# More Schools, Less Trouble?
## Competition and Schools' Work Environment, Sweden 1999–2011 [1]

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**Abstract:** This paper bridge research on work environment and competition among schools using detailed data on complaints and incidents of disorder and violence in all Swedish schools 1999-2011. Findings suggest that competition is associated with lower levels of complaints across educational levels. For lower secondary schools, municipalities with high levels of school competition experience higher levels of violence in schools. To assess the causal effects of competition on work environment, we compare municipalities that have introduced competition with those that have not in a difference–in–difference framework, finding that only school complaints in upper secondary schools decrease after competition is introduced.

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## I. Introduction

The work environment of schools is of increasing relevance for educators and educational policy, as evidenced in a series of recent reports from Sweden – the context of our study – and around the world (Estrada, Granath, Shannon, & Törnqvist, 2009; Skolinspektionen, 2018; UNESCO, 2019; UNICEF, 2018). Yet, few studies examine the determinants of schools' work environment. In this study we address how the organization of a national school market can shape work environment in schools. Specifically, we examine how school competition and the socioeconomic conditions of schools, and the municipalities and regions in which they are located, are related to work environment in terms of i) complaints made against schools by parents and students, ii) reported incidents of disorder, and iii) reported violence between students and between students and teachers.

Schools' work environment is vital for both educational choices and outcomes, and is a key factor that parents assess when considering school choice (Green, Navarro-Paniagua, Ximénez-de-Embún, & Mancebón, 2014; Jacob & Lefgren, 2007; Longfield & Tooley, 2017). The deteriorating work environment witnessed over the last two decades in Swedish schools coincides with an increase in competition between public (municipal) and independent (private, voucher–funded) schools, but also with changes in the composition of students, mainly due to immigration. Yet, we do not know whether these factors are causally related. An extensive literature on competition and choice in education has all but exclusively focused on students' educational outcomes (Epple, Romano, & Urquiola, 2017). However, educational outcomes such as grades are far from being the only relevant outcomes that may be affected by school competition – and not the only factor that students and their parents consider when making their school choices (Palardy, Nesbit, & Adzima, 2015).[1]

One central premise in this literature is that in order to attract and retain students, schools are incentivized to improve when faced with competition. Hirschman's (1970) theory *exit and voice* proposes a more specific mechanism by which this is achieved. Hirschman argues that when school competition is absent, there are fewer available options for parents and students to choose among, and that voice therefore becomes the only available option for improving school quality. The theory thus suggests that the number of reported incidents related to an adverse work environment could be expected to decline with competition as threats of exit incentivize schools to attend to problems that may cause turnover among students. However, few empirical studies have tested these assumptions, especially with regards to the context of school competition.[2] Research on school composition and segregation also suggests that if competition change the student composition in schools (cf. Brandén & Bygren, 2018) this could actually worsen some schools' work environment due to increasingly demanding student composition when strong students opt out. Hence, the relationship between school competition and changes in teachers' and students' work environment is primarily an empirical question.

Non-economic research has explained student disorder as primarily being influenced by the socioeconomic (SES) conditions in schools or their proximate neighborhoods, such as crime and income levels (e.g. Bowen & Bowen, 1999; Stretesky & Hogan, 2005; Welsh, Stokes, & Greene, 2000), yet, studies of SES conditions rarely account for school competition. Prior studies on the work environment in Swedish schools relies on self–reported, cross–sectional data (e.g. Låftman, Modin, & Östberg, 2013; Modin & Östberg, 2009; Modin, Östberg, Toivanen, & Sundell, 2011). Hence, we do not know whether deteriorating work environment is related to increased school competition.

Our study is based on an extensive dataset including all Swedish lower secondary schools (7–9th grade) and upper secondary schools (10–12th grade) between 1999 and 2011. Since 1992, Sweden has had a government funded voucher program whereby all families can choose among both public schools and independent (privately operated voucher funded) schools[3]. Our data enable comparisons between school forms (public or independent), grade levels, and ownership types among independent schools (whether the school is owned by a corporate group that runs many schools or is a non–group school). The data also enable a quasi–experimental comparison between schools in municipalities that have never experienced competition and those in municipalities in which competition was introduced. Since research on school competition and outcomes related to the work environment has found differing effects depending on the educational level studied (e.g. Billings, Deming, & Rockoff, 2014; Deming, 2011) we conduct separate analyses by lower secondary schools, which are more strongly tied to students' areas of residence, and upper secondary schools where commuting to schools is more frequent (Söderström & Uusitalo, 2010).

We analyze schools' work environment using a range of covariates related to school competition, student composition, and the composition of the municipality in which the school is located. Our outcome variables for the work environment include i) parental and teacher complaints, ii) reported student disorder and iii) reported violence. Analyses are performed in two stages: 1) a main cross–sectional time series regression using the total population of schools, and 2) a difference–in–difference model comparing a matched set of comparable schools in municipalities without competition with similar schools in municipalities that introduced competition at some point.

Our main analysis employs three key competition which have been analyzed separately in previous studies: the share of students in independent schools, number of schools, and school concentration in the municipality.[4] We use two key measures of socioeconomic conditions (SES) within schools: the share of students with i) foreign background and ii) highly educated parents. Within municipalities, two SES measures are employed: crime and income levels.

Our results suggest that higher competition is associated with a more adverse work environment in lower secondary schools, but a better work environment in upper secondary schools where as a result of all students must chose schools, competition is more intense. Importantly, we obtain different results depending on the competition measure employed, which we will return to in the discussion section.

Regarding school–level SES, we find that lower secondary schools with a higher share of students of foreign background exhibit fewer complaints but higher incidents of disorder and violence. Interestingly, for upper secondary schools there is no relationship between the share of students of foreign background and the amount of complaints, disorder, and violence, respectively. The share of students with highly educated parents does not alter disorder and violence for either type of school. However, disorder and violence among upper secondary schools is more strongly influenced by SES at the regional level. The difference–in–difference analysis which compares schools in municipalities that introduced competition during our observation period to schools in municipalities that never had competition, reveals that 'complaints' constitute the only work environment dimension that decreases, by approximately 20 percent, following the introduction of competition. We do not find any support for causal effects from competition on the other dimensions of work environment.

Our study contributes to research on school competition by showing that competition may affect schools in other ways than student achievement, highlighting differences in the competition–work environment relationship in schools that face 'softer' competition in terms of a lower voucher rate and where students more rarely change school (lower secondary school) compared to schools where competition is 'intensive' (upper secondary school). The study also has implications for research on behavioral problems and the work environment in schools, which has to date primarily focused on student composition and regional segregation as the primary drivers of work environment, and where the evidence has primarily been limited to cross–sectional samples. We show that socioeconomic factors in schools and regions exert a very different influence on the work environment in (mandatory) lower secondary schools compared to (choice–based) upper secondary schools, suggesting that student and regional SES at best provide an incomplete explanation of differences in schools work environment.

## II. Previous research

### A. Schools' Work Environment

While large–scale research on school competition is extensive, economic research on the long–term work environment in schools is scarce and largely restricted to predictors of teacher job turnover (Hanushek, Kain, & Rivkin, 2004). There is, however, a line of research on schools' work environment primarily in occupational health and social psychology. These studies indicate that the psychosocial work environment of schools has substantial effects on both students' well–being and their school performance (e.g. Modin & Östberg, 2009; Modin et al., 2011). Self–reported measures of the work environment also tend to co–vary with schools' student composition, in terms of being worse in schools with a higher share of minority students (Chen

& Weikart, 2008; Demanet & Van Houtte, 2011). One relationship that has been explored is that between parental involvement and school satisfaction, which varies across minority groups and is influenced by perceived school safety (Friedman, Bobrowski, & Geraci, 2006) and school choice (Hausman & Goldring, 2000). The academic involvement of parents at home or in school activities have been found to reduce students' behavioral problems in schools irrespective of socioeconomic status (SES). However, the involvement of high–SES parents also tends to increase student achievement (e.g. Domina, 2005; Hill et al., 2004).

School has also been studied as a function of the socioeconomic structure of neighborhood–at–large. In a cross–sectional study of of 2,099 students in 93 public middle and upper secondary schools in the US, Bowen and Bowen (1999) found that students' perceptions of danger in the neighborhood and school significantly contributed to disorderly school behavior. Welsh et al. (2000) arrived at similar conclusions in a study of public middle schools in Philadelphia, noting that the communities immediately surrounding the schools (in terms of crime, poverty, racial composition and family structure) had a stronger influence on school disorder than the communities from which students were drawn. Yet, studies on how school segregation affects the work environment in terms of school disorder and violence –mainly based on cross–sections of selected schools in the US – provides mixed results: Eitle and Eitle (2003) found racial segregation among public middle and upper secondary schools in Florida school 1999–2000 to be negatively associated with school violence. Conversely, Stretesky and Hogan (2005) found that segregation among Florida's 371 upper secondary schools in 2004–2005 was positively associated with the level of school disorder, but that the relationship was mediated by the poverty rate in the region. In sum, this body of literature highlights the important to account for both school–SES factors as well as the regional SES.

***B. School Competition***

The consequences of school competition have been studied thoroughly in a number of countries, mostly with a focus on educational outcomes. In contrast to studies on the work environment, which show varying results, studies on school competition indicate that competition in general tends to have a positive impact on students' school results with effect sizes ranging from negligible to quite substantial. Early studies on school competition in Sweden utilized individual–level data for the first cohort affected by the reform in 1992, who finished their final year of lower secondary school in 1998, with competition being measured as the share of students in the municipality attending independent schools (Ahlin, 2003; Sandström & Bergström, 2005). Bjorklund, Clark, Edin, Fredricksson, and Krueger (2006) criticized these initial studies for relying on cross–sectional data, often based on small samples of students in specific municipalities. Later studies have used more extensive school– and student data from pre– and post–reform periods (Böhlmark & Lindahl, 2015; Wondratschek, Edmark, & Frölich, 2013). Wondratschek et al. (2013) and Edmark, Frölich, and Wondratschek (2014) used an alternative measure of competition intended to capture students' opportunities for choice rather than the amount of choices made in a given municipality: the number of public lower secondary schools within students' commuting distance. There is also an ongoing debate as to whether the association between school competition and school results stems from increased educational performance when competition is high, or from more generous grading (Vlachos, 2019). Only one study touches on the role of competition for schools work environment: Böhlmark, Grönqvist, and Vlachos (2016) evaluated the effects of switches between schools by school principals on the work environment in terms of teacher sick–leave, finding a negative effect

which was amplified in municipalities with higher share of independent schools. Hensvik (2012) estimated wages and turnover among upper secondary school teachers using the share of independent school teachers in a region, finding positive effects of competition.

In sum, studies on school competition tend to rely on either demand–side (share of students in independent schools) or supply–side (number of schools) measures of competition, without controlling for the other. Existing measures could also be elaborated by including e.g. type of independent school, given that smaller independent schools catering to minority groups or offering alternative pedagogic models plausibly do not compete in the same way as large multi– unit chains (Lundgren & Lakomaa, 2017). How competition actually shapes the educational conditions in schools remains less well–explored.[5] Pedagogical methods (Ahlin, 2003), staffing policies (Fernandes & Menezes-Filho, 2020) and school management (Bloom, Lemos, Sadun, & Van Reenen, 2015) are both educational conditions that are affected by competition, but to the best of our knowledge, no studies have to date examined competition and schools work environment.

### C. Bridging Competition and the Work Environment

The work environment for students constitutes a key factor assessed by parents when considering school choice (Green et al., 2014; Jacob & Lefgren, 2007; Longfield & Tooley, 2017). Theoretically, competition and enhanced choice may alter the schools' work environment in that students are able to leave schools with which they are dissatisfied, rather than raising complaints in order to improve their current situation (Hirschman, 1970). Complaints could also be an indicator of parental engagement (see Section II.A above), and if so, school choice may impact the level of complaints by altering the student composition in schools in terms of their

socioeconomic (SES) background. Empirically, students with highly educated parents, and more recently also students of foreign background, are overrepresented in Swedish independent schools as compared to public schools (Holmlund et al., 2014). Work environment and competition are also important factors for the ability of schools to recruit and retain highly qualified teachers and principals (e.g. Horng, Klasik, & Loeb, 2010; Rivkin, Hanushek, & Kain, 2005). Hensvik (2012) show that teacher mobility and wage differentials in Sweden have increased as a result of school competition while Bloom et al. (2015) demonstrate that independent schools in Sweden have significantly higher management quality than public schools. Finally, Böhlmark et al. (2016) show that turnover among school principals affects students' outcomes as well as the work environment in schools.

## III. Data and Institutional Setting

Our study is based on rich school–level panel data of all Swedish schools for the period 1999–2011, from which we focus on the lower secondary schools (grades 7–9, n=1,841) and upper secondary schools (grades 10–12, n=1,292) where educational choice is more commonly available and exercised.[6] While school choice has been possible since the early 1990s, the share of students in independent schools was small until the late 1990s (Waldo, 2007). Further, the Swedish grading system changed in 1998, making comparisons before and after this year difficult. We therefore use 1999 as the earliest year in our analysis. For each school, the database contains detailed information on the type of school, students' socioeconomic conditions (SES), and work environment, including complaints and incidents of disorder and violence. To this we add rich municipal–level data. These data have been gathered from Statistics Sweden, the

Swedish National Agency for Education, the Swedish Schools Inspectorate and the Swedish Work Environment Authority.

### A. The Voucher Reform

In 1992 Sweden introduced a voucher system that allows families to choose between public and independent (privately operated) schools. The vouchers cover all costs of education and co–payments by parents are not allowed – the voucher amount is set by the municipalities and reflect cost of the municipal schools (the amount thus varies between municipalities and can also change over time). All independent schools need to be approved by the government. While public schools were only able to offer the standard curriculum, independent schools could also offer extended curricula. Following the voucher reform, independent schools were initially most commonly operated by associations, foundations or companies which operated a single school. The number of independent schools were also very limited. By contrast, the period after 1999 was marked by a significant growth in schools run by corporate groups that simultaneously operate a large number of schools, as well as a growth in the number of schools, average school size, and the share of families choosing them. However, many municipalities still lacked independent schools in 2011. Private schools that directly charge tuition fees do no longer exist in Sweden – after the school voucher reform in 1992 all existing schools of this type applied for approval as independent schools and ceased charging tuition.

The types of independent schools that are established may be of major significance for the competitive pressure they exert on already existing schools (Akyol, 2016). In this study we thus categorized schools into three types: (i) public schools, (ii) independent schools that are part of a corporate group, and (iii) independent schools that are not part of a corporate group.

Figure 1 shows the development of the number of schools (Y–axis) over time (X–axis), by educational level (Panel A–B), and type of school. Panel A of Figure 1 highlights the predominance of public rather than independent lower secondary schools. At the upper secondary school level (Panel B) the gap between the number of public and independent schools is smaller. In 2011, 15 % of students attended independent lower secondary schools and around 24% independent upper secondary schools.

**Figure 1. Number of Schools by Educational Level and Type of School, 1999–2011**
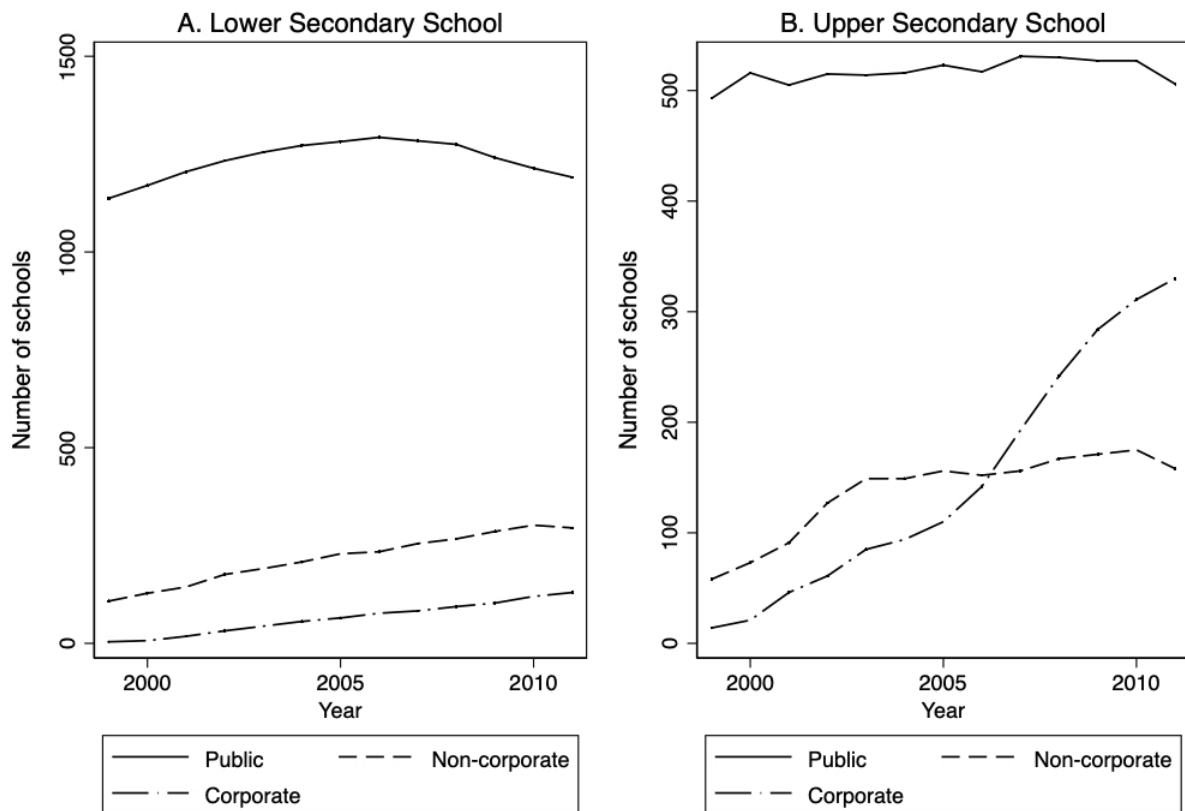


*Notes*: In 2011, public schools constituted around 74% of all lower secondary schools, and 51% of all upper secondary schools; non–corporate schools constituted around 18% of all lower secondary schools and 15% of all upper secondary schools; corporate schools constituted approximately 8% of all lower secondary schools and 34% of all upper secondary schools.

***B. Differences in Choice Between Lower and Upper secondary schools***

The voucher reform affected both primary and lower secondary schools (grades K–9) and upper secondary schools (grades 10–12). A vital factor for potential and realized educational choice among students is that travel distance to school tends to increase with student age (Statistics Sweden 2017)[7]. Previous research on school competition in Sweden has primarily studied the final grade in lower secondary schools, the 9th grade. Although school choice is also possible at the primary school level (grades 1-3), it is less frequently exercised and the majority of students enroll in the most proximate school. In upper secondary schools, students have to actively apply, which means that student mobility – and hence the room for competition – is greater. The Swedish National Agency for Education has identified 94 local upper secondary school markets that connect the 290 municipalities that students commute across in order to attend their school of choice (Skolverket, 2011). We aggregate our upper secondary school variables to the local school markets but keep municipality as the analysis level for lower secondary schools. As in many other countries, Swedish upper secondary schools are divided into vocational and academic programs that may cater to different student groups and that may also influence the work environment in different ways.[8]

## IV. Variable Construction

### A. Dependent Variables: School–Level Measures of Work Environment

We study three dimensions of the work environment of schools: complaints, disorder, and violence. The first variable focuses on complaints made to the National Agency for Education (1999–2007) and the Schools Inspectorate (who took over the responsibility in 2008) by students and parents as a result of dissatisfaction with the school. The second variable comprises reported incidents of disorder to the Work Environment Authority. Each report of a complaint or incident

of disorder, all of which included information about the year in which they had occurred and a short subject title about the nature of the complaint or incident, was matched to the school in which it had occurred using a manually controlled text algorithm.

The first outcome variable – *complaints* – measures the annual number of dissatisfaction complaints reported for each school to a national education agency, divided by the total number of students in the school in a given year. This variable follows Hirschman's focus on "negative voice with a formal orientation" (Hirschman, 1970, p. 16). Dissatisfaction reports are mostly filed by parents but may also be filed by students and school staff.[9] The Swedish National Agency for Education and the Swedish Schools Inspectorate are required to document all reports of dissatisfaction by parents, students or employees. While our data extraction does not allow for distinguishing type of complaints, the Swedish Schools Inspectorate report that besides complaints about bullying, the two most frequent types of complaint relate to 'denied requests for special support' and 'governance issues'. We identified a total of 9,963 complaints made between 1999 and 2011, of which 8,302 complaints had been made in relation to a total of 79% of all lower secondary schools, and 1,661 complaints had been made in relation to 41% of all upper secondary schools.

The second outcome variable – reported incidents of *disorder* – includes damage to school buildings, such as broken windows and graffiti, but also the students' use of firecrackers and pyrotechnics, and small fires. [10] According to Swedish law, and in contrast to "complaints", incidents of disorder must be reported to the Swedish Work Environment Authority by school employees or other members of the organization when these occur or become known. We found a total of 7,799 incidents of disorder reported between 1999 and 2011, of which 5,917 incidents had been reported in relation to 57% of all lower secondary schools, while 1,882 incidents of

disorder had been reported in relation to 29% of all upper secondary schools. Unlike data on

complaints–which do not contain information on the type of complaint– the data on reported

incidents of disorder can be broken down into separate categories based on detailed information

in the case subject as provided by administrators when they archive the reports. This information

has been used in the creation of the third outcome variable – reported incidents of *violence* –

which comprises reports of disorder that were filed for reasons of violence, including fights,

assaults, and threats) occurring between students and between students and teachers. In our

analyses, we separate incidents of violence and disorder as distinct variables. However, we have

also analyzed them together without this producing any major differences in the results. The data

do not include serious acts of violence or crime, which are reported to law enforcement. As with

complaints, both disorder and violence are scaled on the basis of the annual number of incidents

for each school divided by the total number of students in each school multiplied by 100.

Table 1 below shows summary statistics all outcome variables. We note that, on average,

lower secondary schools have worse work environment than upper secondary schools, as

indicated by higher values of the level of complaints and violence but not disorder.

**Table 1. Summary Statistics of Outcome Variables (pooled yearly, 1999–2011)**

| | Outcome variables | Lower Secondary Schools (Municipality [n=290]) | | | | Upper Secondary Schools (local school market [n=74]) | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | **Mean** | **S.D.** | **Min** | **Max** | **Mean** | **S.D.** | **Min** | **Max** |
| 1) | Complaints | 0.118 | 0.333 | 0 | 9.831 | 0.058 | 0.237 | 0 | 7.143 |
| 2) | Disorder | 0.020 | 0.108 | 0 | 4.317 | 0.035 | 0.237 | 0 | 7.143 |
| 3) | Violence | 0.028 | 0.173 | 0 | 10.030 | 0.009 | 0.065 | 0 | 2.273 |

## B. Independent variables: School Competition

Since prior studies on school competition tend to rely on either demand–side (share of students

in independent schools) or supply–side (number of schools) measures of competition, without

controlling for the other, we use three complementary measures of competition in the main

analysis (Equations 1 below) which are in line with those used in previous research: 1) *school*

*concentration (inverse Herfindahl)*, 2) *number of schools*, and 3) *the share of students in independent schools,* all computed at the municipal level. These measures account for the concentration of schools, the amount of choice available, and also the amount of choice made in a given municipality. All variables have been constructed so that higher values indicate higher levels of competition.[11] In the second stage of the analysis we include our fourth competition variable represented by the treatment variable in Equation 2 below: *competition introduced*. Table 2 presents summary statistics for our key independent variables for competition. Lower secondary schools tend to have a lower share of independent school students but higher numbers of schools and a higher school concentration (inverse Herfindahl).

**Table 2. Key Variables of Competition (pooled yearly, 1999–2011)**

|  | Lower secondary schools | | | | Upper secondary schools | | | |
|---|---|---|---|---|---|---|---|---|
|  | **Mean** | **S.D.** | **Min** | **Max** | **Mean** | **S.D.** | **Min** | **Max** |
| School concentration (inverse Herfindahl) | 0.789 | 0.228 | 0 | 0.988 | 0.778 | 0.225 | 0 | 0.986 |
| Number of schools | 24.149 | 33.502 | 1 | 133 | 27.707 | 34.546 | 1 | 130 |
| Share of independent school students | 0.105 | 0.106 | 0 | 0.568 | 0.153 | 0.119 | 0 | 0.490 |
| Competition introduced (treatment) | 0.234 | 0.424 | 0 | 1 | 0.180 | 0.385 | 0 | 1 |

### C. Independent variables: Socioeconomic Conditions

Research has suggested that the schools' work environment is influenced by students' socioeconomic conditions (SES) and characteristics of the neighborhood surrounding the school (Sandy & Duncan, 2010). At the school level we therefore include variables capturing 1) *the share of students of foreign background*, and 2) *the share of students with highly educated parents*. The share of students of foreign background is measured as the annual share of students in a school who were born abroad or born in Sweden to two foreign–born parents. At the local level (municipality), we measure overall SES in terms of 3) *crime rate,* and 4) *average income* (Bowen & Bowen, 1999; Stretesky & Hogan, 2005; Welsh et al., 2000).

We summarize the SES variables in Table 3. We note that the share of students of foreign background is higher among upper secondary schools than lower secondary schools. The share of students with highly educated parents is slightly higher among lower secondary schools, whereas municipal crime rates and mean income levels are similar for both educational levels.

**Table 3. Socioeconomic Conditions Variables (pooled yearly, 1999–2011)**

| | Lower Secondary School | | | | Upper Secondary School | | | |
|---|---|---|---|---|---|---|---|---|
| | Mean | S.D. | Min | Max | Mean | S.D. | Min | Max |
| *School–level SES* | | | | | | | | |
| Share of students of foreign background | 0.083 | 0.117 | 0 | 0.970 | 0.142 | 0.125 | 0 | 0.930 |
| Share of students with highly educated parents | 0.502 | 0.151 | 0.090 | 1 | 0.419 | 0.156 | 0 | 0.920 |
| *Region–level SES* | | | | | | | | |
| Mean income (log) | 5.347 | 0.166 | 4.930 | 6.090 | 5.352 | 0.143 | 4.935 | 5.873 |
| Crime rate | 0.129 | 0.043 | 0 | 0.231 | 0.138 | 0.041 | 0.042 | 0.230 |

## D. Control Variables

We include several school–level control variables: The time–invariant variable *type of school* (measured as '0' if public school, '1', if non–corporate group independent, and '2' if corporate group independent), and several time–variant variables: *share of certified teachers*, *share of specially certified teachers*, *grade point average (GPA),* and *school size*. The type of school is important since independent school types, which we call *'non–corporate'* schools (one owner running a single school) or *'corporate'* schools (owners running multiple schools that are part of a corporate group), respectively (see Figure 1 above) have other expectations and aims than public schools. Corporate groups (most of them are public listed companies) are expected to meet demand by expanding and establish new schools (Vlachos, 2019) and often seek to achieve economies of size (Palardy et al., 2015). Schools that exclusively cater to an ethnic or religious group or are founded to provide continuing education in a village where the municipal school has closed are much less likely to expand and will therefore exert less competitive pressure on other schools (Lundgren & Lakomaa, 2017). *School size* is included as an important control since there is a substantial variation depending on school type, and the average school size is both affected

by competition, and influences school disorder and quality (e.g. Gottfredson & DiPietro, 2011; Lee & Smith, 1997). As argued in the research setting, a distinguishing factor for upper secondary schools is enhanced school choice of educational tracks, we therefore include a time–varying categorical variable coded as '0' if they only offer academic programs, '2' if they only offer vocational programs, and '1' if they offer a mix of both. For our difference–in–difference model (Equation 3 below), we include one additional time–variant municipal–level control: *municipal population (log)*.

## V. Empirical Strategy – Panel Data Analysis

We predict the work environment of schools as a function of (i) the level of school competition in the municipality, and (ii) school– and municipal–level SES characteristics, and we fit separate models for junior high and upper secondary schools. Our baseline model takes the form:

(1) $\quad y_{it} = \beta_1 competition_{tr} + \beta_2 SES_{itr} + X_{itr}\beta_3 + \gamma_t + \psi_r + \varepsilon_{itr}$

where $y_{it}$ represents our outcome variable, the work environment (three different measures, see details above) in school $i$, at year $t$. $\beta_1$ is the effect of a vector of key competition measures, $\beta_2$ is the effect of a vector of key SES measures, while $X_{itr}$ represents a vector of time–varying school, and region (municipality or local school market, $r$) control variables to be estimated; $\gamma_t$ is a year fixed effect, $\psi_r$ is a region (municipality or a local school market fixed effect)[12], and $\varepsilon_{itr}$ is a random error term.

## VI. Results: Panel Data Analysis

We begin by analyzing the effects of competition, and then the effects of school and municipal SES, separately for lower secondary schools and upper secondary schools respectively. To ensure that the results are not affected by multicollinearity, separate analyses were conducted for

each of the variables measuring competition, with no major differences (see Online Appendix, section 4).

## A. Main Results Lower Secondary Schools – Competition

Table 5 below presents our results for work environment and quality in lower secondary schools. By examining Models 1–3 in Table 4, we see that the effects of our three measures of competition differ across our outcome variables for work environment. The level of school concentration (inverse Herfindahl) for lower secondary schools has a weak negative association with complaints ($\beta$:–0.159, p<0.10). In contrast, the number of lower secondary schools among which students in a municipality can choose is positively related to the level of complaints for a focal school ($\beta$:0.002, $p$<0.05). Our third measure of competition, which captures the amount of choice made by lower secondary school students in a municipality ('Share of independent school students'), is positively related to violence ($\beta$:0.128, $p$<0.05), but is not systematically related to complaints and disorder. Hence, the specific choice of competition measure has a non–negligible effect on the results obtained. We will return to this in the discussion section.

## B. Main Results Lower Secondary Schools – Socioeconomic Conditions

We now turn to examine the variables measuring socioeconomic conditions in schools and their neighborhoods in Table 4. We see from Table 4 that the share of students of foreign background in a lower secondary school is negatively associated with the level of complaints ($\beta$:–0.167, $p$<0.01), but positively associated with school disorder ($\beta$:0.055, $p$<0.001) and violence ($\beta$:0.159 $p$<0.001). On the one hand, this provides an affirmation for previous research that has argued that parental SES serves as a proxy for 'school engagement', affecting both achievement and behavior among students (Domina, 2005; Hill et al., 2004). On the other hand, the share of students with highly educated parents is only associated with complaints ($\beta$:–0.133, $p$<0.01).

At the municipal level, Table 4 shows that crime rate is positively associated with school complaints are (β:0.763, *p*<0.05). Interestingly, neither crime rate nor the mean income in the municipality are significantly associated with school disorder and violence.[13] These results raise questions about previous research that has highlighted SES conditions at the regional level as the primary drivers of an adverse work environment in schools.

**Table 4. Regressions of Lower Secondary Schools' Work Environment, 1999–2011**

|  | (1) Complaints | (2) Disorder | (3) Violence |
|---|---|---|---|
| ***School competition*** | | | |
| School concentration (inverse Herfindahl) | –0.159+ | -0.021 | 0.004 |
|  | (0.096) | (0.033) | (0.050) |
| Number of schools | 0.002* | 0.000 | –0.000 |
|  | (0.001) | (0.000) | (0.000) |
| Share of independent school students | 0.004 | 0.015 | 0.128* |
|  | (0.095) | (0.033) | (0.051) |
| ***School SES*** | | | |
| Share of students of foreign background | –0.167** | 0.055*** | 0.159*** |
|  | (0.055) | (0.015) | (0.025) |
| Share of students with highly educated parents | –0.133** | -0.011 | –0.028 |
|  | (0.051) | (0.015) | (0.024) |
| ***Municipality SES*** | | | |
| Mean income (log) | 0.028 | 0.061 | –0.136 |
|  | (0.241) | (0.084) | (0.130) |
| Crime rate | 0.763* | 0.048 | –0.145 |
|  | (0.309) | (0.111) | (0.169) |
| ***Control variables*** | | | |
| Type of school (0=Public) | | | |
|   Non–corporate (=1) | –0.009 | -0.011+ | –0.026* |
|  | (0.026) | (0.006) | (0.010) |
|   Corporate (=2) | –0.025 | -0.012+ | –0.023* |
|  | (0.027) | (0.007) | (0.011) |
| Share certified teachers | –0.195*** | 0.004 | 0.014 |
|  | (0.043) | (0.013) | (0.021) |
| Share spec. certified teachers | 0.317** | 0.001 | –0.012 |
|  | (0.116) | (0.035) | (0.056) |
| GPA (log) | –0.137* | -0.011 | –0.004 |
|  | (0.057) | (0.018) | (0.029) |
| School size (log) | –0.118*** | -0.004 | –0.010+ |
|  | (0.014) | (0.004) | (0.006) |
| Constant | 1.671 | -0.213 | 0.800 |
|  | (1.318) | (0.458) | (0.706) |
| Observations | 10,153 | 10,153 | 10,153 |

| | | | |
|---|---|---|---|
| Number of municipalities | 262 | 262 | 262 |
| Number of schools | 1,305 | 1,305 | 1,305 |
| Year dummies | YES | YES | YES |
| School FE | NO | NO | NO |
| Municipality FE | YES | YES | YES |
| –2LL | –2417 | 8506 | 4107 |
| Within R–square | 0.066 | 0.008 | 0.021 |
| Between R–square | 0.195 | 0.197 | 0.201 |
| Overall R–square | 0.101 | 0.051 | 0.096 |

*Notes*: Estimates based on equation 1. Results are therefore based on multi–level OLS models in which our outcome variables occur at the school level l (level 1) but schools are nested in municipalities (level 2). These models use municipality fixed effects. Standard errors (in parentheses) are clustered at the municipal level in all models. *** $p<0.001$, ** $p<0.01$, * $p<0.05$, + $p<0.10$.

### C. Main results upper secondary schools – competition

Table 5 below presents our results for upper secondary schools with similar specifications as in the analyses for lower secondary schools except for the local context being captured on the level of local school markets (LSM) rather than municipalities to account for commuting patterns among high school students. We also add controls for schools' differences in educational tracks. While the relationship between competition and the schools' work environment was mixed at the lower secondary school level (Table 4), results in Table 5 indicate that competition is associated with an improved work environment in upper secondary schools: School competition, measured by school concentration (inverse Herfindahl) and share of independent school students, is negatively associated with complaints in Model 1 ($\beta$:–0.188, $p<0.01$, $\beta$:–0.188, $p<0.05$, respectively) and availability of choice (number of schools) is negatively associated with reported incidents of disorder ($\beta$:–0.001, $p<0.10$). In contrast to lower secondary schools, none of the competition measures show any relationship with upper secondary school violence.[14]

### D. Main results upper secondary schools – socioeconomic conditions

Turning to the variables measuring school socioeconomic conditions in upper secondary schools in Table 5, we see that in sharp contrast to the analysis of lower secondary schools, in upper

secondary schools there is no relationship between share of students of foreign background and school work environment.

**Table 5. Regressions of Upper Secondary Schools' Work Environment, 1999–2011**

| | (1) Complaints | (2) Disorder | (3) Violence |
|---|---|---|---|
| ***School competition*** | | | |
| School concentration (inverse Herfindahl) | –0.188** | 0.089 | 0.003 |
| | (0.064) | (0.068) | (0.017) |
| Number of schools | 0.000 | -0.001+ | –0.000 |
| | (0.001) | (0.001) | (0.000) |
| Share of independent school students | –0.188* | -0.107 | –0.011 |
| | (0.085) | (0.091) | (0.023) |
| ***School SES*** | | | |
| Share of students of foreign background | 0.013 | -0.075 | 0.003 |
| | (0.036) | (0.047) | (0.010) |
| Share of students with highly educated parents | –0.070+ | -0.034 | –0.002 |
| | (0.038) | (0.048) | (0.011) |
| ***Local school market SES*** | | | |
| Mean income (log) | 0.244 | -0.451 | –0.101 |
| | (0.284) | (0.303) | (0.078) |
| Crime rate | –0.199 | 0.937* | 0.133 |
| | (0.363) | (0.382) | (0.099) |
| ***Control variables*** | | | |
| Type of school (0=Public) | | | |
|   Non–corporate (=1) | 0.022 | -0.035+ | –0.005 |
| | (0.014) | (0.018) | (0.004) |
|   Corporate (=2) | –0.001 | -0.011 | 0.001 |
| | (0.013) | (0.017) | (0.004) |
| Share certified teachers | –0.057* | 0.047 | –0.002 |
| | (0.026) | (0.031) | (0.007) |
| Share spec. certified teachers | 0.015 | 0.092 | –0.010 |
| | (0.112) | (0.129) | (0.031) |
| GPA (log) | 0.051 | 0.014 | –0.016 |
| | (0.044) | (0.051) | (0.012) |
| School size (log) | –0.030*** | -0.012 | 0.001 |
| | (0.005) | (0.007) | (0.002) |
| School educational track (0=Academic) | | | |
|   Mixed (=1) | 0.025* | -0.002 | 0.001 |
| | (0.012) | (0.014) | (0.003) |
|   Vocational (=2) | 0.004 | 0.016 | –0.001 |
| | (0.013) | (0.015) | (0.004) |
| Constant | –0.934 | 2.256 | 0.562 |
| | (1.504) | (1.605) | (0.412) |
| Observations | 6,376 | 6,376 | 6,376 |
| Number of Local School Markets | 94 | 94 | 94 |
| Number of schools | 849 | 849 | 849 |
| Year dummies | YES | YES | YES |
| School FE | NO | NO | NO |
| Local School Market FE | YES | YES | YES |
| –2LL | 362.5 | -125.3 | 8606 |

| | | | |
|---|---|---|---|
| Within R–square | 0.026 | 0.018 | 0.008 |
| Between R–square | 0.136 | 0.124 | 0.118 |
| Overall R–square | 0.057 | 0.104 | 0.054 |

*Notes*: Estimates based on equation 1. Results are based on multi–level OLS models in which our outcome variables occur at the school level l (level 1) but schools are nested in local school markets (level 2). These models use local school market fixed effects. Standard errors (in parentheses) are clustered at the local school market level in all models. *** $p<0.001$, ** $p<0.01$, * $p<0.05$, + $p<0.10$.

Socioeconomic conditions at the local school market level, in terms of mean income and crime rate in Table 5, show no association with upper secondary school level complaints (whereas crime rate was positively associated with complaints at the lower secondary school level). Contrary to the analysis of lower secondary schools, we now find results that are consistent with previous research that has argued for the influence of regional context on behavior in schools, given that the crime rate is positively associated with disorder in upper secondary schools ($\beta$:0.937, $p<0.05$).

Taken together, these findings show that the effects of both school competition and SES conditions in schools and regions differ starkly between analyses of the work environment in upper secondary schools and lower secondary schools, respectively. One possible explanation is that lower secondary schools are presumably more strongly attached to their local catchment area. Around 32 percent of upper secondary school students commuted to schools in another municipality in 2011 (Skolverket, 2011), as against only 5 percent of lower secondary school students in 2016 (Statistics Sweden). We further evaluate this in the 'robustness tests' section below, where we find similar effects for alternative model specifications.

In conclusion, the results show that our competition measures have mixed effects on the work environment in lower secondary schools but are associated with a better work environment in upper secondary schools. Also, school SES exhibits a stronger influence on disorder and violence in lower secondary schools, while municipality SES exhibits a stronger influence on disorder and violence in upper secondary schools. This provides some support for previous

research on the importance of school composition and neighborhood, with the caveat that SES

characteristics varies depending on educational level, and thus potentially also on the degree of

competition and choice.

**VII. Empirical Strategy – Difference–in–Difference Analysis**

As causal test of the association between competition and schools' working environment

indicated by the panel daa analysis, we apply a generalized difference-in-difference model where

we compare schools in municipalities that introduced competition at varying time points between

1999 and 2011[15], with schools in municipalities that never introduced competition:

(2) $\quad y_{it} = \alpha + \beta_1 post\ treatment_{it} + X_{itm}\beta_2 + \gamma_t + \delta_i + \varepsilon_{it}$

Equation 2 is similar to Equation 1 with the exception that $\delta_i$ is a school fixed effect, and $\beta_1$ is a

dummy variable taking the value 1 for all years in the post–treatment period for schools in

municipalities that introduced competition, which here constitutes our key explanatory variable

for competition and our difference–in–difference (DID) measure. We have a staggered treatment,

meaning that the treatment occurs at different years for different municipalities between 1999–

2011. We thus fit a generalized DID model which exploit the variation between schools in

municipalities without competition, i.e., municipalities having 1 public school (our control

group) and compare these to schools in municipalities that introduce competition, i.e., moves

from 1 public school to introduce at least 1 independent school, which constitute our treatment

group. In practical terms this means our sample constitutes schools in smaller municipalities. The

two municipality types are presented in Table 6 below as 'category 1' and 'category 2', together

with counts of the number of schools and municipalities. Schools established during or after the

treatment year are removed since we are interested in the one public school affected by the

treatment, which is represented by the count in parenthesis. Unfortunately, only 7 municipalities

introduced competition among lower secondary schools during our observation period, and we therefore restrict our study to the 27 municipalities that introduced competition among upper secondary schools where there is potentially sufficient variation between treatment (introduction of competition) and control (no competition) groups among municipalities. We tried several alternative definitions in order to increase number of observations in the treatment groups, such as municipalities whose number of public schools increased before introducing competition, or municipalities where non–corporate independent schools appeared before any corporate schools. All these versions of the treatment are problematic due to lack of exogeneity on behalf of the schools involved, as well as unsupported parallel trends assumptions.

**Table 6. Number of Schools and Municipalities per Type of Municipality**

| Municipality category | Upper Secondary Schools | | Lower Secondary Schools | |
|---|---|---|---|---|
| | Schools | Municipalities | Schools | Municipalities |
| 1) No competition | 152 (145) | 143 | 43 | 43 |
| 2) Introduction competition | 369 (172) | 27 | 16 | 7 |
| 3) Two or more public schools | 64 | 79 | 897 | 179 |
| 4) Competition always | 617 | 38 | 1,151 | 61 |
| **Total** | **1,202 (317)** | **287** | **2,107** | **290** |

Notes: Number of schools and municipalities are not equal in the "no competition" category since some municipalities has replaced an existing school with a new one. 290 municipalities existed during the observation period and there are 287 municipalities with information about schools in our data, indicating that there are 3 municipalities without upper secondary schools. The parenthesis for "introduction competition" is the number of schools included in our difference–in–difference model as the introduction of the first independent school to a municipality with 1 public school generate the treatment, but schools' established during and after the treatment are removed in order to estimate the effect of the school receiving the treatment compared to those that have not received the treatment.

To have comparable observations between the control and treatment group we use propensity score matching (PSM) based on three essential covariates: school size (log), municipality population (log), and municipality crime rate. Covariates were chosen based on low rate of missing data as well as providing variation both at the school and municipality level. Among several tested matching algorithms, PSM with a Mahalanobis distance metric (caliper 0.1, common support) yielded the least bias.[16] We obtain 42 schools in the treatment group and 142 schools in the control group after matching. See Appendix B for balance testing results.

### A. Parallel Trends Assumption

A central assumption in DID models is that the trends for the control and treatment groups needs to be similar before treatment occur (Angrist & Krueger, 1999). Since we have a staggered treatment, i.e., treatment occurs at varying time among municipalities, a simple plot of the pre–treatment trends is difficult to obtain without noise. We therefore break up the treatment variable and conduct a formal test for parallel trends assumption using leads and lags indicators as suggested by Autor (2003), estimated by the following model:

$$(3) \qquad y_{it} = \alpha + \sum_{j=-p}^{q} \beta_j D_{it+j} + X_{itm}\beta_2 + \gamma_t + \delta_i + \varepsilon_{it}$$

where $D_{it}$ is an indicator variable taking the value 1 in year $t$ for school $i$ in the treatment group and 0 for all schools in the control group. This estimates the $q$ leads and $p$ lags of the treatment.

Table 7 present results from estimating the model in equation (3), showing all lead indicator (pre-treatment trend point) variables but only the first three lag indicators. No leads should be statistically significant in order for the parallel trends assumption to hold, i.e. the outcome trends between treatment and control group being the same (Stuart & Rubin, 2008). The lags indicate whether the effect of the treatment changes over time. We also include a separate indicator variable for the remaining 4+ years after being treated, coded as 1 in all years from year 4 and onwards for the treated schools, and 0 otherwise. Table 7 shows that the none of the lead variables (t–1 to t–11) are statistically significant for either of our work environment outcomes (complaints, disorder, and violence). Table 7 further reveals that during the year when competition is introduced, complaints are considerably reduced for treated schools, an effect seems to hold on average across the remaining 4+ years.

**Table 7. Parallel Trends Test: Upper Secondary Schools, 1999–2011**

|  | (1)<br>Complaints | (2)<br>Disorder | (3)<br>Violence |
|---|---|---|---|
| Introduction competition t–10 | –0.001 | 0.012 | 0.005 |
|  | (0.033) | (0.025) | (0.005) |
| Introduction competition t–9 | –0.014 | 0.007 | –0.003 |
|  | (0.038) | (0.026) | (0.005) |
| Introduction competition t–8 | –0.027 | 0.005 | –0.004 |
|  | (0.036) | (0.024) | (0.006) |
| Introduction competition t–7 | –0.006 | 0.039 | –0.003 |
|  | (0.039) | (0.033) | (0.005) |
| Introduction competition t–6 | –0.025 | 0.002 | –0.003 |
|  | (0.040) | (0.023) | (0.005) |
| Introduction competition t–5 | –0.005 | 0.026 | 0.016 |
|  | (0.043) | (0.029) | (0.018) |
| Introduction competition t–4 | –0.037 | -0.004 | –0.006 |
|  | (0.038) | (0.027) | (0.006) |
| Introduction competition t–3 | –0.043 | 0.017 | –0.004 |
|  | (0.038) | (0.027) | (0.005) |
| Introduction competition t–2 | 0.008 | 0.006 | 0.002 |
|  | (0.050) | (0.028) | (0.008) |
| Introduction competition t–1 | –0.018 | 0.018 | 0.027 |
|  | (0.050) | (0.032) | (0.019) |
| Introduction competition t0 | –0.073+ | -0.005 | 0.002 |
|  | (0.042) | (0.028) | (0.008) |
| Introduction competition t+1 | –0.049 | 0.019 | 0.006 |
|  | (0.050) | (0.033) | (0.013) |
| Introduction competition t+2 | –0.100* | 0.005 | –0.008 |
|  | (0.044) | (0.029) | (0.007) |
| Introduction competition t+3 | –0.107* | 0.163 | –0.002 |
|  | (0.044) | (0.162) | (0.009) |
| Introduction competition t – 4 forward | –0.071 | -0.019 | 0.004 |
|  | (0.049) | (0.027) | (0.009) |
| Constant | 2.103 | 0.001 | –0.891 |
|  | (2.829) | (0.015) | (0.643) |
| Observations | 1,309 | 1,309 | 1,309 |
| R–squared | 0.065 | 0.063 | 0.040 |
| Number of schools | 127 | 127 | 127 |
| School FE | YES | YES | YES |
| Year dummies | YES | YES | YES |
| Control variables | YES | YES | YES |

*Notes:* Results based on OLS with school fixed effects and year dummies. Standard errors are clustered at the matched group. We match treated schools and control group based on propensity score matching (PSM) using pre–treatment average of covariates 1) school size (log), 2) municipality population (log), and crime rate. We use mehalanobis distance metric with caliper set at 0.1 and common support. Control variables at the school level includes 1) share of students with foreign background, 2) share of students with highly educated parents, 3) share certified teachers, 4) share special certified teachers, 5) GPA (log), 6) school size (log), 7) educational track, and at municipality level: 8) mean income (log), 9) population (log), and 10) crime rate. *** $p<0.001$, ** $p<0.01$, * $p<0.05$, +: $p<0.10$

## VIII. Results: Difference–in–Difference Analysis

Results from the difference–in–difference analyses are presented in Table 8. With the null

hypothesis that the introduction of competition has no impact on any type of work environment,

we reject the null only for the outcome variable 'complaints' at the upper secondary school level

(Model 1) which is negatively affected by the treatment variable (with or without controls).

**Table 8. Generalized DID Models for Upper Secondary Schools, 1999–2011**

|  | (1)<br>Complaints | (2)<br>Disorder | (3)<br>Violence |
|---|---|---|---|
| ***NO CONTROLS*** | | | |
| Introduction competition (treatment) | –0.039** | 0.016 | –0.007 |
|  | (0.013) | (0.016) | (0.006) |
| Constant | 0.014* | -0.000 | –0.000 |
|  | (0.006) | (0.003) | (0.002) |
| Observations | 2,128 | 2,128 | 2,128 |
| R–squared | 0.025 | 0.017 | 0.013 |
| Number of schools | 190 | 190 | 190 |
| ***SCHOOL CONTROLS*** | | | |
| Introduction competition (treatment) | –0.052** | 0.005 | –0.007 |
|  | (0.017) | (0.010) | (0.006) |
| Constant | 0.148 | -0.305 | 0.019 |
|  | (0.489) | (0.257) | (0.076) |
| Observations | 1,309 | 1,309 | 1,309 |
| R–squared | 0.049 | 0.029 | 0.022 |
| Number of schools | 127 | 127 | 127 |
| ***MUNICIPALITY CONTROLS*** | | | |
| Introduction competition (treatment) | –0.039** | 0.017 | –0.006 |
|  | (0.013) | (0.017) | (0.006) |
| Constant | 0.014* | 0.213 | 0.313 |
|  | (0.006) | (1.260) | (0.966) |
| Observations | 2,128 | 2,128 | 2,128 |
| R–squared | 0.025 | 0.019 | 0.019 |
| Number of schools | 190 | 190 | 190 |
| ***ALL CONTROLS*** | | | |
| Introduction competition (treatment) | –0.050** | 0.007 | –0.007 |
|  | (0.017) | (0.012) | (0.006) |
| Constant | 1.976 | -0.232 | –0.913 |
|  | (2.750) | (1.712) | (0.634) |
| Observations | 1,309 | 1,309 | 1,309 |
| R–squared | 0.061 | 0.030 | 0.028 |
| Number of schools | 127 | 127 | 127 |

*Notes:* Model based on school fixed effects models with year dummies. Standard errors are clustered at the matched groups. Control variables at the school level includes 1) share of students with foreign background, 2) share of students with highly educated parents, 3) share certified teachers, 4) share special certified teachers, 5) GPA (log), 6) school size (log), 7) educational track, and at municipality level: 8) mean income (log), 9) population (log), and 10) crime rate*** $p<0.001$, ** $p<0.01$, * $p<0.05$, +: $p<0.10$

The generalized DiD analysis in table 8 also shows introduction of competition among upper secondary schools in a municipality that has never previously had competition leads to a decrease in school–level complaints by roughly 0.04 percent per student (0.04/100 per student, since all outcome variables are multiplied by 100 for ease of comparison), which is a noticeable effect. If we compare mean upper secondary school size in selected municipalities (447) with a one standard deviation increase in mean upper secondary school size (429), the difference between them in terms of complaints is almost 20 percent. (0.04*429=17.2). The effects of competition on upper secondary school complaints slightly increase when we include school–level controls (0.05*429=21.5).

### A. Testing Theoretical Mechanisms Underlying the Competition–Complaints Effects

Our results suggest that the introduction of school competition has no causal effect on the level of disorder or violence in schools, however it does result in notably fewer complaints from parents in upper secondary schools only. To probe our interpretation of relating this effect to Hirschman's (1970) theory of exit and voice we scrutinize the existence of his underlying argument in our data. Hirschman's argument suggests that when an alternative schooling becomes available, parents and students may prefer to leave problematic schools instead of complaining about the schools. We examine this argument in some more detail in two post–hoc test: First, we test whether competition reduce school size as proxy for students being more likely to leave a school. Second, we test whether the effect of competition on the decline in complains is driven by students with high socioeconomic background, predicted by Hirschman to more often act as 'quality conscious consumers' (Hirschman, 1970, p. 79). If more privileged students are more like to take advantage of educational choices by leaving problematic schools instead of exercising voice, there is a long–term risk of increasing social segregation.

Unfortunately, changes in average school size could not be estimated using the DID model since the parallel trend assumption was not accepted. We therefore conduct the first test by using equation (1) to estimate the relationship between competition and school size in the total sample of schools. These tests reveal that average school size is negatively associated with the level competition in terms of school concentration ($\beta$:–0.935, $p<0.001$) but not with the share of independent school students in the municipality ($\beta$:0.365, $p<0.001$).

The second test was conducted by examining whether students with highly educated parents explains the reduction in complaints, conditioned on competition. Using equation (1) to model school complains with added interaction terms for share of students with highly educated parents and the three competition variables, we find all interaction between students with highly educated parents and school concentration ($\beta$:–1.048, $p<0.05$), number of schools ($\beta$:–0.121, $p<0.05$) and share of independent school students ($\beta$:–8.700, $p<0.001$) to be negatively associated with complaints, in support of Hirschman's argument of high-SES students acting as more 'quality conscious consumers' in educational choice settings. Since these tests could not be fully causally estimated using a DID design, results should however be taken as indicative rather than a final test of the underlying mechanisms whereby school competition leads to a reduction in school complaints.

## IX. DISCUSSION

We have investigated the relationship between school competition and the work environment in Swedish lower secondary and upper secondary schools between 1999–2011 with a specific focus on complaints, incidents of disorder, and violence involving students.

A first notable conclusion to be drawn from this study is that the choice of competition measure is of non–trivial significance when analyzing the consequences of school competition, demonstrated by how results differ between our three measures of competition. Scatterplots (available upon request) show that there is an increasingly positive correlation between school concentration and the number of schools in a municipality, the larger the municipality. This indicates that competition is arguably only prominent when there are a sufficient number of schools within the commuting area of students (see also Hanushek, Kain, Rivkin, & Branch, 2007), and it may also entail results obtained in our difference–in–difference analysis (since we there only included municipalities that went from one to two schools). The different results by competition measure also raises questions about what competition really means for schools and how best to measure such competition, as well as for which theoretical questions different measures should be employed. It is likely that the Herfindahl index captures exit and voice better than the two other measures and also reflected in the rather consistent associations between the Herfindahl index and the level of complaints, across grade levels. It is likely that the competition variables *number of schools* and *share of independent schools students* only partially capture the demand and supply side of school competition, and that schools might exercise varying degrees of competitive pressure on surrounding schools (cf Lundgren & Lakomaa 2017).

By simultaneously studying the impact of competition and the socioeconomic composition of regions, our results raise questions about earlier findings showing that both crime and income levels impact levels of school disorder (e.g. Bowen & Bowen, 1999; Stretesky & Hogan, 2005; Welsh et al., 2000). In contrast, we find no support for this in relation to lower secondary schools, but partial support in relation to upper secondary schools, where high levels of crime in the local school market is associated with increased levels of disorder in schools. Interestingly,

however, despite the null effects from crime levels on disorder and violence among lower secondary schools, the number of complaints increases with increases of municipal crime levels.

Overall, our results indicate that the schools' work environment is not simply a function of parental involvement, as has been suggested in much of the existing cross–sectional occupational health and psychosocial research on the work environment in schools. On the one hand, we find a negative association between regional competition and the level of complaints. On the other hand, we find that one dimension of competition is associated with higher levels of violence in lower secondary schools, something that might be an indication of a deteriorating work environment (Hirschman, 1970). At the upper secondary school level, we find a reduction in complaints and reported incidents of disorder when competition increases, which indicates an improvement in the work environment. Yet, we cannot rule out that the power of voice may become stronger as competition intensifies or that a reduction in complaints may indicate suffering in silence (Kolarska & Aldrich, 1980).

Our study also raises questions regarding the findings of previous research on the influence of socioeconomic conditions within schools on the schools' work environment. Our regression analyses indicate that among lower secondary schools, the share of students of foreign background was associated with lower levels of complaints, but higher levels of student disorder and violence. For upper secondary schools, the association between foreign background and levels of disorder were markedly different, with school SES–composition measures having no effect on either complaints, disorder, or violence. This indicates that while schools' socioeconomic conditions may be important conditions for explaining variation in schools' work environment, such effects are strongly conditioned on the school grade and the overall socioeconomic conditions in catchment area. Future research exploiting potential sources of

exogenous variation in in e.g. housing or demographic conditions are needed to assess to what extent such socioeconomic conditions are causally related to work environment or not.

To gauge the causal effect of competition on the work environment we performed a difference–in–difference comparison between the sub–group of municipalities that introduced competition during our observation period, 1999–2011 and those municipalities that did not. We find that the only work environment dimension that is causally negatively related to the introduction of competition in a municipality is 'complaints' in upper secondary schools, meaning that the introduction of competition lowers the frequency with which parents and teachers file formal complaints about a school. This is consistent with Hirschman's (1970) prediction that in the absence of an option to exit, parents and employees are limited to exercising voice if they seek to express dissatisfaction with their school. However, we do not find any causal support for the introduction of competition having affected the other dimensions of work environment in the form of disorder or violence. While we provide indications that the effects of competition on work environment may be driven by high-SES students acting as more 'quality conscious consumers' in educational choice settings, further studies are needed to fully distinguish the distinct causal mechanisms that might explain these results. One important venue for further research is the potential trade–offs between competition, school quality, and work environment. Are the lower levels of complaints because parents with a voice exits (Hirschman, 1970), leaving the voiceless behind? Or does competition work as a 'treatment' for spurring schools to address behavioral problems and adverse work conditions? Why does the number of schools in a municipality increase the level of complaints, when the Herfindahl index decrease it? Individual level data tracking students over time would improve our understanding of these processes. This would also enable us to better adjust for schools in competitive

municipalities potentially attracting more well–behaved students, who may commute from schools in less competition–intensive municipalities.

A limitation is that our population-level results in the panel data analysis is descriptive rather than causal. Even though we include a number of controls on both the region and school levels, it is possible that there are omitted confounders that we have not been able to adjust for. Given that schools' work environment tends to remain persistent over time, school fixed effects are unsuitable for this first stage of the analysis. All models passed Hausman specification tests and are thus consistent and efficient. Robustness tests based on school fixed effects affirm some of the competition relationships but all relationships with respect to school- and region SES are picked up by the fixed effects removing heterogeneity in schools' persistent level of work environment (see Appendix A).

Concluding, this study fills an important gap in school research and suggests a need for broader scholarly attention to be directed at the impact of school competition on not only academic outcomes but also on disorder and the overall work environment in schools. With this study, we have taken a first step by examining potentially important school- and region level predictors of schools' work environment rather than its consequences (e.g. Böhlmark et al., 2016). By doing so, the study contributes to our understanding of how the organization of a national school market can shape work environment in schools at different dimensions, and thus inform us about its' unintended consequences. It also points to the complexities of these relations, and the need to study them simultaneously.

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**Appendix A. Panel Data Analysis: Robustness tests**

To gauge the veracity of results in our panel data analysis (equations 1-3) we conducted a set of robustness tests. First, we fit school fixed effect, which at the lower secondary level removes the relationship between school concentration and complaints, as well as share of independent school students and violence, while number of schools become positive associated with disorder (B=0.001, p<0.05). At the upper secondary level, number of schools and crime rate, respectively, is no longer associated with disorder. For both educational levels the share of students with highly educated parents is no longer associated with complaints. Second, we carefully examined potential outlier observations (see Figure 6 in the Online Appendix). Removal of potential outliers in the panel data analyses did not change any of the main results obtained. Third, we also examined the effect of each competition measures when estimated separately (excluding the other two competition measures). The results – outlined in section 4 of the Online Appendix – revealed similar results and when the measures were assessed jointly. Fourth, in unreported models we including a second–order polynomial term representing population size to control for population density potentially affecting competition did not affect the main results for either of the two school types. Fourth, lagging the predictor variables by one year resulted in no major differences. Finally, a set of first–order panel vector autoregression models revealed school concentration to Granger–cause complaints among upper secondary schools, whereas the share of students of foreign background and mean income levels were found to Granger–cause complaints among lower secondary schools. The share of independent school students was also found to Granger–cause disorder and violence among lower secondary schools. Other relationships were reciprocal or not Granger–causal.

**Appendix B.  Difference–in–Difference Analysis: PSM Imbalance Test**

This appendix provides balancing details on the matching algorithm used. The PSM imbalance

test below show the matching to yielding low percentage bias (all three matching variables below

5%). None of the t–test of mean differences in matched treatment and control observation are

statistically significant. Differences in variance between treatment and control observations close

to 1 indicative of good balance in the matching algorithm (Stuart & Rubin, 2008). PSM

imbalance graph allows to see the complete distribution of matched pairs (see Online Appendix

Section 5)**;** Kernel Density plots and boxplots for the matching variables (raw vs matched

observations) indicates good overall balance and fully symmetry in the +/- 1 S.D. range of the

variables, with a few outliers for either the treatment or control groups.

**PSM imbalance test**

|  | Mean | | | t–test | | |
|---|---|---|---|---|---|---|
|  | Treated | Control | %bias | t–test | p–value | V(T)/V(C) |
| School size | 6.2662 | 6.3102 | –4.1 | –0.18 | 0.856 | 0.92 |
| Municipality size (log) | 9.8088 | 9.8282 | –3.1 | –0.14 | 0.888 | 0.90 |
| Municipality crime rate | .09553 | .09603 | –2.1 | –0.14 | 0.886 | 0.92 |

**PSM imbalance graph**
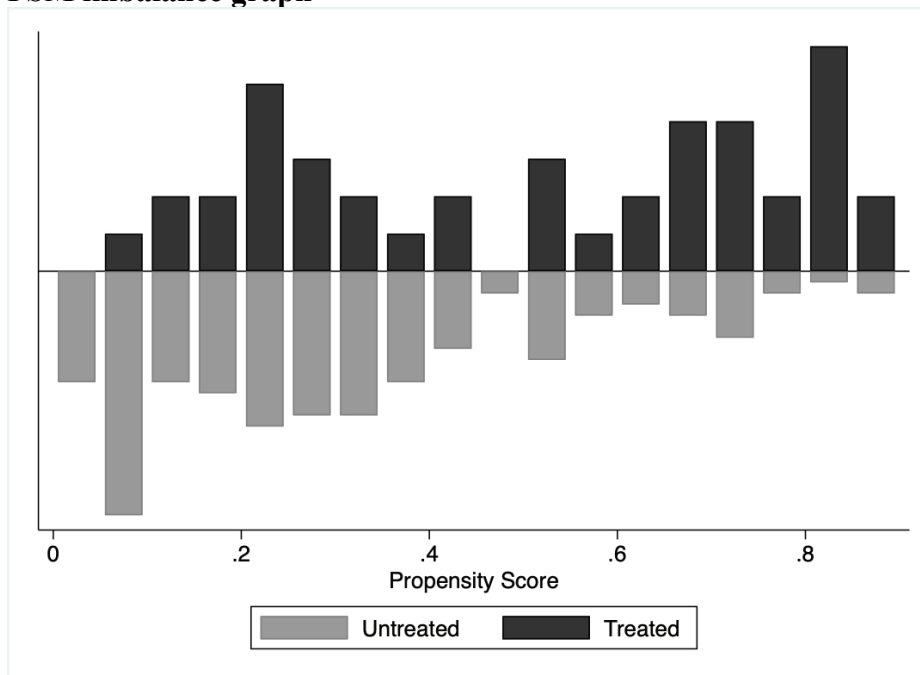
[1] A survey by Almega in 2018 on school choice in municipalities with compulsory choice showed that parents considered absence of violence and disorder more important than educational outcomes. The survey also showed that most families regardless of stated preferences chose the school closest to home (Almega, 2018).

[2] However, see Willms and Echols (1992) and Dowding and John (2008), both based on cross-sectional self-report data.

[3] Choice is however limited by the absence of independent schools in one third of Sweden's 290 municipalities.

[4] Correlations between these measures are below 0.5 for upper secondary schools and 0.7 for lower secondary schools. We have also tested for multicollinearity using Variance Inflation Factor (VIF) with all values below 5.

[5] Many studies examining outcomes of competition acknowledges that competition measures may be endogenous to student achievement due to various types of student sorting. This is dealt with using instrumental variables.

[6] Due to missing data our models include 1,305 lower- and 889 upper secondary schools with complete data. Missing data occurs when information regarding schools' GPA, numbers of students and student background is based on fewer than 10 students. We omit schools solely serving students with special needs and with diagnosed behavioral problems.

[7] https://www.scb.se/hitta-statistik/artiklar/2017/Vanligare-pendla-till-friskola/

[8] We have also run upper secondary school models at the municipality level with qualitative same results but weaker effects. In an earlier version of this paper we used municipality level and local school market as well as educational tracks as robustness tests, using them at the start saves space and is more reader friendly.

[9] When stakeholders want to report their dissatisfaction with a school, the Swedish Schools Inspectorate recommends that complaints are first made directly to the school, thereafter to the local municipality, and finally to the national agency. Our records thus constitute a sub-set of only the most serious types of reported dissatisfaction.

[10] We removed incidents of disorder that includes accidental falls in corridors or the playground since we have no theoretical justification for its relationship with competition. However, we also tested disorder including these types of incidents with no qualitative different results.

[11] School concentration (inverse Herfindahl) measures market concentration as the sum of each school's squared market share of the total student population in each municipality. The index is inversed and ranges from 0 to 1, where 0 indicates full monopoly with a few schools having large market shares, while 1 indicates perfect competition with several schools having equal market shares.

[12] This is also motivated since the competition measure 'number of schools' in a municipality is correlated with the size of a municipality, which might be correlated with other regional–level characteristics that could be correlated with both the measures of competition and the outcomes.

[13] In unreported models of complaints (available upon request) we included interaction terms between competition and SES in the municipality in terms of crime rate, revealing an indirect effect of the competition-complaints relationship conditioned by the municipal SES among lower secondary schools. Among upper secondary schools there is however no direct relationship between SES in the region and complaints but only a strong indirect relationship between competition and complaints conditioned by region SES in terms of crime rate.

[14] If competition variables are entered separately, we find the number of schools as well as the share of students in independent schools to be negatively associated with disorder at the 1 and 5 percent significance level, respectively.

[15] Complete school data including type of school prior to 1999 are unavailable. Further, work environment data are poorly documented prior to this point. The chosen period is also more comparable, since there has been a significant growth in the number of independent schools in most regions, rather than in metropolitan areas only. Beginning in 1999 also avoid the problems associated with converting grades from one system to another.

[16] Matching models including municipality income level decreased the number of treated observations with 11. While the results were similar (introducing competition was negatively associated with complaints ($\beta$=-0.093, $p<0.05$) matching bias and balancing criterion were worse, and the parallel trends assumption did not hold. We also examined a nearest neighbor matching based on euclidean distance metric. Results were similar ($\beta$=-0.022, $p<0.10$, $\beta$=-0.024, $p<0.05$, respectively) but fitted the parallel trends assumption somewhat worse.