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INTERNATIONAL EVIDENCE
ON SCHOOL TRACKING:
A REVIEW*

LUDGER WOESSMANN**

Introduction

Countries differ widely in the age at which they first track children into different types of schools. In the majority of OECD countries, tracking takes place at the age of 15 or 16, which means that there is no tracking until the 9th or 10th grade (Table). In contrast, some countries – including most parts of Germany – undertake the first tracking at the age of 10. Do such institutional differences make a difference for the level and distribution of educational outcomes?

This article reviews a series of comprehensive empirical studies that use the international variation to estimate the impact of tracking on student outcomes, as measured by various international student achievement tests.¹ As with other institutional features of the school system (see previous contributions to this journal (Woessmann 2003b, 2004)), institutional comparisons across countries lend themselves particularly well to analyze the effects of tracking.²

* This article draws heavily on Woessmann (2009). I would like to thank Anne Heritage for a first translation and Christa Hainz for valuable comments.

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¹ The tests investigated in this article are: PISA = Programme for International Student Assessment, TIMSS = Trends in International Mathematics and Science Study, and PIRLS = Progress in International Reading Literacy Study.

² See Woessmann (2003a, 2007b, 2007c) and West and Woessmann (2009) for empirically based analyses of additional reform possibilities in various areas of the school system.

³ See Meier and Schuetz (2008) for a more comprehensive discussion of the theoretical background.

In this article, tracking refers to the placement of students into different school types, hierarchically structured by performance. Such school placement policies are variously called tracking, streaming, ability grouping, or selective (as opposed to comprehensive) schooling. The advantages and drawbacks of early tracking into differing-ability schools have been the subject of heated debates in many countries, and remain so today. It is all the more surprising how little empirical evidence is available about the actual effects of early tracking.

From a theoretical point of view, the effects of educational tracking are controversial. On the one hand, those who favour early tracking believe that homogeneous classes contribute to a focused curriculum and adequate progress, which could lead to an optimal learning situation for all students. On the other hand, it is conceivable that weaker students profit from the presence of better students without the latter suffering. Thus, critics of early tracking generally argue that the weaker groups are systematically disadvantaged if they are separated early on. Since theoretically, a wide variety of causal mechanisms is conceivable – depending, among others, on the type of peer effects assumed – the effects of educational tracking are ultimately an empirical question.³

In general, education systems aim both for a high level of achievement as well as equality of opportunity

Table

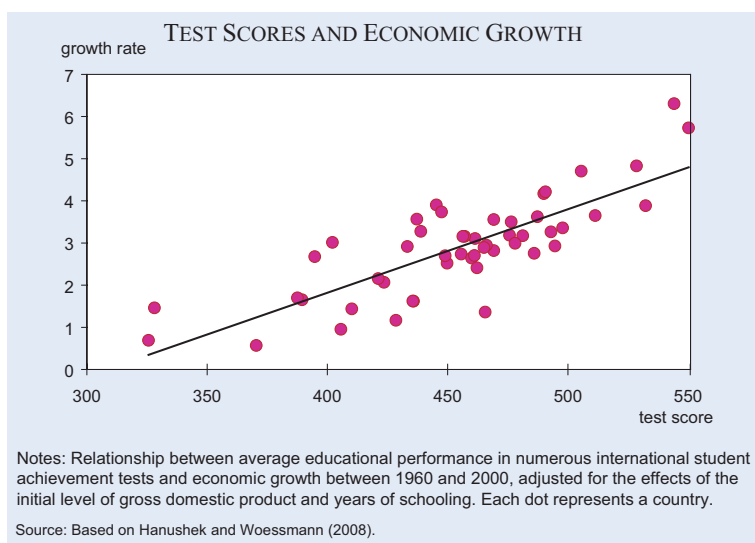
School tracking in international comparison

10	11	12	13	14	15	16
Austria Germany	Czech Rep. Hungary Slovakia	Belgium Netherlands		Italy Korea	France Greece Ireland Japan Poland Portugal Switzerland	Australia Canada Denmark Finland Iceland Norway Spain Sweden United Kingdom United States

Note: Age when students are tracked for the first time.

Source: OECD (2004).

Figure 1



for all children. That is why in this article, we investigate the effects of tracking both on the level and on the inequality of educational performance. To motivate these two goals, we start by briefly pointing out that both have important long-term consequences.

First, the average level of educational performance of the population is probably the most decisive factor for the long-term growth of an economy (see Hanushek and Woessmann 2008, 2009). Countries that had better results in the numerous international cognitive student achievement tests of the past – i.e., the predecessors of PISA – have a significantly higher long-term per-capita growth of their gross domestic product (Figure 1).

Second, the distribution of economic prosperity is closely related to the dispersion of educational performance. Thus, most of the international differences

in earnings inequality can be attributed to international differences in the inequality of educational achievement as measured by test results (Nickell 2004). As shown in Figure 2, there is a close link between earnings inequality and inequality in educational performance. In contrast, minimum wages and the degree of unionisation among workers, for example, seem to have little to do with international differences in earnings inequality.

In order to investigate whether and how tracking influences educational performance and inequality, one needs variation in tracking. Since tracking is mostly a national feature, this article exploits the international variation depicted in the Table. In addition, the cross-country evidence will be compared to within-country evidence from a federal country, Germany, where tracking is a regional feature.

The next section analyzes in an international comparison whether early school tracking has an impact on how the level and distribution of student achievement at the end of lower-secondary school develops compared to the level and distribution already given at the end of primary school. The subsequent two sections summarize two studies that compare countries with and without early tracking in terms of whether tracking is associated with the dependency of students' achievement on their family background – i.e.,

whether tracking aggravates inequality of educational opportunity – once using the TIMSS studies, once using the PISA study. The final section investigates the same association across German states and compares the results with those of the international comparisons.

An international differences-in-differences approach

The first study reviewed here, by Hanushek and Woessmann (2006), places particular emphasis

Figure 2

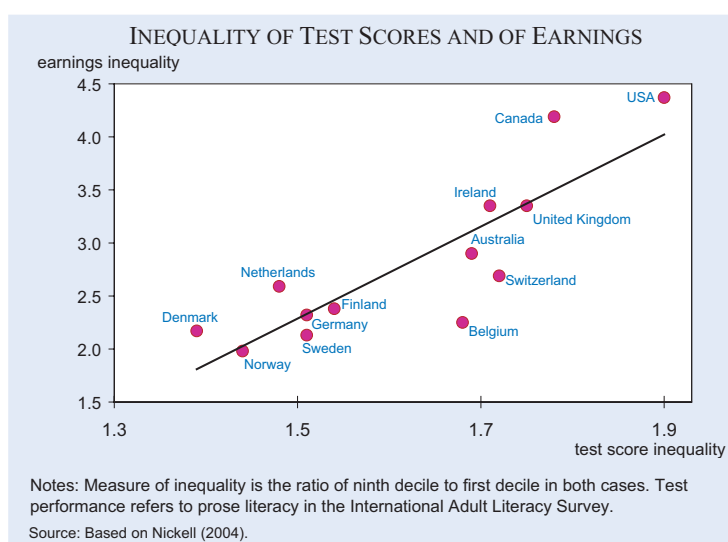
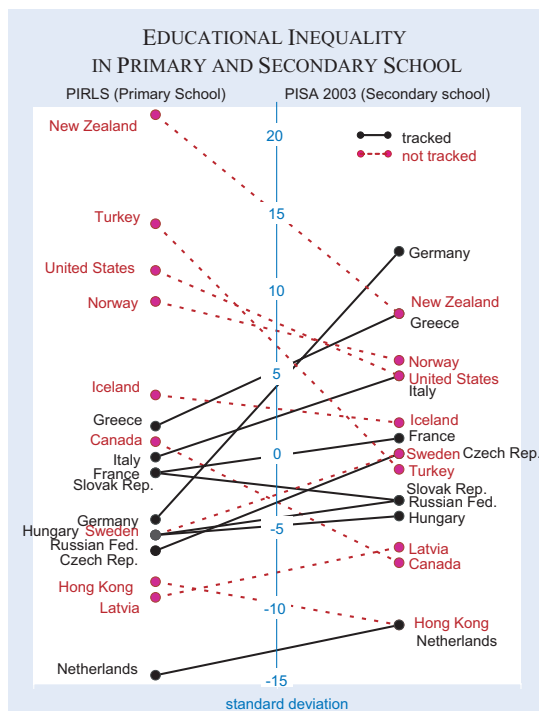


Figure 3



Notes: Dispersion of student achievement measured as standard deviation of test scores in primary school (PIRLS) in comparison to lower-secondary school (PISA 2003), in both cases measured as difference to the international mean of national standard deviations in each test. The lines indicate the change in performance dispersion from primary to lower-secondary school. The black solid lines indicate school systems that track their students into different school types before the age of 16, while the red dashed lines refer to those school systems that do not track their students by this age.

Source: Based on Hanushek and Woessmann (2006).

sis on the empirical identification of the causal effect of early tracking. They employ a method developed especially for estimating the effects of tracking to ensure that the relationship between early tracking and performance results in an international comparison is not caused by other differences in the educational systems of the countries investigated.⁴

The considerations of this approach start with the fact that in all countries, students are taught in a uniform school type for the first four years of schooling. It is only at a later point in time that tracking begins in some countries but not in others. Therefore, a comparison of the change in educational inequality between the end of primary school and towards the end of lower-secondary school can provide information on possible impacts of early tracking. The extent of inequality that exists in a country in 4th grade is clear-

ly not brought about by tracking.⁵ As a consequence, it makes sense to take this general level of inequality out of the analysis and to consider only the change in inequality that occurs after 4th grade in order to determine the effect of early tracking on the extent of inequality in school performance. The question is thus how the dispersion of educational performance on international tests develops between the end of primary school and the end of lower-secondary school.

Basically, this method involves an investigation of the relationship depicted in Figure 3. The figure shows the inequality in educational performance in PIRLS and in PISA 2003 for all countries that participated in both of these studies. Both PIRLS and PISA investigate the reading competency of students. The measure for educational inequality within a country is the standard deviation in student test scores. It represents for every country the average deviation of the individual test results from the results of the national mean.⁶

The left-hand side of the figure depicts the inequality in the performance results of the PIRLS study, which measures reading performance of students in 4th grade. Note that at this point, Germany does not show any unusual inequality in students' performance. In 4th grade, Germany is still in the lower half of countries who have relatively balanced student performance. On the right-hand side, the figure shows the inequality in educational performance in the PISA 2003 study, which tests students at the age of 15, i.e., towards the end of lower-secondary school. As shown in the figure, Germany displays the largest inequality in the performance results at this stage.

The essence of the analysis now basically involves comparing the change in inequality that occurs from primary to lower-secondary school between countries with and without educational tracking during this period. When viewing the change between the performance dispersion in PIRLS and PISA, that part of the inequality measured at the end of lower-secondary school that already existed at the end of primary school is not taken into account. The change is indicated by the lines that connect the two points of each country. For countries with early tracking, black solid connecting lines are used, while red dashed lines indicate countries without early tracking. It is noticeable that nearly all the black solid lines point upwards

⁴ For a more comprehensive report of this study, its methodology and additional results see Hanushek and Woessmann (2006).

⁵ To minimize potential anticipation effects, we also performed the analysis with inequality in 3rd grade rather than 4th grade for a study that contains 3rd-grade results, obtaining similar qualitative results.

⁶ Alternative measures of inequality, such as the difference in performance between the best and the worst 5 percent (or 25 percent) of students, yield similar results.

whereas nearly all the red dashed lines point downwards. This means that in countries that track their students into different school types, inequality increases systematically, whereas in countries where there is no tracking it decreases systematically (relative to the mean change in the sample). Of all countries, Germany is the one in which inequality increases the most between the end of primary school and the end of lower-secondary school.

Hanushek and Woessmann (2006) transform this graphic depiction into econometric estimates based on a differences-in-differences approach: The difference between countries with and without early tracking is investigated in terms of the difference in inequality between primary and lower-secondary school. The results show that early tracking leads to a systematic increase in inequality of student performance between the end of the primary and the end of lower-secondary school. This result is confirmed by various alternative model specifications and by the analysis of numerous additional pairs of international student achievement tests in primary and secondary school, including the various TIMSS tests. In total, eight different pairs of tests in primary and secondary schools were taken into account, combining a total of 176 observations.

In contrast to the results concerning the effects on inequality, the results on the performance level are less clear. But there is little evidence that early tracking would increase the performance level. To the contrary, in the most comprehensive model there is a negative effect of early tracking on the average performance level which is statistically marginally significant. Additionally, performance is evaluated at different percentiles of the performance distribution. The results indicate that not even for the best 5 percent of students is there a positive effect of early tracking.

The impact of family background on performance in TIMSS

In the previous investigation, the focus has been on the dispersion of student performance as a measure for the inequality of performance. Whereas in a positive analysis the results have a sizeable effect, it is not per se clear whether such a dispersion measure can be seen as normatively relevant because the dispersion does not necessarily tell us anything about the actual inequality of opportunity. That is why

Schuetz, Ursprung and Woessmann (2008) investigate a more direct measure for the inequality of opportunity: the extent to which individual student performance depends on the family background of the students.⁷

In national and international student achievement tests, it has been shown that almost without exception family background plays the most important role in influencing students' performance. The extent of family influence is, however, not unalterable. As reported below, there is considerable difference between countries. If the extent of family influence is seen as measure of inequality of opportunity that an educational system offers children from various family backgrounds, then countries vary in terms of the extent to which equality of opportunity is achieved. The study by Schuetz, Ursprung and Woessmann (2008) investigates whether these international differences in equality of opportunity are systematically related to the school policies of the countries.

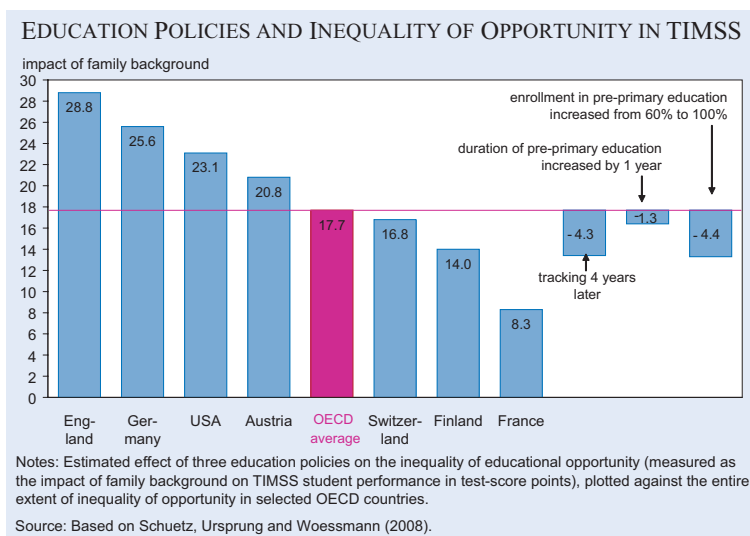
The study combines the international TIMSS student achievement test of 1995 with the repeat study TIMSS-Repeat of 1999, which test performance in mathematics and natural sciences in 8th grade, at the age of approximately 14. Micro data are available for over 325,000 students from a total of 54 countries. The study uses the number of books available in a household as a proxy for socio-economic background. Since the multivariate analysis takes into account the effects of immigration status of the student, the mother and the father (as well as age, gender and family status), the estimates are limited to the association between student performance and family background *in the non-migrant population* of each country.

Figure 4 shows the resulting measure for inequality of opportunity in a country, measured as the effect of family background on students' achievements in mathematics and science for selected OECD countries.⁸ The results indicate that in every country investigated, students with a high socio-economic background have a statistically significant lead vis-à-vis students with a low socio-economic background.

⁷ Such an operationalisation draws on the concept of equality of opportunity as defined by Roemer (1998; see also Betts and Roemer 2007). The central idea of the concept is that inequality should only be tolerated to the extent that there are differences in an individual's effort – not, however, due to differences beyond the control of the individual (for example, as a consequence of gender, race, or family background). For details of the methods, data, and results of the reported study, see Schuetz, Ursprung and Woessmann (2008).

⁸ For the estimated measure for inequality of opportunity in those of the 54 countries not shown in Figure 4, see Schuetz, Ursprung and Woessmann (2008).

Figure 4



In addition, the results show clear differences in equality of opportunity between the countries studied. Germany, for example, ranks fourth among those OECD countries that are most unequal. Thus, Germany shows a particularly strong association between the performance of students and their particular socio-economic background, compared to other countries. The only two countries with greater inequality are the United Kingdom (England and Scotland) and Hungary. The countries with the greatest equality in this study are France and Canada.

How can we account for the fact that the equality of opportunity for children from different family backgrounds in the countries studied differs so widely? To analyze the possible effects of education policies on the differences in opportunity equality empirically, the study relates the measure of inequality of opportunity in the various countries to systemic characteristics of their education policies.

The study shows that inequality of opportunity is significantly smaller, the later the tracking age of students is. The sooner students are placed in different school types, the greater the dependence of student performance on family background.⁹ If tracking is postponed by four years, for example, the impact of

family background on test scores declines by one quarter of the entire impact of the family background averaged across the OECD countries (see Figure 4). The international comparison also reveals that, apart from later tracking, a comprehensive system of pre-school education is another way of establishing larger equality of opportunity for children from different family backgrounds.

With this model, it is also possible to investigate the relationship between tracking and the average level of performance. The association between the age of the student when tracking begins and the average performance level of a country turns out not to be statistically significant. However, the point estimates are positive in the various models, indicating that the tendency is for the performance level to be lowered rather than raised by early tracking.

The impact of family background on performance in PISA 2003

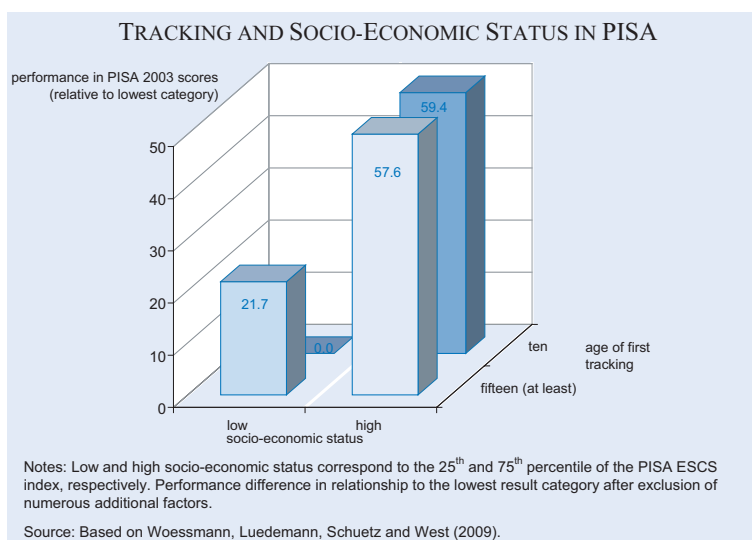
Another study by Woessmann, Luedemann, Schuetz and West (2009) investigates the same association between tracking and equality of opportunity on the basis of micro data from the PISA 2003 study. In a comparable econometric specification, it investigates whether achievement in mathematics and science of the tested 15-year-old students is associated more closely with their family background if school tracking into different school types takes place at an earlier age. The analysis is based on data for around 180,000 students from 27 countries. The Index of Economic, Social and Cultural Status (ESCS) as provided by the PISA study is used as an alternative measure for family background.¹⁰

The qualitative results with the alternative data and measures are the same: the association between test scores and family background is significantly smaller, the higher the age of first tracking. This association is depicted in Figure 5: in countries with earlier track-

⁹ Ammermüller (2005) reports similar results based on the international PIRLS and PISA data. Waldinger (2007) uses a combination of the approach of Hanushek and Woessmann (2006) and Schuetz, Ursprung and Woessmann (2008) and tends to find statistically insignificant results, but this may be largely due to limited degrees of freedom in samples of only 8–14 countries and a less informative tracking measure. Brunello and Checchi (2007) use the international approach described here for results beyond school age, finding that tracking increases the effect of family background on earnings in the labour market.

¹⁰ See Woessmann, Luedemann, Schuetz and West (2009) for further details of this study.

Figure 5



ing, the difference in performance between children with different socio-economic backgrounds is considerably larger.

As the figure reveals, this effect arises primarily from the fact that children with low socio-economic status in countries with later tracking perform considerably better. At the same time, children from families with a relatively high socio-economic status perform at approximately the same level. Accordingly, with respect to the average performance level in PISA 2003, the overall effect of later tracking is positive, albeit not statistically significant (see Woessmann, Luedemann, Schuetz and West 2009).

A comparison of within-German and international evidence using PISA-E 2003

Can the cross-country analyses be trusted, or are there omitted factors at the country level such as differences in culture, language or legal background that may account for the reported associations? One way to test this is to perform analyses within a country with a common culture, language and jurisdiction in which the tracking regime differs across regions. Therefore, the study by Woessmann (2007a) investigates the association between school tracking and equality of opportunity in a comparison of German states (*Länder*).¹¹ Even though tracking into different school types – usually *Hauptschule*, *Realschule* and *Gymnasium* – occurs at an early age everywhere in

Germany, there are small differences between the states. In Brandenburg and Berlin, there is a six-year comprehensive primary school, and only thereafter are the students separated into different school types. In all other states, tracking takes place already after 4th grade (in some cases with an orientation phase).

The advantage of an analysis within one country is that potentially remaining distortions of the international results due to unobserved, e.g., cultural, heterogeneity, can be excluded. Such a study is also particularly relevant

for the German context. The disadvantage of such an analysis lies above all in the limited statistical degrees of freedom as a result of the small number of 16 state observations.¹²

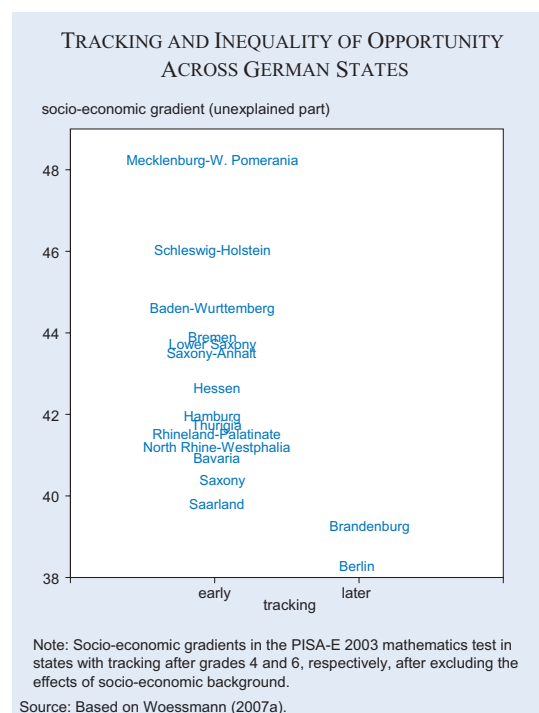
In the state comparison, the slope of the so-called socio-economic gradient in the German PISA extension PISA-E 2003 is used as the measure for the inequality of opportunity. It indicates again how strongly student performance varies with the PISA-defined ESCS index of economic, social and cultural status. The steeper the slope, the stronger the influence of family background on test performance of students, and the smaller the extent to which the principle of equal opportunity is realized. To allow for a fair comparison between states, the socio-economic gradient is adjusted in a multivariate analysis for the facts that states with a heterogeneous population (such as city states) and those with a weak economy tend to achieve less equality of educational opportunities.

As the results reported in Figure 6 indicate, the adjusted socio-economic gradient in the two states with later tracking, namely Brandenburg and Berlin, is lower than in every other state. Thus, the association between student performance and socio-economic background is significantly lower in both states with later tracking. Also in Germany, it holds true that equality of opportunity for children from disadvantaged backgrounds is greater when school tracking occurs later.

¹¹ For details of the study reported in this section, its methodology and numerous further detailed results, see Woessmann (2007a).

¹² Unfortunately, the PISA-E micro data are not available in a form that allows a corresponding analysis to be made at the student level. Therefore, the 16 states constitute the level of observation of this study.

Figure 6



Similar to the international results, this does not come at the cost of lower average performance: There is no statistically significant association between the age of first tracking and the average performance level. The point estimate is negative, however, which again points more towards a performance-reducing than a performance-increasing effect of early tracking. The results for both equality of opportunity and performance level are extremely robust in terms of taking into account further control variables. Thus, consideration of indicators for city states or Eastern states and of other variables, ranging from the political nature of the state governments to the make-up of voters and the extent of expenditures for the school system, do not change the results.

Not only the age when school tracking sets in, but also the number of school types differs across German states. The Saarland, Saxony, Saxony-Anhalt and Thuringia, for example, have only two school types to choose from – i.e., there is only one other secondary school type in addition to the *Gymnasium*. As with the age when tracking begins, the German state study reveals a significant positive association of less tracking with equality of opportunity: In states with fewer school types, the opportunity for children from disadvantaged backgrounds is significantly higher, without the performance level suffering. Equality of opportunity is particularly lower when only a small share of students attends the lowest track, the *Hauptschule*.

In contrast, there is no systematic difference in equality of opportunity or performance level between states with and without the so-called *Gesamtschulen* (a “comprehensive” school type that is available in addition and next to the existing selective school types). Once further factors are taken into account, states with *Gesamtschulen* do not have a significantly lower performance. However, the traditional promise of putting *Gesamtschulen* next to the existing school types to improve equality of opportunity is not achieved either.

What is more, the study shows that the effects of early tracking and of the number of school types that are found in the comparison of German states are similarly significant in the international PISA comparison of the OECD countries. If the German states are analyzed together with the OECD countries in a sample of 42 to 54 observations, neither the effect of early tracking nor the effect of the number of school types differs significantly between the two observation groups. What is true for the international comparison is also true for Germany – suggesting that the international results are unlikely to be biased substantially by cross-country differences in culture, language, legal structures or the like.

Conclusions

The studies reviewed in this article investigate the international association of school tracking with the level and equality of opportunity of student performance. The results show that the dispersion of educational performance increases considerably more between primary school and lower-secondary school in systems that track students into differing-ability schools compared to school systems that remain comprehensive. In addition, the effect of family background on individual student performance is shown to be weaker, the later tracking into different school types takes place. Additionally, equality of opportunity tends to be higher in school systems that have fewer school types, once tracking has taken place.

At the same time, later tracking does not go hand in hand with a drop in the performance level. The estimated effects are generally statistically insignificant, but in all four studies they point towards better rather than poorer performance levels with later tracking. In general, however, tracked school systems appear to achieve approximately the same average level of student performance as non-tracked school systems.

The international evidence presented in this article is corroborated in various studies based on variations that exist within certain countries. In line with the within-German cross-state evidence presented here, Dustmann (2004) shows that in Germany, the choice of school type is closely associated with parental background, which translates into substantial earnings differences later in life. Bauer and Riphahn (2006) find that early tracking reduces intergenerational mobility in a comparison of Swiss cantons. Exploiting certain variations across schools within the Netherlands, van Elk, van der Steeg and Webbink (2009) find that early tracking reduces participation in and completion of higher education, without having a positive effect on those placed in the upper track.

Apart from the (usually limited) cross-sectional variation in some countries, another type of identification is possible if educational tracking varies over time within a country because of educational reforms. Thus, Meghir and Palme (2005) investigate the reform of educational tracking in Sweden in the 1950s and Pekkarinen, Uusitalo and Pekkala (2006) the Finnish reform in the 1970s. Exploiting the fact that both reforms were implemented gradually in different municipalities in a differences-in-differences framework, both studies find that the postponement of school tracking reduced later inequality on the labour market.¹³

Thus, both the international and several pieces of national evidence consistently show that the earlier the school tracking, the greater the impact of family background on educational success. The data show clearly that later school tracking increases equality of opportunity. At the same time, later tracking is not associated with a lower performance level. Thus, there is no indication of an apparent trade-off between the goals of equality and efficiency in the organisation of school systems.

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¹³ Another tracking reform that has been analyzed is the one in the United Kingdom (e.g., Galindo-Rueda and Vignoles 2007), but Pischke and Manning (2006) show that it is very hard to eliminate selection bias from different students attending different types of school in this kind of setting.

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