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Educational outcomes: A literature review of policy drivers from a macroeconomic perspective

Zuzana Smidova

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EDUCATIONAL OUTCOMES: A LITERATURE REVIEW OF POLICY DRIVERS FROM A MACROECONOMIC PERSPECTIVE

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By Zuzana Smidova

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Abstract/Résumé

Educational outcomes: A literature review of policy drivers from a macroeconomic perspective

This paper reviews recent empirical literature on policy drivers of two educational outcomes - years of schooling and rates of return - that form the OECD's aggregate measure of human capital. The paper sets the literature findings into the context of current educational polices in place in OECD countries. While much of the empirical results are mixed, depend on country and time coverage as well as estimation methods, the review identifies the following policies most likely to promote better educational outcomes: quality pre-primary education, quality teaching, accountability and autonomy of teaching institutions, comprehensive lower secondary education and availability of individual financing for the pursuit of higher education.

JEL codes: E24, I20, I26, I28, I25, J24

Keywords: education, early childhood education, education attainment, education quality, primary school, secondary school, teacher, higher education, OECD

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Déterminants politiques de l'éducation : Revue de la littérature d'une perspective macroéconomique

Cet article revue la littérature empirique récente sur les déterminants politiques des années de scolarisation et les taux de rendement qui constituent la nouvelle mesure globale du capital humain de l'OCDE. Le document présente les résultats de la littérature dans le contexte des pays de l'OCDE. Bien que la plupart des résultats empiriques soient mitigés, dépendent des pays et périodes couvertures ainsi que des méthodes d'estimation, la revue identifie les politiques les plus susceptibles de favoriser de meilleurs résultats scolaires: qualité de l'éducation préscolaire, qualité de l'enseignement, responsabilité et autonomie des établissements d'enseignement, enseignement secondaire générale et disponibilité de financements individuels pour la poursuite des études supérieures.

Classification JEL: E24, I20, I26, I28, I25, J24

Mots clefs: l'éducation, l'éducation préscolaire, des années de scolarisation, qualité de l'éducation, école primaire, école secondaire, enseignant, éducation postsecondaire, OCDE

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Educational outcomes: A literature review of policy drivers from a macroeconomic perspective

By Zuzana Smidova[1]

1. Introduction and summary

1. Education is one of the key components in forming a country's human capital. Recommendations to improve educational outcomes feature prominently for many OECD and non-countries as a way of enhancing macroeconomic outcomes as well as addressing inequalities (OECD, 2019). The following literature review focuses on the empirical evidence of policy drivers of two components of human capital – years of schooling and rates of return – used in the OECD analytical framework.[2] The review does not cover a key driver –family background *per se*. Although it is of paramount importance, family background is difficult to influence by policy, at least in the short-term.[3]

2. Reforms to expand compulsory education have worked in terms of increasing the educational attainment of populations of OECD countries dramatically in the post-war period. The current trend of expanding pre-primary as well as tertiary education are also increasing average years of schooling. There is evidence, although often controversial, that particular institutional features of educational systems can boost or diminish educational achievements (often measured by student test scores), which might be ultimately reflected in broader macroeconomic measures of human capital, in terms of years of schooling as well as rates of return to education.

3. The main findings of the review suggest that the policies most likely to promote better educational outcomes are:

- Lowering the age of compulsory schooling. An increasing recognition of the importance of pre-primary education suggests that encouraging involvement at an earlier age will boost educational outcomes.
- Quality pre-primary education that focuses on both cognitive and non-cognitive skills. This is likely to involve centre-based care with developmental and educational activities for children and good working conditions for staff (including in-service training and adequate salaries). Students from disadvantaged backgrounds particularly benefit from such policies.
- Policies to improve the quality of teaching and teachers. These should attract higher-ability individuals into the profession, mandate extended period of clinical

[1] The author is Economist at the OECD's Economics Department. She would like to thank David Turner, Bàlazs Égert, and Paolo Santiago for comments and discussions of earlier versions of this paper, and Veronica Humi for preparing the document for publication.

[2] The purpose of the review was to inform recent empirical OECD work identifying the most promising drivers of a macroeconomic measure of human capital (Botev et al., 2019). This is part of a wider framework for evaluating the macroeconomic effects of structural reforms (Egert and Gal, 2017).

[3] Various policies reviewed here attenuate or mitigate the impact of family background. For a detailed review of the literature on the impact of family background, including on equality of opportunity and child development, see for instance Bjorklund and Salvanes (2010).

practice, offer in-service professional development and ensure that appraisal mechanisms have a strong focus on continuous improvement.

- School systems in which students pursue general education until the age of 15 or 16, after which they can chose from diversified pathways that allow for continuation in post-secondary programmes. Tracking at an early age in secondary education is mostly associated with negative education outcomes.
- In some countries, policies to reduce drop-out rates may provide an obvious channel to improve human capital. These policies should focus on early prevention and offer diversified pathways without dead ends.
- Policies improving accountability of teaching institutions at various levels of education, as well as autonomy in terms of process and personnel decisions. External exit exams are one way of holding schools accountable, but should not be the only measure taken into account.
- Improving the availability of individual financing for post-secondary education that does not compromise the quality of teaching, for instance by introducing income-contingent loans.

4. The review is structured as follows: first, it highlights the global expansion of education of recent decades, before surveying policies at various educational levels: pre-primary, primary, secondary and tertiary.

2. Global expansion at all levels of education

5. Education expanded massively in the twentieth century with a number of OECD countries leading the trend. In 1965, 43% of young adults (25-34 year old) had attained upper secondary education or higher on average across the OECD, but by 2015, this share had almost doubled (OECD, 2017a).

6. There is no clear-cut consensus on the underlying drivers of this global sea change. Some attribute the unprecedented increase in schooling to a range of factors such as democratisation and human rights, the strength of a country's links to the world polity, and increased institutionalisation of science, all of which emerged at about the same time (Schofer and Meyer, 2005). Others link it to the expansion of the welfare state and its focus on equality of opportunities (Bjoerklund and Salvanes, 2011). Several studies examined demographic variables such as fertility and mortality rates, life expectancy, migrant share or general economic factors such as GDP per capita (Blanchard and Olney, 2017; Cordoba and Rippoll, 2013; Oster *et al.*, 2013). In these, the two most commonly used education-specific variables are public spending on education per student and the length of compulsory education.

7. The length of compulsory schooling ranges today between eight and 14 years (Figure 1). After the Second World War, many countries extended the years of compulsory schooling. Some continue to make changes to the duration even more recently. For instance, France has reduced the initial age for compulsory education to three years of age in 2019. Recently, United Kingdom and Australia increased the school leaving age from 16 to 18 years while Hungary decreased it from 18 to 16.

8. A number of studies provide evidence of the positive effect these policies had in individual countries, although much of this evidence relates to the 1960s and 1970s or earlier (Table 1). In a cross-country setting, Brunello *et al.* (2009) show that increasing the length of compulsory schooling in twelve European countries, increased educational attainment by 0.3 to 0.4 years for those at the lower end of the distribution, and 0.1 years for the rest of the population. Braga *et al.* (2013) come to similar conclusions on a larger panel of European countries. Given that in most OECD countries compulsory education laws achieved almost universal coverage, the policy focus has since shifted elsewhere.[4]

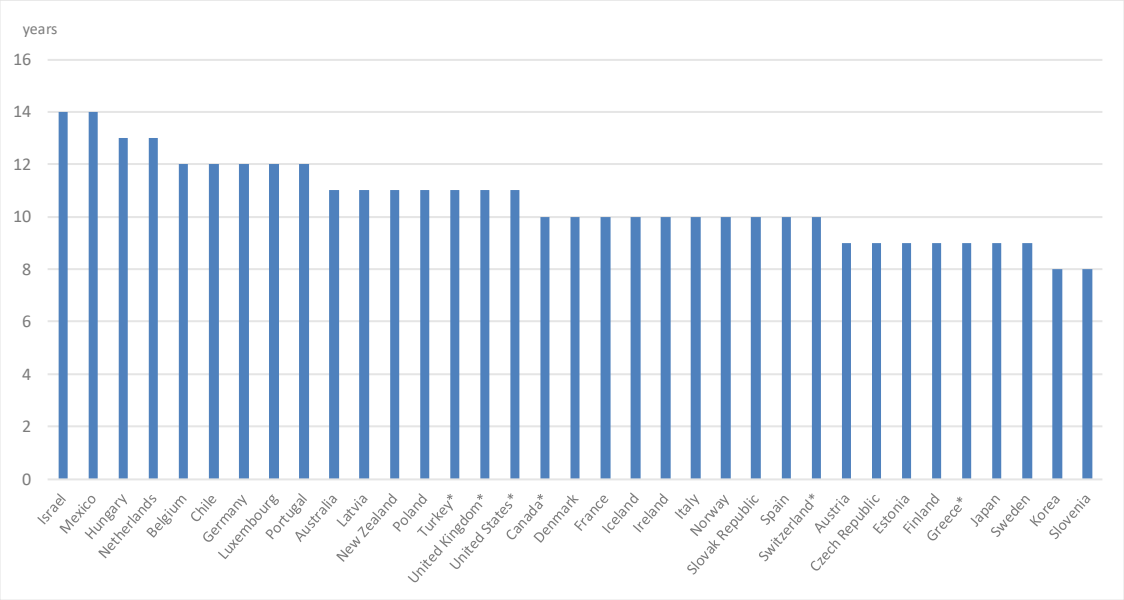
9. Among OECD countries, the benefits from further increasing the length of compulsory education by raising the school-leaving age may be limited, as at the current levels there appear to be trade-offs between the length of the compulsory schooling and drop-out rates (Lyche, 2010). In 2015, Ireland, Canada, Korea and Japan had the highest mean years of schooling of the 20-39 year olds, none of which have the longest compulsory schooling and Korea having actually one of the shortest (Figure 1). The strength of the relationship between the length of compulsory schooling and mean years of schooling has decreased over time for countries with available data.[5] Given the increasing recognition of the importance of pre-primary education, encouraging involvement at an earlier age, for instance by lowering the age of compulsory schooling, can boost educational outcomes.

[4] For example, one of the EU's Europe 2020 strategy goals is a reduction of early school leavers to less than 10%, coupled with an increase in the share of population completing tertiary education to at least 40%.

[5] For countries with available data the correlation coefficient between the mean years of schooling of 20-39 year olds and the duration of compulsory schooling falls from 0.48 in the 1970-1985 period to 0.16 in 1985-2000 period.

Figure 1. Length of compulsory schooling across the OECD

2016, or latest available.



Note: * Countries where starting or leaving schooling age can vary.
Source: OECD (2018a).

10. Braga *et al.* (2013) is one of the few papers that investigates the impact of various educational variables on overall educational attainment. Examining 24 European countries during the period 1930-2000, they show that a number of educational reforms increased educational attainment, measured by years of education at a cohort-level. These reforms included: an expansion of pre-primary education, reforms extending the duration of compulsory schooling, expansion of university access, introduction of standardised tests strengthening school accountability and an increase in the size of grants available for tertiary education. Other reforms, such as early tracking and admissions selectivity at the tertiary level tended to decrease educational attainment (Braga *et al*., 2013). The following sections summarise the existing empirical evidence on these reforms, focusing primarily on OECD countries.

Table 1. Selected literature on individual country experience of extending compulsory education

Author	Country	Year of reform	Variable of interest	Details of the reform	Effect of the extensions of compulsory education
Arendt (2005)	Denmark	1958	Years of schooling	Compulsory schooling extended by three years.	**Positive.** Years of schooling increased by 0.35 for women and 0.4 years for men.
Black *et al*. (2001)	Netherlands	1973	Years of schooling	Compulsory schooling extended by a year.	**Positive.** Years of schooling increased by 0.71 and 1.33 years for men and women.
Brandolini and Cipollone (2002)	Italy	1963 -1976	Years of schooling, enrolment rate	Compulsory junior high school as of 1963.	**Positive.** Years of education increased by 0.21, as did enrolment rate in 8th grade.
Del Bono and Galindo-Rueda (2006)	England and Wales	1973	Years of schooling, employment, earnings	Compulsory school leaving age increased from 15 to 16, change of "leaving" eligibility.	**Positive.** A strong impact on educational attainment in the years following the change. A causal employment and participation effect found, stronger for women.
Denny and Harmon (2000)	Ireland	1972	Years of schooling	School leaving age raised to 15 and further to 16 years, secondary schooling made tuition-free.	**Mixed.** Decrease of schooling attainment of those from high-skilled background, increases for those from low-skilled background.
Grenet (2004)	France	1957	Years of schooling, drop-out rates	Compulsory schooling increased by two years.	**Positive.** Increase of 0.34 years of schooling, with varying effect by parental background. Drop-out rates lower by 20% among farmers' sons.
Meghir and Palme (2005)	Sweden	1949- 1962	Years of schooling	Compulsory schooling increased from 7or 8 years to 9, abolished tracking and introduced a unified curriculum.	**Positive.** Increase of 0.27 and 0.22 years of schooling for men and women.
Oreopoulos (2006)	Canada	1920-2000	Years of schooling, drop outs, earnings	Increases in compulsory school leaving age in various provinces	**Positive.** Increasing school leaving age increased grade attainment as well as earnings, reducing drop-outs.
Pekkarinnen (2005)	Finland	1972-1977	Probability of further education	Compulsory education increased by three years, tracking shifted from 10 to 16 years.	**Mixed.** Probability of women to continue academic education increased, probability of men decreased, especially from non-academic backgrounds.
Pischke and Wachter (2005)	Germany	1947-1969	Years of schooling	Complusory schooling extended by one year.	**Positive.** Years of schooling increased by 0.28% years among students in the basic track.

Note: 'Positive' ('Negative') refers to statistically significant positive (negative) effect of the reforms on the variable of interest, and 'Mixed' to either statistically insignificant effects or a combination of negative and/or positive results.

Source: Various studies, see first column of table.

3. Pre-primary education policies

11. In principle, children attend early childhood education and care (ECEC) when parents are working. There have been concerns about the negative impact of mothers re-entering the labour market during the child's infancy while the childcare is provided by alternative means. Parental employment improves family income and thus the socio-economic environment that in itself is a pivotal driver of educational outcomes. Studies on the relationship between maternal employment and child's cognitive and behavioural development have found mixed results (Table 2).

12. The effect seems to vary according to child and family characteristics as well as childcare quality (with often negative findings on informal care). The impact on child outcomes for children of two-parent families, high income or highly educated may be more negative (Gregg *et al.*, 2005; Ruhm, 2000). In single parent families or minorities, maternal employment has not been linked to poorer outcomes of children (Brooks-Gunn *et al.*, 2010). Combining birth cohort studies of five OECD countries, Huerta *et al.* (2011) conclude that return to work by mothers within six months after childbirth may have negative effects on cognitive development, but the effects are small and not observed across all the countries examined. Furthermore, there is only little evidence of associated conduct problems or attention-hyperactivity (Huerta *et al.*, 2011).

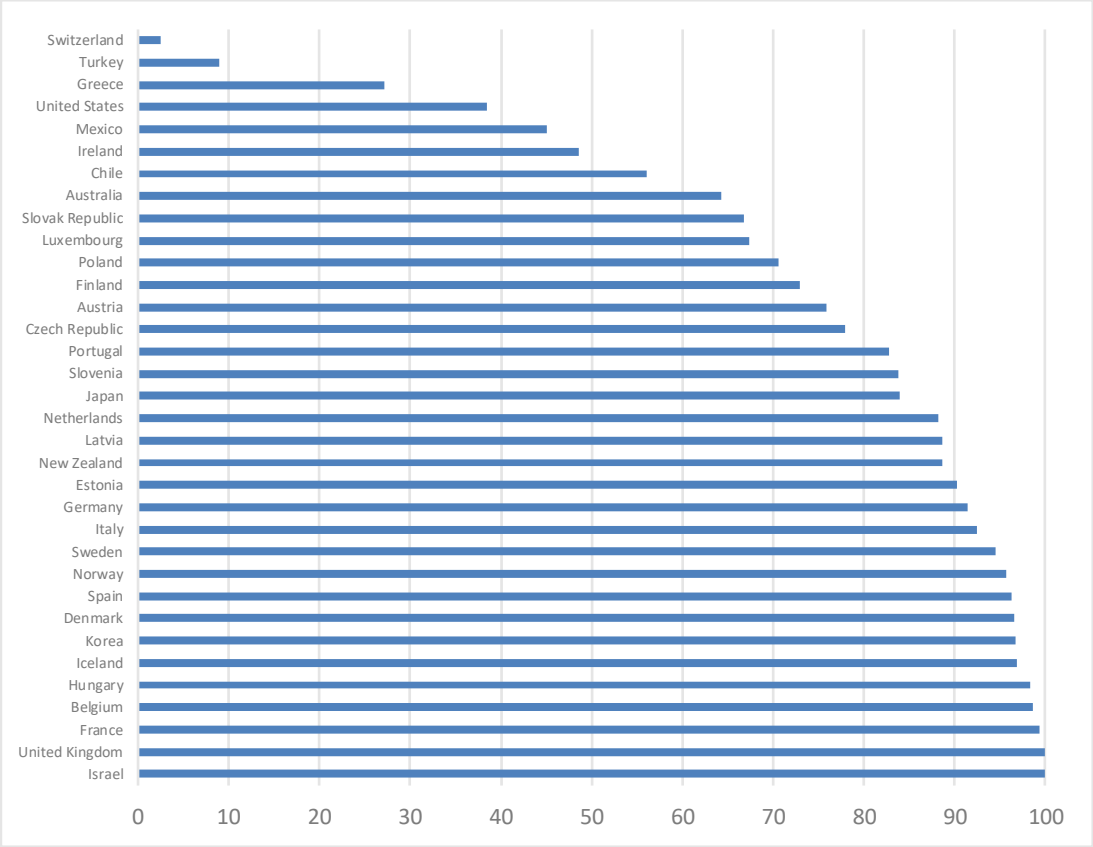
13. Many OECD countries increased access and financial resources to ECEC. In most countries, more than 90% of five-year-olds and over 60% of three-year-olds attend pre-primary or primary education (Figure 2). While the coverage differs in terms of legal entitlements to a place, hours per week and guarantee of free access for younger ages, it has been on the rise across the OECD.

14. Policies focused at this age group take various forms: from extensions of parental leave, institutionalised childcare and education, childcare subsidies to home-based intervention programmes. The empirical evidence on each is mixed, as it tends to depend on a number of often country and programme specific factors. Differences can also arise due to different identification strategies, data sources, countries and institutional settings.

15. Pre-primary education has received considerable policy attention in recent years, as it has been linked to educational and other outcomes later in life such as physical and mental health, socioeconomic status and employment (Table 2). Adult educational attainment and achievement is correlated with early cognitive as well as non-cognitive skills (see literature review by Shuey and Kankaras, 2018). Gaps in both, cognitive and non-cognitive skills, open up at early ages across individuals and socioeconomic groups. They are strongly influenced by family environment, and persist (see summary of the literature for instance in Cunha *et al.*, 2005; Attanasio, 2015). PISA tests scores of students that attended pre-primary education are on average 8.2 points higher, having the same impact as around a one-third of a school year (Schuetz, 2009).

Figure 2. Enrolment rates in pre-primary education and care

At age 3, 2016.



Source: OECD (2018).

16. Much of the country-specific studies based on large scale longitudal data find positive association of early numeracy, visual-motor skills and certain non-cognitive skills (e.g. memory, inhibitory control and mental flexibility) with educational attainment and achievement later on in life (Shuey and Kankaras, 2018).

17. A large strand of the literature shows that policy interventions that come early in the child's life are the most efficient in mitigating the impact of unfavourable family background (Carneiro and Heckman, 2003; Cunha *et al.*, 2005, Almlund and Currie, 2011). This is because during the early years improvements in IQ and aptitude to learn a language are stronger. In addition, human capital investments are complementary across time, whereby the marginal returns to later investments increases with the level of early investment (Bjoerklund and Salvanes, 2011). This body of evidence suggest that early childhood education is perhaps the most effective policy lever to reduce the strong role of family background and the intergenerational persistence of educational inequality of the most disadvantaged (Garcia *et al*., 2017).

18. Expansion of pre-primary education has been shown to increase educational attainment (Braga *et al.*, 2013). Since "learning begets learning", i.e. early investments reinforce the future ones, quality pre-primary education can increase skills leading to students achieving better results later on as well as staying longer in education. This will affect positively both the mean years of schooling as well as returns to education.

3.1. Importance of quality childcare

19. A growing body of research suggests that children's development and subsequent learning benefits from *quality* early education and care although the evidence on precise features of such childcare is not yet fully established (OECD, 2018c) (Table 3). Much of the literature so far examined centre-based care for children aged three-five with less evidence on toddler and infant care (aged zero-two), be it family-based or institutionalised.[6]

20. The primary driver of gains in children's development through early education and childcare is so-called process quality. This includes features such as quality of staff-child interventions, developmental and educational activities, organisational climate, leadership and favourable working conditions (that includes also remuneration reflecting the level of qualifications and level of skills attained) as well as professional development and in-service training for the staff (OECD, 2018c).

21. The evidence on structural features of ECEC is less straightforward. Fewer children *per* staff member, higher *ex ante* qualifications of staff or system of quality monitoring relate indirectly to children's development via the staff-child interactions (for literature review see Slot, 2018). For instance, the association of pre-service training and child development and learning is inconclusive, while higher in-service training is associated with better staff emotional, educational and developmental support for children, and this relationship is stronger for the youngest ones (OECD, 2018c).

[6] There are reasons for caution in interpreting the results of such studies. Many of them refer to longitudal data of children born twenty or more years ago while childcare facilities have changed considerably since (Huerta *et al*., 2011). Much of the research focus has been on short-term outcomes. Also, better identification methods are now available to establish the causal effects of maternal employment (Bjoerklund and Salvanes, 2011).

Table 2. Selected literature on maternal employment and leave

Author	Level of analysis/country	Variable of interest	Determinants examined	Effect of maternal employment/maternal leave
Brooks-Gunn *et al*. (2010)	United States	Cognitive skills	Maternal employment	**Mixed.** Negative effects of maternal employment are offset by positive effects of higher use of centre-based care, high quality home environments and greater maternal sensitivity.
Carniero, Loken and Salvanes (2009)	Norway	High school drop outs	Extension of maternity leave	**Positive.** High school drop-out rate declined by 2.7 percentage points, for children of less educated mothers the effect was stronger.
Dustmann and Schoenberg (2012)	Germany	Average schooling	Expansion of paid and unpaid leave	**Positive.** No impact on average schooling of first reform, somewhat negative impact in case of second reform.
Gregg *et al*. (2005)	United Kingdom	Cognitive skills	Maternal employment	**Mixed.** No evidence of full or part-time work with formal care leading to any adverse outcomes. Informal care by relatives or friends does lead to poorer outcomes.
Joshi *et al*. (2009)	United Kingdom	Cognitive skills	Maternal employment	**Mixed.** Employment during first year tends to go with poorer outcomes (for reading), cognitive skills have small positive association with maternal employment at later stages.
Liu and Nordstrom Skans (2010)	Sweden	Cognitive skills	Extension of maternity leave	**Mixed.** On average no effect on test scores and grades at age 16. Positive effect of the reform for children of well-educated mothers.
Wurtz Rasmussen (2010)	Student/ Denmark	Cognitive skills, drop-out rates	Extension of maternity leave	**None.** No measurable effect on test score at age 15 or on high-school drop-out rates.

Note: 'Positive' ('Negative') refers to statistically significant positive (negative) effect of the reforms on the variable of interest, and 'Mixed' to either statistically insignificant effects or a combination of negative and/or positive results.

Source: Various studies, see first column of table.

Table 3. Selected literature on pre-primary education

Author	Level of analysis/country	Variable of interest	Determinants examined	Effect of pre-primary education
Braga *et al.* (2013)	Cross-country panel	Years of schooling, educational inequality, intergenerational persistence	Attendance of pre-primary education and others	**Positive.** Expansion of pre-primary education increased educational attainment.
Del Boca *et al.* (2018)	Cross-country	Test scores	Participation in pre-primary education, index of quality of pre-primary education, public spending on pre-primary education	**Mixed.** Higher shares of children who received pre-primary education improve later educational outcomes. Quality, coverage and costs are also found to exert a positive impact on aggregate assessments. Attendance of pre-primary education over a year is positive but not statistically significant.
Havnes and Mogstand (2011)	Norway	Educational attainment, earnings and welfare dependency, family formation	Attendance of publically funded childcare	**Positive.** Child-care exposure improved long-run prospects of children in terms of educational attainment, labour market attachment and welfare dependency. Most of the effects on education attainment stem from children with low-educated mothers and most of the earning effects relate to girls.
Rossin-Slater and Wuerst (2016)	Denmark	Educational attainment, income, probability of survival, intergenerational effects	Pre-primary school attendance	**Positive.** Children that attended high-quality pre-school have better outcomes on all measured fronts, infant home-visit program lowered marginally the outcomes, suggesting that the marginal benefit of pre-school was lower for those already exposed to the infant program.
Schuetz *et al.* (2009)	Cross-country	Test scores	Index of equality of educational opportunity, pre-school education and tracking.	**Positive.** Pre-school education of relatively small part of the population is positively related to family background, but once a substantial share of students is enrolled, it has an education-equalising effect.
West and Woessmann (2010)	Cross-country	Test scores	Attendance of pre-primary education for over one year.	**Mixed.** Positive but not statistically significant effect on test scores.

Note: 'Positive' ('Negative') refers to statistically significant positive (negative) effect of the reforms on the variable of interest, and 'Mixed' to either statistically insignificant effects or a combination of negative and/or positive results.

Source: Various studies, see first column of table.

4. Primary and secondary education policies

4.1. School inputs: spending, class size and teacher quality

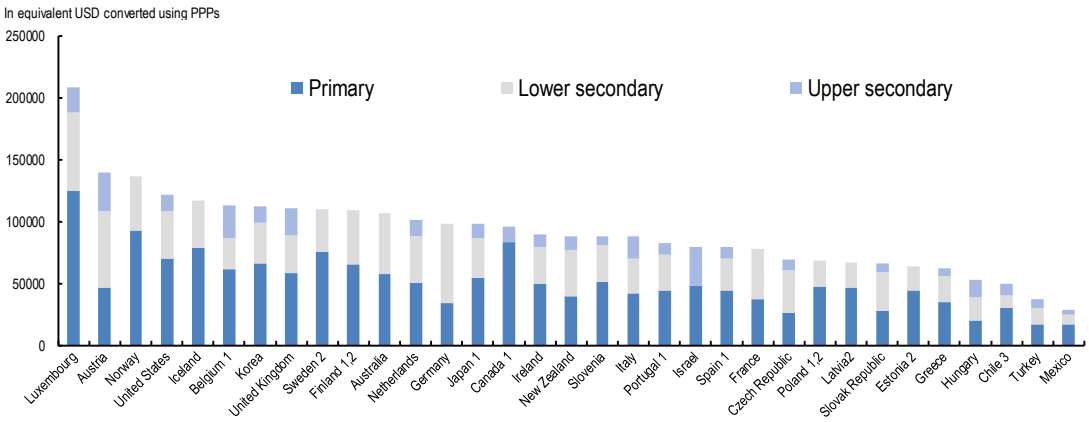
22. Across the OECD, countries spend on average 10 500 USD per student per year on all education levels (in equivalent USD, converted using 2015 PPPs). Spending per student at secondary level is 15% higher than per primary student, and at tertiary level spending is 30% more than at primary level on average. Most of the spending goes on core education services (such as teacher salaries). There is a large variation among the countries in overall spending as well as per level of education both in terms of absolute and relative levels (Figure 3).

23. Excluding the tertiary level, country income level and its spending on education is correlated, with lower income countries spending less per student than the higher income ones (OECD, 2018a). With real spending on education having shown a strong tendency to increase over time, many OECD countries now focus on efficient allocation of school spending (OECD, 2017d, Wolff *et al.,* 2014).

24. To compare resources allocated to education across countries, indicators of inputs such as spending per student, class size, student-teacher ratio, teacher salaries and qualifications or quality of instruction material are used. Much of the empirical evidence in this area looks at the links between school inputs and student performance in terms of test scores or grades. There ought to be a link, albeit indirect, between test scores and measures of human capital: assuming that well-performing students are motivated to continue their education, this will affect both quality of education (i.e. rates of return) and overall educational attainment of a country (i.e. mean years of schooling).

Figure 3. Cumulative spending per student

Annual expenditure on educational institutions per student between the age 6 and 15, multiplied by the theoretical duration of studies (2015)



Notes:
1. Includes some other levels of education.
2. Includes one year of pre-primary education.
3. Year of reference 2016.

Source: OECD (2018a).

4.1.1. Spending per student

25. Several countries with high expenditures do as well as some of the countries with low levels of expenditures per student. In recent decades, expenditure per student at the primary and secondary level has increased substantially, although the student performance as measured by international tests scores have not increased commensurately (Gundlach *et al.*, 2010, Fuchs and Woessmann, 2007).

26. The evidence on the link between higher *spending per student* and better educational outcomes, measured by the international test scores, is mixed (Table 4). Such a conclusion holds when controlling for other factors such as student background and various school features in both time-series and cross-sectional studies (see the literature review by Hanushek and Woessmann, 2011).

27. Some literature suggests that the relationship is non-linear. In countries with cumulative spending per student for the ages 6-15 below 50,000 USD, higher expenditure on education is strongly associated with higher PISA science scores. Above this threshold, the relationship is difficult to discern, suggesting that improvements in education outcomes require more than money (OECD, 2016a). Currently, most of the OECD countries rank above this threshold with the exceptions of Chile, Mexico and Turkey (Figure A4).

28. A wave of recent US studies, examining spending increases in disadvantaged schools mandated by court rulings on equity and adequacy grounds, finds on average a causal effect of increased spending on both educational attainment and test scores (Lafortune *et al.*, 2018; Jackson *et al.*, 2015, Johnson, 2015). In line with the threshold effects, these policy reforms can be seen as increasing the spending at the bottom of the distribution. Increased spending per student can take various forms: by lowering the student-teacher ratio, increasing teacher salaries, hiring more teacher assistants or improving the tangible infrastructure of the school networks.

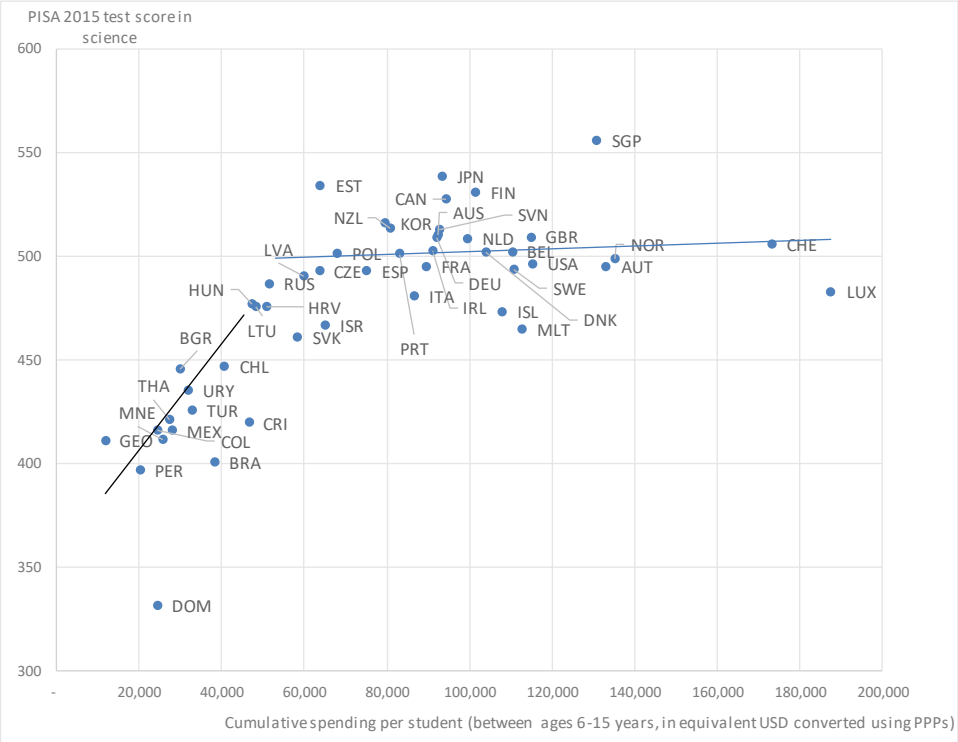
29. Country experience suggest that distribution of spending and the incentives a funding formula provide is at least as important as the level of funding (OECD, 2017d). As countries seek to enhance the performance of all students as well as provide more equitable learning opportunities for different groups, there has been greater focus on ensuring that resources are directed to the areas where improvements in teaching and learning outcomes can be best achieved (OECD, 2017d).

4.1.2. Teaching resources

30. In 2016, there were 15 students per teacher in primary and 13 students per teacher in secondary education on average across OECD countries (OECD, 2018a). In primary education, the teaching staff ranges from less than ten students per teacher in Luxembourg and Greece to about 20 or more in Turkey, France, United Kingdom and Chile. A number of countries impose hard upper bound rules.

Figure 4. Spending per student and test score performance

Cumulative spending per student from the age of 6 to 15 and PISA science test score.



Note: Only countries and economies with available data shown. Significant relationship (p<0.1) is shown by the black line, non-significant relationship shown by the blue line (p>0.1).
Source: OECD (2015).

31. Classes have been getting smaller over time. Average class size at primary level is over 21 students, but there are significant differences across countries ranging from fewer than 17 in Luxembourg, Latvia and Lithuania to 30 or more in Chile, Israel or Japan. At lower secondary level, the average class size is 23. There is no consensus on what is the best ratio of students to teachers at different ages, although the 'conventional wisdom' is that younger students need more time and interaction with teachers for quality education.

Table 4. Selected literature on spending per student

Author	Country coverage	Dependent variable - test scores	School input determinants examined	Effects of spending per student
Fuchs and Woessmann (2007)	OECD	Math, science, reading	Resources (average educational expenditure per student in secondary education), student and teacher and institutional features	**Mixed.** Positive association between spending per student and student performance likely driven by a few countries with very low spending, but not existent among the developed OECD countries.
Gundlach *et al.* (2001)	OECD	Math, science	Primary and secondary level expenditure per student	**Negative.** Real expenditure increased substantially over time, but student performance remained at best constant.
Hanushek and Kimko (2000)	OECD and non-OECD	Math, science	Student teacher ratio, current expenditure per pupil, adult schooling	**Mixed.** No effects of school resources.
Juerges and Schneider (2004)	OECD	Math	Teacher, class, school resources and institutions (public expenditure on education relative to GDP)	**Mixed.** Background, teacher characteristics, school resources have positive effect. Public and private expenditure on education not statistically significant.
Lee and Barro (2001)	OECD and non-OECD	Math, science, reading and drop-out rates	Student teacher ratio, spending per student, teacher salaries, length of school year	**Positive. P**ositive and significant impact of school resources.
OECD (2016)	OECD and non-OECD	Science	Cumulative spending per student from age six to 15	**Mixed.** A significant and positive relationship found for countries spending under 50 000 USD. Above that threshold the relationship no longer significant.
Woessmann (2003)	OECD and non-OECD	Math, science	Resources, teachers, insitutional features of the school systems	**Mixed.** Family background and institutional features more important than resources.

Note: 'Positive' ('Negative') refers to statistically significant positive (negative) effect of the reforms on the variable of interest, and 'Mixed' to either statistically insignificant effects or a combination of negative and/or positive results.
Source: Various studies, see first column of table.

32. The student–teacher ratio can be seen as a general measure of teaching resources in schools. Nevertheless, similar ratios across countries can effectively mean different class sizes at various levels of education, possibly making it difficult to draw clear-cut conclusions from the aggregate level indicator. Many studies tend to look at a class size that correspond to an outcome measure of interest, e.g. a test score at a given age (Table 5).

33. The empirical evidence on the relationship between test scores and student-teacher ratio is mixed. Studies using a large number of covariates tend to finds statistically insignificant effects of the student-teacher ratio. Large country samples tend to show positive effects, while negative effects (implying smaller student-teacher ratio is beneficial) tend to come out of studies using only few countries. Significant effects seem to be present in the context of relatively low quality of teachers, which is sometime justified by a hypothesis that weaker teachers have a difficulty to manage larger classes (Hanushek and Woessmann, 2011).

34. Some studies find a small positive impact of reduced class size on long-term outcomes such as overall educational attainment (Bingley *et al*., 2005; Browning and Heinesen, 2007; Fredriksson *et al*., 2013). Smaller class sized seem to matters more in disadvantaged schools and for less academic students (Heinesen, 2009; Chetty *et al* 2011; Dynarski *et al.*, 2013). In majority of countries that participated in 2015 PISA, disadvantaged schools had smaller classes and/or lower student-teacher ratio (OECD, 2018d).

35. Decreasing significantly class size is a costly measure, when other factors are held constant, and only a few studies have directly compared the cost and benefit of class size reductions with those of alternative interventions (OECD, 2018d). Certain high-performing education systems have instead chosen to reduce teacher workloads, invest in higher teacher salaries, or employ assistant teachers more widely. Findings from the 2013 Teaching and Learning International Survey (TALIS) illustrate that class size is not a significant predictor of low job satisfaction of teachers in most participating countries; instead, it is the proportion of students with behavioural problems that matters, an issue that is generally better dealt with by assistant teachers (OECD, 2018d).

36. Some authors point to aggregation bias in country-level analysis since the probability of finding statistically significant and correctly signed class size effect increases with the level of aggregation of data (Hanushek and Woessmann, 2011; Fertig and Wright, 2005). Moreover, conventional (least squares) estimates suffer from endogeneity bias, the direction of which is *a priori* unclear: Schools may reduce class size for under-performing students, they may get compensatory funding for larger shares of students from disadvantaged backgrounds, and/or some parents may be choosing schools with smaller classes. Nevertheless, they conclude that even when employing quasi-experimental identification strategies, the results remain mixed (Hanushek and Woessmann, 2011).

Table 5. Selected literature on student-teacher ratio and class size

Student-teacher ratio			
Author	Level of analysis	Determinants examined	Effect of lower student-teacher ratio
Andre *et al*. (2019)	Sweden	Student-teacher ration and other characteristics	**Mixed.** The statistical significance varies according to model used.
Boarini and Ludemann (2009)	OECD	Student-teacher ratio and other characteristics	**None**. More teachers not associated with better outcomes, although higher teacher wages are, suggesting a trade off between the number of teachers and the wage bill.
Del Bocca *et al*. (2018)	European countries	Student-teacher ratio in pre-primary, expenditure on pre-primary and primary education	**Mixed**. Low pupil-teacher ratios in pre-primary decreases the share of low-performing students (measured by PISA), the effect on mean score, and share of high performers not significant.
Edwards and Marin (2015)	OECD and non-OECD	Student-teacher ratio and other characteristics	**Negative**. The quality of education depends on socio-economic, structural and policy variables such as expenditure per student, teacher-student ratio.
Giambona and Porcu (2018)	Cross-section (Italy)	Student-teacher ratio and other characteristics	**Positive.** Relationship between the school size and achievement follows an inverse U-shaped forms suggesting the existence of an optimal size of school, but in the Italian context specific regional issues remain (strong socioeconomical divide between the North and the South).
Lee and Barro (2001)	OECD and non-OECD Cross-country panel	Student-teacher ratio, public educational expenditure per pupil, average salary of primary school teachers	**Positive**. Most school resources are positively related to student perfomance, with the strongest result for student-teacher ratios.
Meroni *et al*. (2015)	Cross-country	Teacher-student ratio	**Positive**. Teacher - student ratio is positive and statistically significant. Variance in teacher skills explains around 14% and 17% of performance in Math and Reading respenctively.
Thorson and Gearhart (2018)	Cross-country panel	Teacher-student ratio	**Mixed.** In most years and subjects the ratio was statistically insgnificant.
Woessmann (2003)	Cross-section	14 measures of school resources, including student-teacher ratio	**None**. International differences in student performance can not be attributed to differences in resources but are considerably related to institutional differences.

Note: 'Positive' ('Negative') refers to statistically significant positive (negative) effect of the reforms on the variable of interest, and 'Mixed' to either statistically insignificant effects or a combination of negative and/or positive results.

Source: Various studies, see first column of table.

Table 5. Selected literature on school inputs: student-teacher ratio and class size (*contd.*)

Class size			
Author	Level of analysis	Determinants examined	Effect of smaller class size
Altinok and Kingdon (2009)	Student	Differences in class size across subjects	**Mixed**. Small significant negative effects in ten countries, positive in six, effect larger in developing countries and with low teacher quality.
Bingley *et al.* (2005)*	Student	Class size reduction	**Positive**. Variation in class size between siblilngs shows that one unit reduction in class size in the 8th grade gives rise to approximatelly 0.04 more years of education. Cost benefit analysis finds that in event the most favourable circumstances the costs outweight the benefits.
Browning and Heinesen (2007)*	Student	Class size, pupils per teacher hour	**Mixed**. Positive effects of reducing class size or pupils per teacher hour on educational attainment. A reduction in class size of 5% (i.e. by one pupil from the average of 20) increases the probability of completing a secondary education by 0.4% and average length of education by 0.02 years.
Chetty *et al.* (2011)	Student	Class size reduction	**Positive.** Kindergarten test scores highly correlated with earnings at age 27, college attendance, home ownership and retirement savings. Effect of class quality fade in terms of test scores in later grades but gains in non-cognitive measures persist.
Dynarski et al. (2013)	Student	Class size reduction	**Positive.** Assignment to a small class increases probability of attending college by 2.7 percentage points, with effects more than twice as large among blacks and more so among students enrolled in the posets schools. Smaller classes also increase the likelihood of obtaining a college degree.
Fredriksson *et al.* (2013)*	Student	Class size	**Positive**. Smaller classes in the last three years of primary school are beneficial for cognitive and non-cognitive ability at age 13, and improve achievement at age 16. They have positive effects on completed education, wages and earnings.
Fertig and Wright (2005)	Student	Class size	**Mixed**. Class-size estimates become negative and significant only at high aggregation levels, indicating aggregation bias.
Fuchs and Woessmann (2007)	Student	Class size	**Mixed.** The effect of class size is positive for math and science score but statistically insignificant for reading score.
Hanushek and Luque (2003)	Classroom	Class size, teachers' experience and education	**Mixed**. Limited evidence of effects of school inputs; cross-country differences hard to explain systematically, no evidence of stronger effects in developing countries.
Lastra-Anadon and Mukherjee (2018)	Student	Class size	**Mixed.** Class size has positive but statisticaly insignificant impact on test scores.
Woessmann (2005)	Student	Class size, shortage of materials, instruction time	**Mixed**. The size of teaching classes has no statistically or economically significant effect on cognitive skills of students among a representative samples of middle-school students in 15 West European countries.
Woessmann and West (2006)	Student	Class size	**Mixed**. Sizeable beneficial effects of smaller classes rejected in eight countries, present for Greece and Iceland, noteworthy effects only in countries with low teacher salaries, conventional estimates severely biased.

Note: Dependent variable is student test scores or grades, except for studies with (*) where the dependent variables include also educational attainment and completion of education. Positive' ('Negative') refers to statistically significant positive (negative) effect of the reforms on the variable of interest, and 'Mixed' to either statistically insignificant effects or a combination of negative and/or positive results.
Source: Various studies, see first column of table.

4.1.3. Teacher quality

37. In schools, teaching quality is the single most important factor that affects student learning (OECD, 2005). Good teachers have been defined as those that lead to improved student achievement and are generally characterised by pedagogical content knowledge, quality instruction, classroom climate and management, professional behaviour and beliefs (Coe *et al.*, 2014). Many US studies that tracked student attainment over time illustrate how some teachers produced consistently more gains in student achievement than others (Hanushek and Rivkin, 2012; Jackson, Rockoff and Staiger, 2014). Better teachers lead also to better student life-time outcomes such as a higher probability of attending higher education and higher initial earnings (Chetty *et al.*, 2014).

38. However, identifying good proxies for teacher quality has not been straightforward (Table 6). Some of the most common features such as education, experience levels and teacher preparation are not consistently related to better student outcomes in both within and cross-country studies (Hanushek *et al.*, 2018). Subject-related degrees and knowledge, not general certification, work better in correlations: they show a positive relationship with student performance, particularly so for Master's degrees in math and science (see literature review by Coenen *et al.*, 2018). Recent cross-country evidence confirms that substantial differences in teacher cognitive skills are strongly related to student performance (Hanushek *et al.*, 2018).

39. Certain studies use teacher salaries as a proxy for quality. A number of older studies found mixed results but the more recent evidence shows that teacher pay is often positively related to cross-country as well as national differences in student outcomes (Hanushek *et al.*, 2018; Britton and Propper, 2016). This is also true when pooling country-level data from various international tests between 1995 and 2006 (Dolton and Marcenaro-Gutierrez, 2010). Cross-country evidence suggests student performance is also related to existence of pay incentives (Leigh, 2013, Atkinson *et al*., 2009; Goodman and Turner, 2013; Woessmann, 2010).

40. It is plausible that the lack of evidence is partly a result of too little variation in quality of teachers within countries: teachers tend to be recruited from the same percentile of the ability distribution and are often under the same national pay scales (Dolton and Marcenaro-Gutierrez, 2011). Indeed, school autonomy over teacher pay is limited in a number of OECD countries (see below).

41. Top performing countries (e.g. Singapore, Finland and Korea) in the international student tests apply highly selective recruitment policies (Barber and Mourshed, 2007). Attracting individuals with higher ability into teaching as well as allowing for a quicker salary rise does appear to have a positive effect on student outcomes (Dolton and Marcenaro-Gutierrez, 2011).

42. Country experience shows that high-performing countries and schools share common features of teachers' policies: an initial education or induction period that includes a mandatory and extended period of clinical practice; a variety of opportunities for in-service professional development; and teacher-appraisal mechanisms with a strong focus on continuous improvement (OECD, 2018b; OECD, 2018d).

Table 6. Selected literature on quality of teachers

Author	Level of analysis / Country coverage	Determinants examined	Dependent variable	Effect of the variable of interest
Andre *et al.* (2019)	School level /Sweden	Certification of teachers	Test scores	**Mixed.** Positive but statistical significance of the share of certified teachers varies across models used.
Boarini and Ludemann (2009)	Cross-country	Teacher wages	Test scores	**Mixed.** Teacher wages are positively associated with 2006 PISA scores but the relationship is not statistically significant.
Braga *et al.* (2013)	Cross-country/ 24 countries	Higher educational requirements and additional teacher training	Years of schooling, educational inequality, intergenerational persistence	**Mixed**. Negative correlation of teacher qualification requirements for pre-primary and primary level, insignificant correlation at secondary level.
Braga, Paccagnella and Pellizari (2016)	University class level/ Italy	Citation, academic rank, age	Labour market and academic returns	**Mixed**. Teacher effects are only mildly positively correlated with students academic and labour market outcomes.
Britton and Propper (2016)	School level /England	Teacher wage gap vis-à-vis local labour market	National exams	**Mixed**. Positive effects of relative teacher pay on school productivity, exploiting regional variation in teachers' relative wages vis-à-vis local labour market.
Carrell and West (2010)	Post secondary class level/ United States	Position, teaching experience, student evaluation, value added	Test scores	**Mixed**. Professors who excel at promoting contemporaneous student achievement teach in ways that improve their student evaluations but harm follow-on achievement of their students in more advanced classes.
Dolton and Marcenaro-Gutierrez (2011)	Cross-country/ 39 countries	Real and relative teacher remunenation (various measures)	Test scores	**Positive**. Both relative and absolute levels of teacher wages exert an important influence on pupil performance. Recruiting higher ability individuals into teaching and permitting scope for quicker salary rise will have a positive effect on student outcomes.
Fuchs and Woessmann (2007)	Cross-country panel	Certification of teachers, distinguishing also for subject of qualification	Test scores	**Positive.** The share of teachers with teacher certificate and masters in the subject that was tested have positive and statistically significant effect on student test scores.
Hanushek and Rivkin (2012)	Student level/ United States	Teacher value added	Test scores	**Mixed.** Teacher experience and degree does not capture differences in effectiveness. Teacher value added estimates are an alternative for capturing the differences it is but important to consider the family and school choices that
Hanushek et al (2013)	Cross-country panel	Share of fully certified teachers	Test scores	**Positive**. In the basic specification model the share of fully certified teachers has positive and statistically significant impact.
Hanushek *et al.* (2018)	Cross-country/ 31 countries	PIAAC teacher scores	Test scores	**Positive**. Robust and positive relationship between teacher cognitive skills and student performance. One standard deviation increase in teacher cognitive skills is associated with 0.1-0.15 standard deviation higher student performance.
Lastra-Anadon and Mukherjee (2018)	Student level/Cross country	Teacher salary	Test scores	**Mixed.** Both positive and negative relationship with test score outcomes but statistically insignificant.
Meroni et al (2015)	Student level/Cross country	PIAAC teacher scores	Test scores	**Positive**. Teachers' skills seem to have a positive effects on student achievement and explain part of the variation between countries in students' achievement.
Palardy abd Rumberger (2008)	Student level/ United States	Teacher qualification, attitudes and methods	Test scores	**Positive**. Robust and positive relationship between teacher cognitive skills and student performance. One standard deviation increase in teacher cognitive skills is associated with 0.1-0.15 standard deviation higher student performance.

Note: 'Positive' ('Negative') refers to statistically significant positive (negative) effect of the reforms on the variable of interest, and 'Mixed' to either statistically insignificant effects or a combination of negative and/or positive results. N.A. means not applicable.
Source: Various studies, see first column of table.

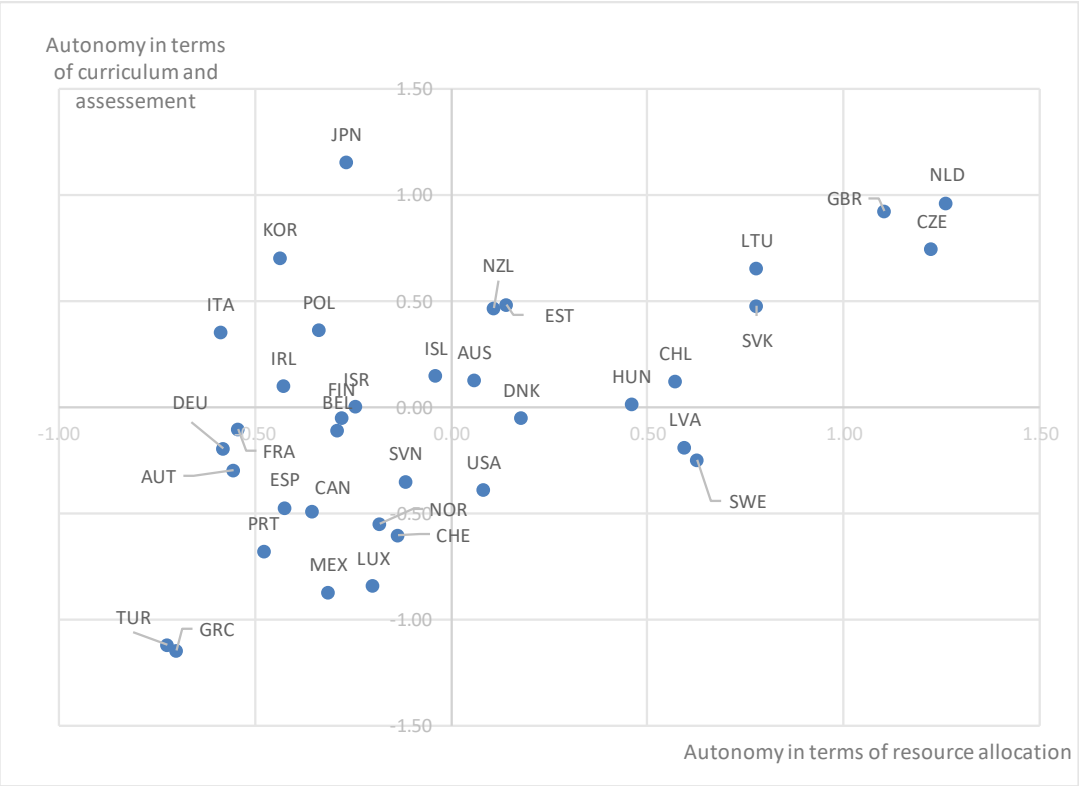
4.2. Institutional features: autonomy, accountability and competition

43. Much research has gone into identifying the institutional features of well-performing educational systems, three of which stand out: how much autonomy individual schools have; how they are held accountable; and whether, and how much, competition there is between the publicly and privately operated schools. OECD countries vary on all three.

4.2.1. Autonomy

44. Schools have gained more autonomy over recent decades, although there are various degrees and types of autonomy. The relationship between school autonomy and performance within countries is complex and varies according to the extent of accountability (OECD, 2013). The Czech Republic, the Netherlands and the United Kingdom grant the greatest autonomy to schools, not only in resources allocation, but also in making decisions about staff hiring and dismissal, curricula and assessments. At the other end of the spectrum on autonomy is Greece and Turkey (Figure 5).

Figure 5. Levels of school autonomy across OECD countries



Note: Higher value indicates more autonomy for school principals and teachers.
Source: OECD (2011).

45. School autonomy in terms of process and personnel decisions is associated with better educational outcomes (Table 7). On average, increases in school responsibility for selecting teachers were associated with improvements in test scores across countries participating in PISA 2006 and 2015 (OECD, 2018d). On the other hand, autonomy in

terms of budget formation and subject matter covered is associated negatively with student outcomes (Hanushek and Woessmann, 2011).

46. The empirical literature concludes that autonomy works in an environment where schools are held accountable for the achievement of their students, for instance by the existence of external exit exams. This is because of a principal-agent problem, according to which local decision makers can act opportunistically and have only little superior local knowledge in terms of budget formation and curricula (Hanushek and Woessmann, 2011). There is also some evidence that autonomy negatively affects student achievement in developing and low-performing countries, while the impact is positive in developed and high-performing ones (Hanushek *et al.*, 2011).

47. In order to capitalise the benefits of more autonomy, country experience highlights the importance of capacity at the school and local government level, in particular in terms of school leadership (OECD, 2017c).

4.2.2. Accountability

48. One way of holding schools accountable for delivery of teaching are standardised national exams and assessments. Such exams (with formal consequences for further educational progression) are common among OECD countries at the upper secondary level. Assessment (without impact on further progression) are more prevalent at the lower secondary level (OECD, 2015). Nevertheless, several OECD countries have no examinations at the lower or upper secondary level and in these, a number of tertiary fields of study require examinations that can serve as an accountability check for the secondary level. [7]

49. Other policy levers include evaluation and assessment frameworks. These consist of assessments of teachers, external evaluation of schools, appraisal of teachers and school leaders and expanded use of performance data (OECD, 2013).

[7] The following countries/regions did not conduct national examinations at either the lower or upper secondary level in 2015: Belgium (Flemish sp.), Canada, Iceland, Japan, Mexico, Sweden and Switzerland.

Table 7. Selected literature on school autonomy

Author	Country coverage	Determinants examined	Effect of school autonomy
Fredriksen (2013)	34	Decentralisation and school autonomy	**Positive.** Positive overall, but mixed when broken down into various sub-measures of autonomy. Fiscal decentralisation increases the share of public funds directed to capital spending, the bulk of which is on education. Educational performance is significantly higher in decentralised countries.
Fuchs and Woessmann (2004)	31	Student and school characteristics, including measures of autonomy	**Positive.** Students performance is higher with external exams and autonomy in budget formulation, texbook choice, hiring teachers and with-school budget allocations. Students perform better in priivately-operated schools but private funding is not decisive.
Han (2018)*	34	School-based teacher hiring, income level, external exit exams.	**Mixed**. School-based hiring associated with a larger gap in the distribution of teacher quality between advantaged and disadvantadged schools, as well as inequality of achievemnt based on socioeconomic status.
Hanushek *et al.* (2011)	42	Autonomy on academic content, autonomy in personnel decisions, autonomy in budget, student and school characteristiscs	**Mixed.** Negative on its own, but positive when interacted with income per capita for all three measures of autonomy. Autonomy affects student achievement negatively in developing and low-performing countries, but positively in developed and high-performing ones.
Hanushek *et al.* (2018)	31	Teachers' cognitive skills, student and school characteristics (including three measures of autonomy)	**Mixed**. No impact of content autonomy, and budget autonomy, negative impact of personnel autonomy. Substantial differences in teacher cognitive skills are strongly related to student performance.
Juerges and Schneider (2004)	23	Teacher, class, school resources and institutions (including public expenditure on education)	**Mixed**. Differences in school, teacher and student characteristics as well as financial resources explain differences between countries.
Lastra-Anadon and Mukherjee (2018)	35	Fiscal decentralisation, administrative decentralisation and school autonomy	**Positive.** Positive relationship between school autonomy and average PISA outcomes. When included with fiscal and administrative autonomy, these show consistently positive and statistically significant relationship. When interacted with fiscal and administrative autonomy, the relationship can be negative but not statistically significant.
Shuetz *et al.* (2007)	27	Accountability, various measures of autonomy, school choice	**Mixed.** Autonomy in budget formulation negative impact, autonomy in course content and personnel decisions mixed impact. Accountability, autonomy and school choice appear to be tuides that lift all boats. External exit exams have a strong positive effect for all students.

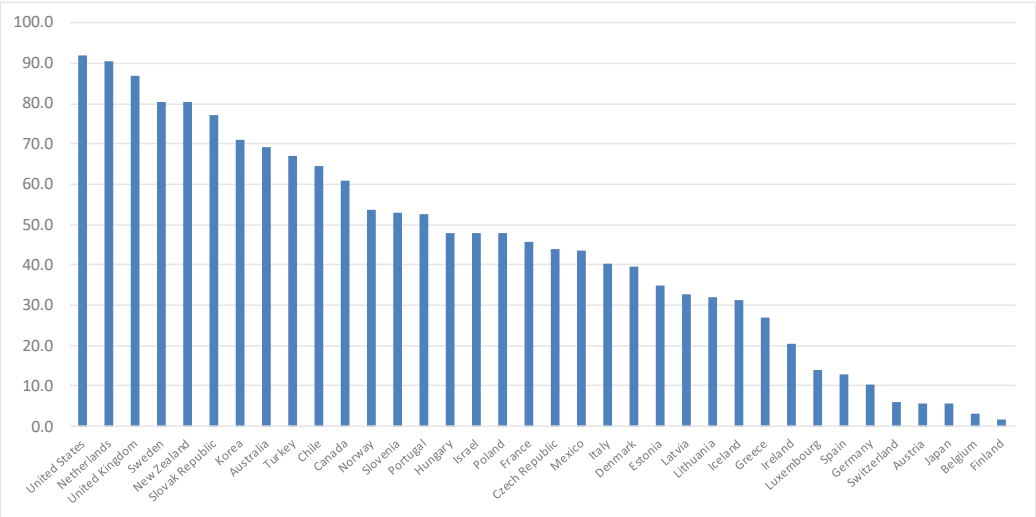
Note: Dependent variable is test scores except for (*) where it is proportion of certified teachers, teachers with bachelor's degree, lack of qualified teachers, extent of a lack of qualified teachers hindering student learning. 'Positive' ('Negative') refers to statistically significant positive (negative) effect of the reforms on the variable of interest, and 'Mixed' to either statistically insignificant effects or a combination of negative and/or positive results.

Source: Various studies, see first column of table.

50. Much of the empirical literature looks at the existence of standardised national exams, as a proxy for accountability. External exit exams signal the level of achieved learning to potential employers as well as to institutions of higher education. This way they increase student's rewards to learning, offer parents monitoring of the learning process and benchmark the quality of the school (especially when schools have a certain level of autonomy) (Figure 6).

Figure 6. Publication of school achievements data

Share of students in schools that post achievement data publically (2012)



Source: OECD (2015).

51. The empirical evidence from various international tests shows that students in countries with external exit exams perform substantially better than those without such exams (Hanushek and Woessmann, 2015; Bishop, 2006; Woessmann *et al.*, 2009a). This finding holds when controlling for family background, school inputs, degree of centralisation, in cross-country as well as cross-regional settings and when applying difference-in-difference estimation approach (Juerges *et al.*, 2005). Accountability features aimed at teachers (such as internal and external monitoring of lessons) as well as schools are also positively associated with better student achievement (Woessmann *et al.*, 2009a) (Table 8).

52. Country experience shows that accountability design should build on a broad range of assessment information (OECD, 2013). Most of these are difficult to capture empirically. Excessive emphasis on one particular measure, for instance, standardised student tests, might result in excessive focus on teaching students the specific skills that are tested, possibly narrowing the curriculum.

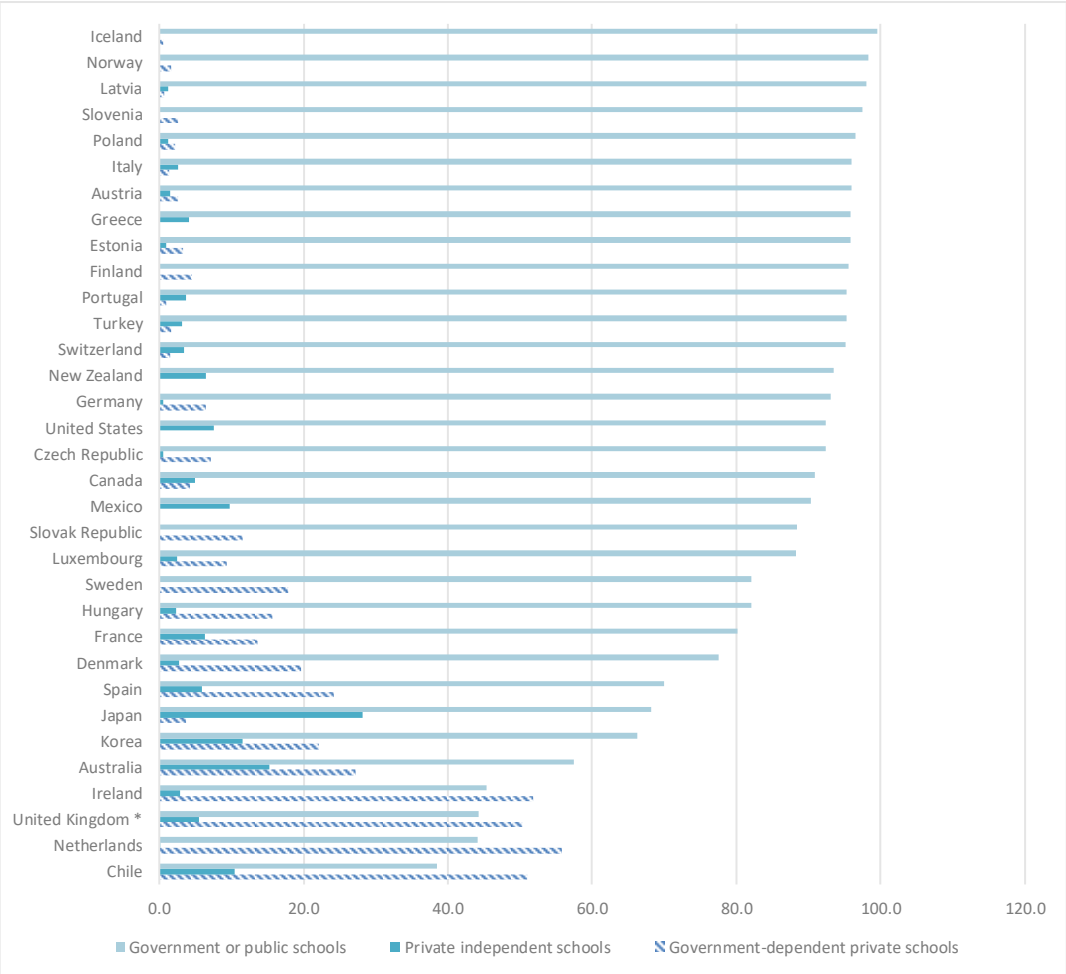
4.2.3. Competition and private involvement

53. A number of OECD countries have increased the degree of school choice that parents and students have. This choice has an impact on funding of education, so that schools compete not only for enrolment of students but often also for public funding. The public funding can directly either follow the student or it can be given to the students who then decide on a publicly or privately managed institution. On average across OECD

countries in 2015, around 12% of students attended government-dependent private schools and slightly over 4% government-independent private schools (OECD, 2017c) (Figure 7).

Figure 7. Prevalence of privately operated compulsory education schools

Share of 15-year-old students enrolled in various types of schools.



Note: 'Government or public schools' are schools that are directly or indirectly managed by a public education authority, government agency, or governing board appointed by a public authority or elected by public franchise. 'Government-dependent private schools' are privately managed schools that receive 50% or more of their core funding (i.e. funding that supports the basic educational services of the institution) from government agencies. 'Private independent schools' are privately managed schools that receive less than 50% of their core funding (i.e. funding that supports the basic educational services of the institution) from government agencies.

* In England, Northern Ireland and Wales, public schools are those managed by the local government and government-dependent private schools are those funded by government but managed by not-for profit charitable trusts, including academies and free schools.

Source: OECD (2016).

54. In principle, private schools should exert competitive pressure on nearby public schools and thus raise overall performance. Nevertheless, the empirical evidence is mixed. While within country studies suffer from self-selection bias, such bias should be common

across countries, and thus matter less for cross-country studies. At the cross-country level, private operation of schools tends to be associated positively with student achievement, though this pattern is not uniform across countries or studies (Hanushek and Woessmann, 2011). Looking at within-country differences in PISA results, and once the socio-economic background is taken into account, in most countries private schools do not have better results compared to public schools (OECD, 2017c).

55. The mix of public-private funding seems important. The share of private funding is associated negatively with student outcomes. The highest tests scores of 2003 PISA math test scores were found in countries with both a high share of privately operated schools and high average share of government funding (Woessmann *et al.*, 2009). This points to the importance of a level-playing field between the public and private schools in terms of government funding (Hanushek and Woessmann, 2011).

56. Country experience shows that oversight of the delivery of education is important in countries with school choice. Successful choice-based systems have in place checks and balances preventing such choice leading to inequality and segregation (OECD, 2017c). Both inequality and segregation could lead to underinvestment in human capital of those from lower socio-economic backgrounds.

4.3. Tracking

57. Tracking – i.e. separation of pupils by ability or achievement - happens at different ages in OECD countries (Figure 8).[8] Students disengaged from academic studies and/or those attuned to practical learning follow vocational programmes – a specific form of tracking, often provided in parallel programmes and learning environments. Vocational education and training (VET) is valued for its links to labour market and involvement of employers, improving the employment prospects of its graduates. Moreover, it has a potential to improve graduation rates and enrolment in tertiary education (OECD, 2018d). On the other hand, VET prevalence and early tracking can exacerbate initial socio-economic disadvantages, create different peer effects and can limit students from pursuing further learning (Liu, 2018; Hoxby and Wengarth, 2015; Duflo, Dupas and Kremer, 2011).

58. PIAAC data for 20-35 years olds show that among adults, countries with an important VET sector have higher average skill performance and a compressed upper part of the skills distribution (Liu, 2018). Studies using large-scale cross-country data show that while individuals with VET are initially better off in the labour market than those with general education, these advantages fade away later (Hanushek *et al.*, 2017, Brunello and Rocco, 2015, Bol and van der Werhorst, 2013). The empirical evidence in terms of educational outcomes remains mixed. Tracking at an early age in lower secondary school is mostly associated with lower educational attainment, while the existence of VET systems has some positive outcomes (Table 8).

[8] In North America, tracking happens as early as middle school (ages 11-13) within schools, where students are grouped according to abilities. In many European countries, tracking means separating students into two or three different types of schools, each of which has a distinct curricular focus. There can be also differences in terms of the school resources such as spending per student and teacher-pupil ratios (Betts, 2011).

Table 8. Selected literature on tracking

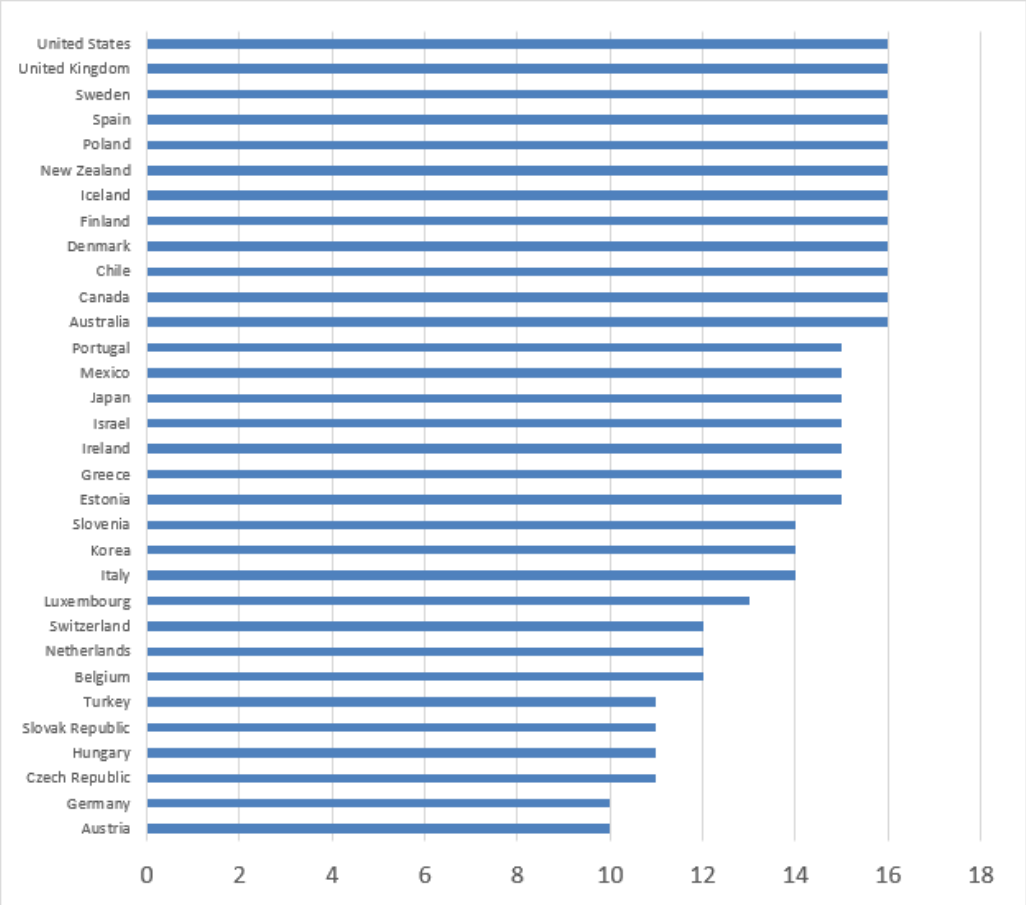
Author	Country coverage	Determinants examined	Dependent variable	Effect of tracking
Brunello and Checchi (2007)	32	Age of first tracking, length of tracking, share of vocational education	Educational attainment, post-secondary enrolment, literacy, labour market outcomes	**Mixed**. Mixed results, tracking reinforces family background effects on formal education but weakens it for learning on the job.
Braga *et al.* (2013)	24	Age of tracking	Years of schooling, educational inequality, intergenerational persistence	**Negative**. Early tracking tended to decrease the educational attainment.
Daemmrich and Triventi (2018)	15	Age of tracking	Test scores	**Mixed.** Skill gaps by social background apear to be stable in both high- and low- track s ystems. Medium tracking systems show an increase in social inqualities from primary to secondary school, but afterwards a certain reduction of the inequalities (albeit statisticaly insignificant).
Hanushek and Woessmann (2006)	45	Age of first tracking	Inequality, mean test scores	**Mixed**. Significant negative effect of early tracking on inequality; less clear (negative) effect on mean performance.
Liu (2018)	24	Tracking and prevalence of vocational education	Adult numeracy scores (PIAAC)	**Positive**. Education systems with more students enrolled in vocational tracks have on average higher levels of numeracy skills and more compressed skills distributions at the upper half. Postponement of tracking does not have significant effect on the average skills of the population but increases skills for those at the lower part of the distribution. Expanding university access is associated with an increase in numeracy, in particular at the bottom of the distribution.
Piopiunik (2014)	1	Earlier tracking	Test scores	**Negative.** Performance of all students decreased, the share of very low performing students increased in low-track schools.
Pekkarinen *et al.* (2009)	1	Postponement of tracking	Army cognitive test scores	**Mixed**. Postponement of tracking had a small positive effect on verbal test scores but no effect on mean performance in the arithmetic and logical reasoning tests. The test scores of students from families with low education improved.
Schuetz *et al.* (2008)	54	Age of first tracking, pre-primary care enrollment and duration	Test scores	**Positive**. Late tracking and pre- primary care duration reduce impact of family background.
Van Elk *et al.* (2009)	1	Early-age tracking	Probability of post-secondary education	**Negative**. Students average probability of participating in post-secondary education falls as a result of tracking at early age.
Waldinger (2006)	29	Grade of first tracking	Test scores	**Mixed**. Tracking doesn't increase impact of family background after controlling for pre-tracking dfferences, but study uses small samples. Interaction between parental education and use of early tracking is positive and signficant.

Note: 'Positive' ('Negative') refers to statistically significant positive (negative) effect of the reforms on the variable of interest, and 'Mixed' to either statistically insignificant effects or a combination of negative and/or positive results.

Source: Various studies, see first column of table.

Figure 8.Tracking age across OECD countries

Age of first tracking (2015).



Source: Bol and Van de Werfhost (2013).

59. Several OECD countries postponed tracking until the age of 15 or 16 during the second half of the twentieth century. Tracking influences not only educational attainment but also other outcomes, such as equity and skills distribution. Studies analysing the impact of such reforms often look at earnings, educational attainment and skills across the distribution. Earlier literature based on US data found no or small effects of tracking. The more recent papers and their critical reviews show no compelling evidence on either the overall effect of tracking on average achievement or the distribution of achievement (Betts, 2011). European studies tend to find positive effects from reforms postponing tracking, in particular for the lowest socio-economic groups in terms of educational attainment as well as income mobility (Pekkarinen *et al.*, 2009; Meghir and Palme, 2004).

60. On a cross-country level, numerous studies find that postponing the age of tracking weakens the impact of family background for disadvantaged pupils or that the impact of family background is smaller the higher the age of tracking (Brunello and Checchi, 2007; Shuetz, Urspung and Woessmann, 2008). Others find no evidence of a positive effect of early tracking for the top students. Comparing test scores at primary level with those at

lower-secondary Hanushek and Woessmann (2006) show that in countries with early-age tracking the skills dispersion increases with age, while it decreases in countries without tracking. Braga *et al*. (2013) do not find any significant association between the age at which students are split into different tracks and educational attainment.

61. Several reasons could explain the mixed findings in the literature. In many countries postponement of tracking happened at the same time as extensions of the compulsory schooling, so it can be difficult to disentangle the impacts of the two changes. Further, there are large cross-country differences in the meaning of tracking, the most obvious one being between Europe and the North America but also within the European systems in terms of pupil-teacher ratios in different tracks and expenditure per student (Brunello and Checchi, 2007). Since European versions of tracking seem more dramatic than tracking within schools typical in the North America, such differences can help to reconcile the differences between the American and international studies on the effects of tracking on student achievement (Betts, 2011). Varying country coverage as well as estimation methods also contribute to the mixed evidence.

4.4. Addressing drop-out rates

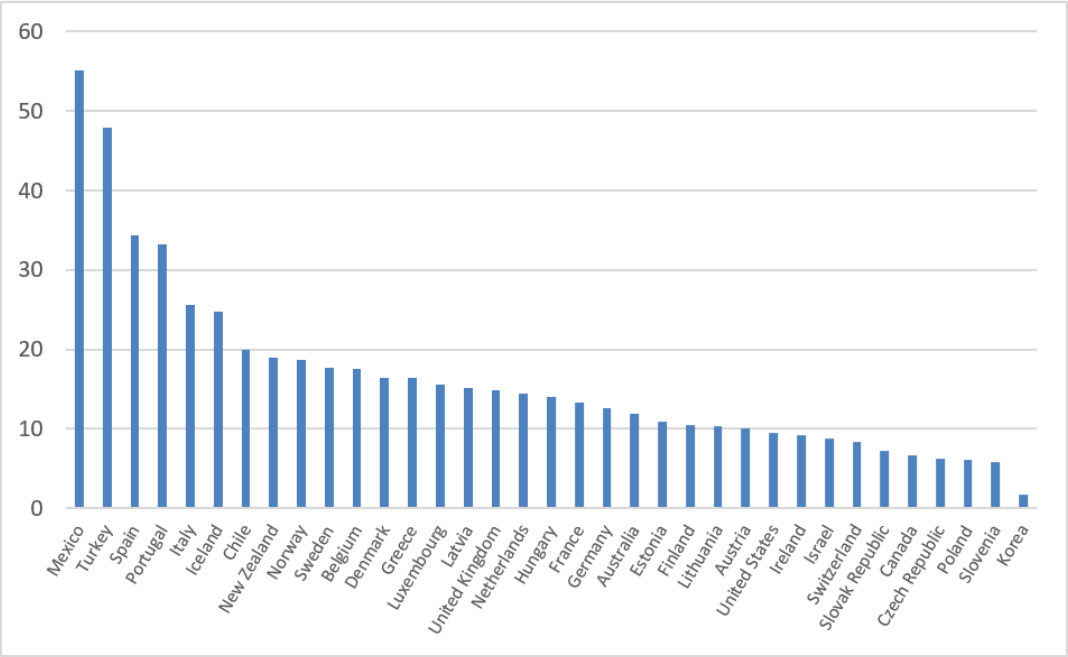
62. Having achieved almost universal coverage of the compulsory schooling, countries have tended to focus on reducing school dropout rates in secondary education that stand at around 15% for the OECD average. In Central European countries, Korea and Canada, the dropout rates are low: less than 5% attain at most lower secondary education. In Turkey, Mexico, Portugal and Spain, considerable shares of youth obtain at most lower secondary education (Figure 9). Students in rural areas are almost twice as likely to have repeated a grade and rural regions in most OECD countries lag behind their urban counterparts in terms of both educational achievement and attainment (OECD, 2018d).[9] Moreover, there is a gender dimension too: Boys are more likely to repeat a grade and drop out of school.

63. As recent OECD country reviews illustrate, year repetition, early school leaving and unsuccessful transitions beyond secondary education are common (OECD, 2018d). Leaving school early is a result of multiple factors, such as poor prior school experience, lack of ability, low perceived labour market returns to education, heavy discounting of future benefits, unfavourable social background and peer influence. Therefore, policies address a number of different aspects (Brunello and De Paola, 2014).

[9] Students in rural lower secondary schools scored 31 points lower in 2015 PISA science tests than students in urban schools (rural school are those located in areas with fewer than 3 000 inhabitants, urban schools in cities with 100 000 inhabitants or more). Much of this gap can be explained by the students' and schools' socio-economic status.

Figure 9. Secondary school drop-out rates

Percentage of 25-34 year old adults with below upper secondary education (2015)



Source: OECD (2016b).

64. There is little empirical literature looking at the effect of limiting dropouts on overall educational attainment. Most of the studies look at the efficiency of various programmes focused on specific population groups in terms of keeping them in education and/or achieving graduation (Cabus and De Witte, 2011; Brunello and De Paola, 2013). At the individual level, dropping out of school has considerable implications for labour market prospects and other life-outcomes (Brunello and De Paola, 2013). At the macroeconomic level, decreasing drop-out rates is likely to have only a marginal impact for most OECD countries. Nevertheless, in Mexico, Turkey, Portugal or Spain, more than 30% of 25-34 year olds have less than upper-secondary education, so the potential benefits can be large.

65. Programmes for adolescents still in school have better results, though it remains to be seen whether this is because, on average, those at school have higher abilities or whether there is some advantage to intervening before the adolescents leave school (Cunha *et al.*, 2015). Evidence from the US studies shows that programmes focusing on adolescents from disadvantaged backgrounds alter non-cognitive skills and have smaller effects on cognitive skills. Nevertheless, non-cognitive skills matter for overall educational attainment (Cunha *et al.*, 2015).

66. On average, just over 10% of 15-year-old students across the OECD report having repeated a year. Yet, there is only little evidence that children benefit from grade repetition (see literature review by Lyche, 2010; Ikeda and Garcia, 2014). Moreover, it is expensive, though schools have only a few incentives to take the costs into account (OECD, 2007, 2015). In some OECD countries over one-quarter of students repeat a year at some point (e.g. Belgium, Chile, Luxembourg, Spain and Portugal).

67. On its own, at the level of schools, municipalities or regions, increased resources to reducing drop-out rates do not work but do seem to work when means-tested resources go directly to students of low-income families. Such tools are often a part of a wider programme that includes non-monetary features such as increasing the involvement of parents and students (Lyche, 2010).

68. Country experience shows that policies aiming at reducing early school leavers should focus on early prevention: supporting and engaging those who struggle already at basic school, monitoring of those at risk, offering good quality pathways without dead ends at upper secondary education to those less academically gifted, and offering additional support for learning at the end of secondary school (OECD, 2007; OECD, 2018d).

69. For instance, almost all students are automatically promoted in Finland. Individualised support is provided by trained professionals and a hierarchy of successive formal and informal interventions is used to assist those falling behind at school. Such an approach appears to be working: only 3.3% and 0.7% of the 15-year olds are unable to demonstrate basic math and reading skills, respectively, while the OECD average is 8% and 1.3%.

4.5. Non-cognitive skills

70. Non-cognitive skills play an important role in school attainment and educational achievement, since they contribute to staying longer in education and that generally raises the amount of learning (Cunha *et al.*, 2005). At the bottom of the distribution such effects are particularly pronounced (Heckman *et al*., 2006; Cook *et al.*, 2014). Student 'mindset' seems to have more influence on student outcomes than socioeconomic background in European countries (DeNoel *et al.*, 2018), though such measures can be difficult to capture objectively, let alone to directly influence with policies.

71. Most of the empirical literature focuses on the so-called "big five" non-cognitive skill domains (conscientiousness, openness to experience, extraversion, agreeableness and emotional stability) (Chernyshenko *et al.*, 2018). Of these, conscientiousness and openness to experience come out as significant and positive predictors of years of schooling as well as general educational outcomes in the empirical literature (Almlund *et al.*, 2011) (Poropat, 2009; Poropat, 2014).

72. School-based programmes for development of social and emotional learning have significant immediate effects on these skills. Two recent meta-analyses by Durlak *et al.* (2011) and Sklad *et al.* (2012) confirm this, as reported in Chernyshenko *et al.* (2018). The size of the impact usually decreases a few months after the programmes and varies across the type of outcome measured (e.g. social and emotional skills, anti-social behaviour, mental disorder, academic achievement). Nevertheless, other studies show longer lasting effects of non-cognitive programs, visible in early and late adolescence (Algan *et al.*, 2014).

73. Durlak *et al.* (2011) identify effective school-based programmes as those that are sequenced (i.e. connected and coordinated activities), focused, involve active learning, and have an explicit goal of developing social and emotional learning. Sklad *et al.* (2012) point to programmes with duration under one year and the number of sessions under 20 as more effective, and that teachers are as good as other staff in implementing these programmes.

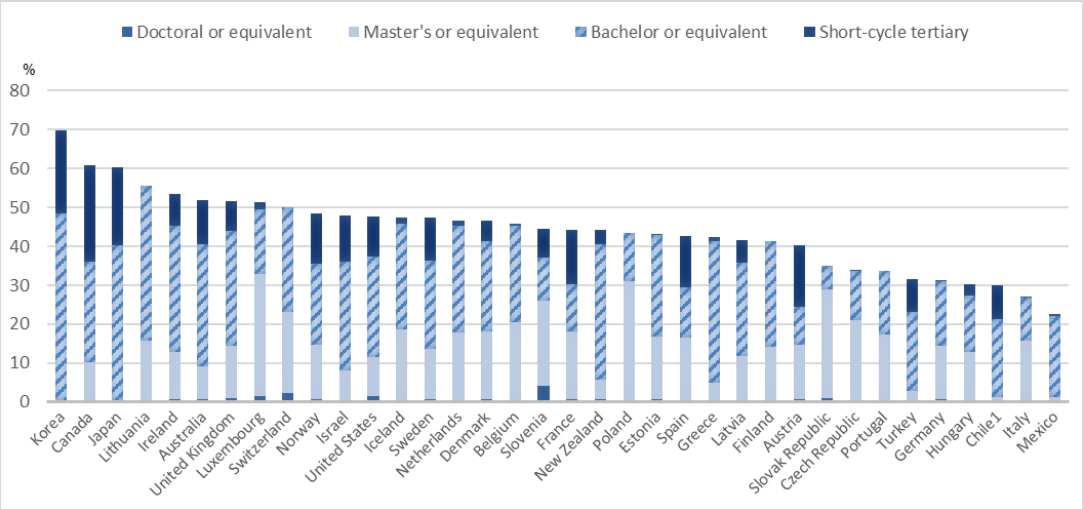
5. Tertiary education policies

74. Graduation rates at the tertiary level have been increasing steadily and accelerated at the turn of the century. In 2016, 40% of 20-24 year olds were enrolled in education in the OECD (Figure 10). Australia, Poland and Spain experienced the largest increases over 2005-2016 in tertiary education enrolment while Finland, Hungary or Lithuania saw a moderate decrease in graduation rates, though some from a high level. The expansion of the tertiary sector been accompanied by diversification of provision, an increasingly heterogeneous student composition and new funding arrangements. Moreover, assurance of quality has become a key topic (OECD, 2008).

75. Around one third of overall spending on education goes to the tertiary level in the OECD, equivalent to 1.5% of GDP, with considerable differences across countries. Variance in the degree structure and qualifications can explained some, but not all, of these differences (OECD, 2018a). The fastest increase in spending per student has happened at tertiary level in recent years, increasing by 12% between 2010 and 2015, while the growth in enrolment was 3% during that time. Nevertheless, spending on R&D is included, so it can distort comparison across countries (OECD, 2018a). There are also considerable differences between the public-private split in financing higher education across OECD countries.

Figure 10. Composition of tertiary education

Percentage of 25-34 year olds with tertiary education by type of degree (2017).



Note: 1. Year of reference differs from 2017.
Source: OECD (2018a).

76. Several direct and indirect policy drivers explain the developments of graduation ratios in OECD (Table 9). Demand-side drivers include policies that impact individual (private) rates of return, e.g. marginal and average taxation, unemployment benefits, or the cost of tuition (Oliveira Martins *et al*., 2007; Card and Lemieux, 2000, OECD, 2018d). The way secondary school is organised will also affect demand for tertiary education, i.e. how comprehensive the school system is and what kind of leaving exam certification it gives that allows for enrolment into the tertiary level.

77. On the supply side, responsiveness of the tertiary education supply and lower liquidity constraints have also been linked to higher graduation ratios (Oliveira Martins *et al.*, 2007, Braga *et al.*, 2013). Except for some English-speaking countries, tertiary education systems remain highly regulated in the majority of OECD countries. This means that the supply of the places is regulated and centralised. Nevertheless, the role of privately funded programmes has been on the rise and with it also the degree of autonomy and responsiveness of the tertiary education.

5.1. Autonomy

78. Two institutional features of the tertiary system stand out among characteristics that may influence the supply of higher education: autonomy (in managing resources, setting objectives and staff policy) and admissions selectivity (Oliveira Martins *et al.*, 2007; Aghion *et al.*, 2010, Braga *et al*., 2013) (Table 10).

79. The literature reviews various forms of autonomy (e.g. academic, financial, organisational and staffing). Autonomy can differ also within countries, depending on the private-public status of the institution. The evidence on the importance of the different subcomponents of autonomy can be mixed, or pointing to certain trade-offs, e.g. more autonomous universities shifting attention from teaching to research (Knott and Payne, 2004). Others highlight the importance of the right 'framework' conditions, such as sufficient level of public expenditure, financial incentives, sufficient capacity to attract and retain productive staff and sufficient capacity to meet demand. Under such framework conditions, autonomous universities can contribute to improved research productivity, greater numeracy among graduates as well as higher levels of educational attainment (Enders *et al*., 2012, Ritzen, 2016).

80. OECD countries differ in terms of the autonomy of the tertiary education sector. The tertiary institutions in most English-speaking countries as well as Japan and Mexico, enjoy a high degree of autonomy while in Greece, Turkey and Belgium there is a considerable degree of centralisation still in place, according to Oliveira Martins *et al.* (2007)'s indicator on input flexibility (that includes selection of students, budget autonomy, and staff policies). In terms of accountability, Australia, some Canadian provinces and United Kingdom scores the highest, with Turkey and Greece on the other side of the spectrum on this measure. For European countries disaggregated and more up-to-date data is available, based on the university autonomy scorecard (Pruvot and Esterman, 2017), that confirms scope for increasing the autonomy in the lagging countries (Table 9).

81. Certain caveats should be born in mind. Most of the studies rely on data on formal autonomy without accounting for effective autonomy. Furthermore, the performance criterion (dependent variable) does not always reflect wider societal goals nor account for quality (e.g. impactful publication and patenting). Neither does it account for other quality aspects such as graduation rate inflation in systems where funding is based on diplomas (Enders *et al*., 2012).

Table 9. Degree of university autonomy across selected European countries

2016 or latest available.

	High	Medium high	Medium low	Low
Organisational autonomy	GBR, DNK, FIN, EST, LTU	PRT, AUT, NOR, IRL, NLD, POL, ITA, SVN, SWE	FRA, LVA, HUN, ESP, CHE, ISL, SVK, GRC*	LUX, TUR*
Financial autonomy	LUX, LVA, GBR	EST, NLD, ITA, PRT, SVK, DNK, FIN, CHE, IRL, LTU	ISL, AUT, SVN, SWE, POL, FRA, NOR, TUR*	HUN, GRC*
Staffing autonomy	EST, SWE, GBR, CHE, LUX, FIN, LVA, DNK, POL, LTU	AUT, NLD, ISL, NOR, PRT, SVK	HUN, ESP, ITA, SVN, FRA, IRL, TUR*	GRC*
Academic autonomy	EST, FIN, IRL, LUX, GBR, NOR	ISL, DNK, AUT, CHE, POL, SWE, HUN, ESP, ITA, SVK, PRT, NLD, LVA, SVN, LTU	FRA, BEL, TUR*	GRC*

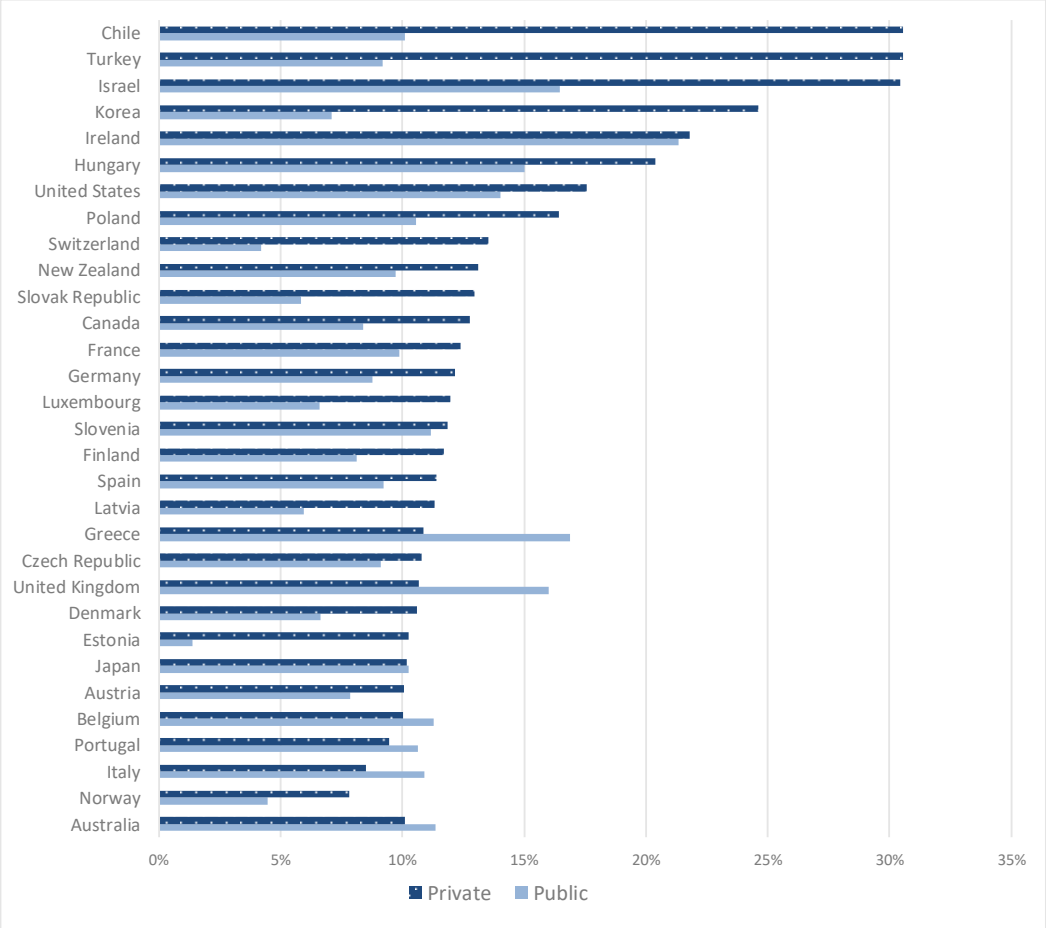
Note: Based on 30 indicators. High corresponds to a score between 81-100% autonomy, medium high to a score between 61-80%, medium low to a score between 41-60% and low to a score of 40% and lower. The scores are deduced from qualitative questionnaires. *Data for Greece and Turkey refer to 2010 Scorecard.
Source: European University Association.

82. The admissions system in place can also play a role. In several countries, admission to public tertiary institutions is automatic once a required qualification level, usually upper secondary, is achieved (so-called open admission systems). In other countries, the tertiary education institutions set the admissions criteria themselves and can be selective, including requiring for instance completion of specific upper secondary courses for study in certain fields (e.g. engineering or medicine). Nevertheless, in certain study fields (such as medicine) the number of places remains regulated even in the open admission countries.

83. A growing body of evidence from the United States illustrates that facilitating admission exams and other targeted interventions increased the enrolment rates of disadvantaged students, and in many cases also graduation (Hyman, 2017; Bulman, 2015, Dynarski *et al.*, 2018, Carrell and Caserdote, 2015). Such policies include free in-school administration of and/or default registration by to the entrance exams.

Figure 11. Public and private rates of return to attaining tertiary education

A model calculation based on cost and benefits for a man, as compared to attending upper secondary education (2015).



Note: A hypothetical real interest rate that an individual can expect to receive every year during working-age life on the investment made on a higher level of education. It equalises the costs and benefits related to the investment. A number of simplifying assumptions have been made, such as that students have no earnings and pay no taxes while studying or that forgone earnings are equal to a minimum wage. The same discount rate is applied across countries and set at 2%. Public rates of return are based on the difference between public costs (e.g. direct costs for education, foregone taxes on earnings) and public benefits (income tax, social contributions, social transfers and unemployment benefits), while the private returns are based on private costs (direct costs and foregone earnings) and private benefits (earnings, from employment and unemployment benefits).
Source: OECD (2018d).

Table 10. Selected literature on tertiary education

Author	Level of analysis	Determinants examined	Dependent variable	Effect of the variable(s) of interest
Aghion *et al.* (2008)	Cross-country and state level (US)	University autonomy and competition	Patenting	**Positive**. University autonomy and competition is positively correlated with university output, both among European and US public universities. Merit-based competition for public research funding is also linked to more patents.
Braga et al (2013)	Cross-country	Financial support index, autonomy and selectivity index	Years of schooling, educational inequality, intergenerational persistence	**Mixed.** Financial support index positively associated with educational attainment, while university autonomy negatively. Admissions selectivity is not statistically significant.
Cascio *et al.* (2008)	Country	Average educational attainment across age groups, graduation rates at universities	Literacy rates	**Positive**. Countries with high university graduation rates have steep improvement in literacy tests scores between need of compulsory schooling and adulthood. Such countries tends to have comprehensive secondary education and highly accesible university sector.
Card and Lemieux (2000)	Country	Socio-economic background, unemployment rate, cohort size, tuition.	University enrolment	**Mixed** socio-economic background does not explain the slowdown in university enrolment after the 1950s. Higher unemployment rates lead to a rise in high school completion, while larger cohorts and tuition to lower university enrolment and completion. Changes in the returns to education also play a role.
Carrell and Sacerdote (2017)	Student	Participation in a mentoring program	University enrolment	**Positive.** Support program for college applicants that include mentoring and assistance with navigating the complex system of application and financial aid were the most effective in increasing enrolment. Persistence of these students was simmilar to the rest.
Hyman (2017)	Student	Mandatory entrance exam	University enrolment, persistence and choice	**Positive.** Introduction of mandatory college entrance exam increased the probability of students enrolling into a college, with strongest effects for the students from schools with high poverty. The completion rates are simmilar to those enrolled anyway.
Knott and Payne (2004)	State-level panel (US)	Various features of regulation, autonomy and output	University revenue, indirect measures of performance (endowment, research funding, publications, citations)	**Negative**. Regulation in terms of structure is negative for revenue, research funding and publication. Productivity and resources are higher at universities in a more decentralised setting.
Oliveira-Martins (2007)	Cross-country panel	Wage premium, part time working students, average and marginal tax rate, study duration, direct cost, internal rates of return, financial constraints, output gap, indicator of supply side responsiveness	Graduation rates	**Positive**. Policy driven differences in prvate returns to education and institutional features of the tertiary education are an important determinants of the investment in tertiary education (proxied by graduation ratios). Higher private returns, more incentive-based university systems and lower financial constraints lead to higher graduation ratios.

Note: 'Positive' ('Negative') refers to statistically significant positive (negative) effect of the reforms on the variable of interest, and 'Mixed' to either statistically insignificant effects or a combination of negative and/or positive results.

Source: Various studies, see first column of table.

5.2. Student financing

84. Unlike in the English-speaking countries, most other OECD countries fund tertiary education publically or provide considerable subsidies with tuition fees set at low levels. In Continental Europe there are no university fees; this is the case also in Nordic countries which in addition provide considerable grants for living expenses. In Austria, Italy and Switzerland tuition fees are moderate. There are also considerable differences in tuition fees between public and private institutions within countries as well as those charged for national and foreign students. The financing of tertiary education has changed considerably in recent decades, as in many countries a larger share of the costs and risks has shifted towards students and their families (Diris and Ooghe, 2017) (Figure 12).

85. There are both direct and indirect costs of tertiary education. At the individual level the direct costs include living expenses and study material, and indirect ones including foregone income from gainful labour market activity. Due to market imperfections, such as uncertainty about the return on such investment, imperfect information and difficulties in accessing credit to finance such investment in one's human capital, governmental intervention is often advocated as otherwise potential students, who are risk-averse, will be reluctant to finance higher education investments.

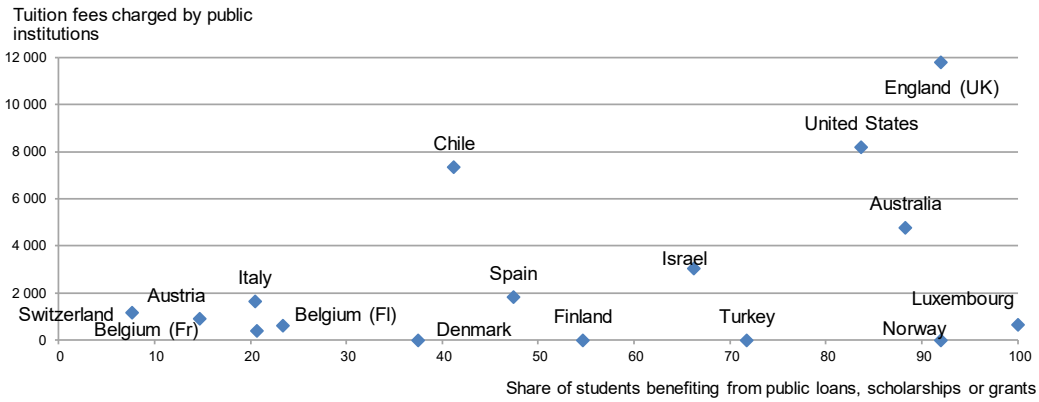
86. A large body of mainly US literature studied the impact of tuition and financial aid policies on enrolment. Indeed, a number of countries face a question of whether financial support for students should be provided in the form of loans or grants and scholarships (OECD, 2018a). Loans allow for scaling up the number of students that can benefit from the available resources and shift some of the costs of the tertiary education to those who benefit most from it, reflecting the high private returns. On the other hand, loans seem less effective than grants in encouraging low-income students. Also, if large number of students are unable to repay their loans (due to poor employment prospects for instance) such debt will have adverse effect for both the students and public sector (OECD, 2018a).

87. Much of the literature explores the question of credit constraints limiting access to tertiary education, in particular for those from low-income backgrounds and various minorities. Cunha *et al*. (2005)'s literature review of US studies concludes that long-run factors such as permanent family income, crystalized in ability, determine college attendance, not short-term borrowing constraints. Once adjustment for ability at the age students entering college is made, it more than accounts for the differences of attendance of minorities (Cunha *et al*., 2005).

88. More recent findings show that the estimates on the presence of short-term credit constraints are sensitive to the context of the study (Diris and Ooghe, 2017). Credit constraints have increased over time in the United States (Belley and Lochner, 2007; Lochner and Monge-Naranjo, 2011), as a result of increased earnings risk that has made low and middle-income parents less inclined to fund the college participation of their children. The evidence from European studies shows smaller enrolment gaps between the children of high-income and low-income families once controlled for achievement (Chowdry *et al.*, 2013). Nevertheless, in several European countries tuition fees have been introduced or increased in recent years, and this experience is not necessarily fully captured in the reviewed literature.

Figure 12. Tuition fees and public financial support

Bachelor's or equivalent level, 2015/16.



Note: Tuition fees refer to those charged by public institutions. The share of students receiving financial support for Denmark includes only students benefiting from loans, while the value for Luxembourg includes all students eligible for support.
Source: OECD (2018a).

89. Several studies show that lower liquidity constraints as well as favourable financing conditions are associated with higher graduation ratios or educational attainment (Oliveira Martins, 2007; Braga *et al.*, 2013). Targeted assistance with filling in financial aid applications or an *ex ante* guarantee of no fees for high-achieving low-income students has also been shown to increase enrolment (Dynarski *et al.*, 2018).

90. To improve the access to tertiary education a number of countries put in place various schemes to ease the short-term credit constraints that include grants, and often subsidized loans systems. Such loans can be guaranteed by the government in order to reduce their costs or be income-contingent, to protect the students from uncertainty of the labour market after graduation.

91. Income-contingent loans are in place in Australia, Hungary, the Netherlands, New Zealand and the United Kingdom. Korea and the United States use loans with income contingent features targeted at specific students. Germany uses a system of loans that revert to mortgage-style loan above a certain threshold (Diris and Ooghe, 2017). If well-designed, income-contingent loans avoid creating so-called repayment burdens for low-income young graduates that can damage their credit ratings in case of a default, as for instance happens in the US system of student loans (Chapman and Lounkaew, 2015). Income-contingent loans however require a well-functioning income tax and/or social security collection and an efficient repayment mechanism – i.e. computerised record keeping of the financial obligations and up-to-date incomes, as well as a system of unique identifiers (Chapman, 2016).

5.3. Quality of tertiary education

92. In a number of OECD countries the transition from elite to mass participation in tertiary education since the 1980s raised issues of quality (OECD, 2008). In principle, quality of tertiary education will manifest itself in rates of returns to the tertiary degree. A

large bulk of the empirical literature examines the impact of obtaining a degree on earnings, i.e. private returns to earning a degree (Ehrenberg, 2004, OECD, 2018d). These differ based on a field of study, selectivity of the institution attended, gender, experience but also position at the wage distribution. The private financial returns are also affected by country specific factors such as economic situation and labour market mismatch and context, i.e. scarcity or abundance of certain skills and education profiles. Nevertheless, much of the evidence point to business and science, technology, engineering and math graduates obtaining the highest returns, arts and humanities the lowest (Webber, 2014).

93. Since internationally comparable tests of skills of graduates of higher education are not available at this stage, it is difficult to draw any conclusions on the impact of quality of tertiary education at the macroeconomic, cross-country level. A glimpse of the skills dispersion of tertiary education graduates can be found in OECD's Survey of Adult Skills (PIAAC). On average across OECD countries, over 25% and 30% of young adults (under the age of 35) do not reach level 3 in literacy and numeracy respectively.[10] Italy, Spain and the United States rank much higher internationally in the proportion of 25-34 year olds with tertiary attainment than they do in literacy or numeracy proficiency among the same age group. PIAAC data also shows that, on average, Japanese and Dutch 25-34 years olds who have completed only high school easily outperform Italian or Spanish university graduates of the same age (OECD, 2013).

94. Existing measures, such as university rankings, offer only a snapshot of tertiary education, often with heavy focus on bibliometric indicators that tend to be biased towards English-speaking and hard-science oriented institutions (Taylor and Braddock, 2008). Research quality, measured by citations, does not equate to the quality of teaching (Marsh and Hattie, 2002). The various university rankings have been a subject to extensive criticism (Saisana *et al.*, 2011; Taylor and Braddock, 2008). Aghion *et al.* (2010) consider several institutional features, comparing the US and European universities, and show that autonomy and competition are positively associated with university output, measured as patenting and international ranking. This does not however relate directly to the higher rates of return at the country-level.

95. OECD countries generally rely on three levers to ensure quality in higher education: accreditation (i.e. registration and authorisation), quality assessment and quality audit (OECD, 2008). Quality assurance agencies have been established in most OECD countries, conducting accreditation, assessment and audit activities in various forms and regularity.

96. The experience from European countries points to some commonly reported outcomes: External quality assurance seems to have affected internal governance structures of universities, helping to professionalise quality process within universities and so contributing to organizational learning and sharing of best practices and bought the issue of quality to the forefront of university's objectives (Beerkens, 2018).

97. Due to the lack of internationally comparable data and difficulties in developing such comparable indicators, impact studies of quality insurance tend to focus on national level. For instance, Australia and UK have used various performance metrics, and shown that universities responded to such performance instruments on several dimensions (such as retention rate, employability). It is however unclear whether it represented a qualitative

[10] Out of five levels attainable, with level 5 being the highest. Level 3 in literacy refers to understanding and responding appropriately to dense and lengthy text, Adults at level 3 of the numeracy scale can successfully complete tasks that require an understanding of mathematical information that may not be explicit and may be embedded in context that are not familiar.

change or substitution of the overall goals with the specific indicators (Guthrie and Neumann, 2006). Various assessments exist in the United States, such as the Collegiate Learning Assessment, an on-line assessment of generic skills such as written communication, critical thinking, analytic reasoning and problem solving, as well as the student-reported data on their learning experience.

98. A number of other authors show the impact of quality insurance on internal processes and various other dimensions of tertiary education, but evidence supporting improved student learning, in particular in terms of marginal rates of return, remains rare (see recent literature reviews Liu et al., 2015 and Ryan, 2015).

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