup>, 3<sup>rd</sup> etc. rounds, applying to schools with remaining slots.

- ⇒ Heterogeneous pupils have different preferences for individual schooling tracks according to own study aptitude, initial skills, career vision, parental-professional background.
- ⇒ Schools want to attract and enrol enough and better pupils -> enhancing competition-efficiency but also selectivity.
- ⇒ Important role is played by:
  - spatial access to schools (problem in small towns),
  - gender (problem of 3 tracks, see section 3),
  - local/school demand-supply gap,
  - parental wealth and willingness to pay for private schooling,
  - availability of transparent and credible information (school quality, curriculum, excess demand, etc.) is important for optimal decisions,
  - riskiness built in the scheme coordinating/guiding/restricting iterative admission\* processes (applications, entry testing, assurance of enrolment).

\*A note on admission scheme: The riskiness considered here is the uncertainty about which schools will still be available in the second admission round if pupil's 1<sup>st</sup> choice school rejects her application. In the presence of high riskiness, the information about the demand revealed through applications does not reflect actual demand (latent). Risky scheme leads to seemingly balanced supply & demand. Then, supply adjustment by individual schools and/or central administrators becomes slow and uncertain.

Interestingly, there is lack of comparative information about legal and effective mechanisms driving pupils-schools matching in most European countries.

Sizeable demographic changes and regional inequity.

*Empirical evidence to be prepared*