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The Economics of Financing Higher Education

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THE ECONOMICS OF FINANCING HIGHER EDUCATION*

Ron Diris · Erwin Ooghe

1 Motivation

Higher education has expanded considerably over the last decades. Participation rates have strongly increased in virtually all developed countries, through both increases in the number of domestic students as well as increased inflows of international students. As a consequence, total public spending on higher education has increased since the beginning of the century, across the OECD (see Figure 1).

The resulting budgetary pressure, reinforced by the recent financial crisis, has led to reforms in the financing of higher education in many developed countries, and also to somewhat of a slowdown in the upward increase in spending as portrayed in Figure 1 in recent years. Tuition fees have been increased in several countries.[1] In response, grants have been increasing as well in some countries, but they often have not kept up the same pace, which has also led to rises in the take-up of private loans (especially in high tuition countries) as well as in loan default rates. In some countries, income contingent loans—loans with repayments that are contingent on future income—have been introduced to also provide students with the necessary

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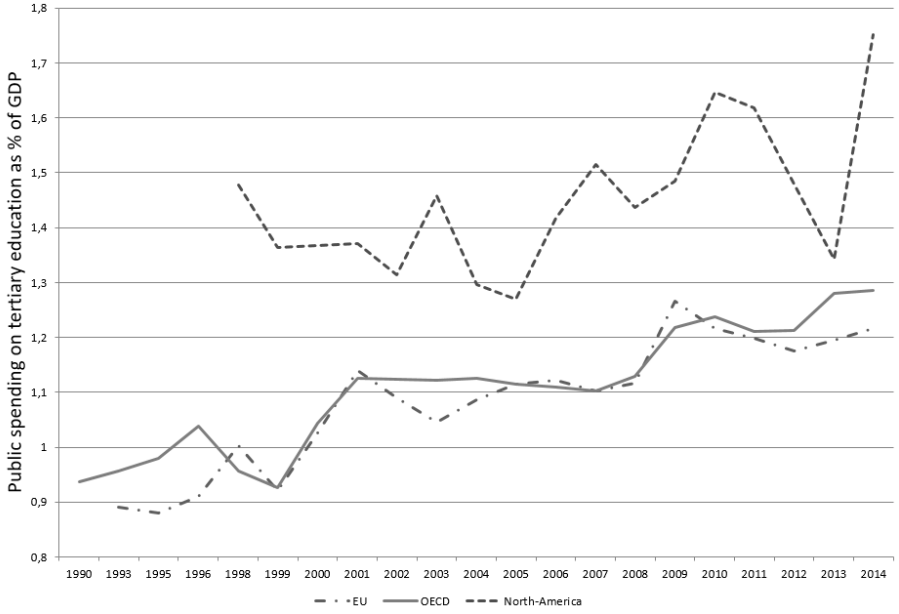
[1] See, e.g., OECD (2016) and Eurydice (2014) for a more systematic overview of recent reforms in higher education.

Figure 1: Trends in spending on higher education



Notes: The figure shows public spending on higher education as a % of GDP across regions, over the period 1997 to 2015. Source: Unesco

resources, while limiting the risk of loan default. Finally, several countries have introduced merit or demerit fees, most prominently by introducing financial sanctions for study delays. Taken together, these changes have often shifted a substantial share of the costs and risks towards students and their parents. Yet, tax-financed subsidies to institutions (to keep tuition fees low) and to parents (through either universal or targeted grants) remain important, also today.

The multitude of recent policy changes has further intensified the policy discussion on how higher education 'should' be financed. An argument that has been provided in support of increases in private contributions is that tax-financed subsidies are unnecessary and perverse because (1) the high private rate of return on higher education gives sufficient incentives to study and (2) non-students and their families, who are poorer on average, co-finance these studies by income taxes. On the other side of the discussion, several arguments have been put forward why state intervention might be desirable. First, higher education produces positive externalities, i.e., positive and direct effects on others which are not taken into account without government intervention. Second, credit constraints can prevent poor, but talented students to participate in higher education when there is no intervention. Third, the risks that students face during and

after higher education are often difficult to insure without government intervention and may therefore cause efficiency losses. Fourth, the previous arguments are based on classical market failures. More recently, behavioral economics shows that individuals may 'fail' as well if they take suboptimal/irrational investment decisions in higher education. Behavioral failures can provide an additional justification for government intervention.

Before we scrutinize the different arguments, Section 2 provides a short overview of the current financing of higher education across developed countries. We discuss how the current major financing mode—tax-funded subsidies—compares to four alternatives: no government intervention, (secured) classical loans, income-contingent loans, and graduate taxes. The latter two financing modes make students pay for their own costs of higher education, but the payment must be made after higher education and is dependent on future income.

In Section 3, we take a closer look at the incentives for investing in higher education by calculating the private rate of return, which combines the private costs and the private benefits of investing in higher education. We compute approximate figures for the OECD member countries. Even though these computations are rough, the more sophisticated econometric literature confirms the message that the rate of return is indeed high on average in most countries. Still, whether the private rate of return is high or low does not tell us whether more or less subsidies are needed. According to economic theory, policy should be based on the marginal social return. Adopting a comprehensive social welfare perspective, the marginal social welfare gain of investing more or less will reflect equity and efficiency considerations.

Sections 4 and 5 discuss the equity and efficiency implications of financing higher education. We introduce the main issues and indicate that the properties of two of the alternative financing modes—income-contingent loans and graduate taxes—make them especially fit to deal with these problems.

Section 4 deals with the equity side of the story. Based on the fact that the public costs of higher education are typically funded from general taxes, we compute the fiscal cost that is paid by both the low skilled and the high skilled to finance higher education in the OECD member countries. We take two viewpoints: the parental view (altruistic parents invest in the

higher education of their children) and the student view (students invest in their own higher education). The student view supports the claim that subsidies are perverse, because the educational costs of students, who will be richer over their lifetime, is co-financed by the taxes of non-students. In the parental view, tax-financed subsidies can be progressive: even though low-educated (thus, poorer) parents receive less subsidies (as their children are less likely to attend higher education), they also pay less taxes. Depending on the relative usage and the relative tax contributions of each group, this may lead to a positive net transfer towards the poor in some countries. In any case, because countries with high levels of tax-financed subsidies are regressive in both the parental and student view, we argue that the two alternative financing modes—income-contingent loans and graduate taxes—would be less perverse, as the costs are borne by students rather than the population at large.

In Section 5, we review efficiency reasons why government intervention might be justified. Although these different reasons are well-understood in theory, the empirical literature is the ultimate judge of their relevance. The empirical literature of the last decades point to three major insights. Again, each insight has implications for the financing of higher education.

First, although positive externalities are often invoked to justify (strong) intervention, tedious research shows that it is hard to (causally) identify externalities in higher education. A critical overview of the literature indicates that pecuniary externalities are likely to be small and cannot, in isolation, justify the current levels of subsidization of higher education. Additionally, the literature suggests that fiscal externalities are also not large enough to recover the costs of subsidies.

Second, uninsurable risks and credit constraints, arguments that were largely discarded based on earlier research, turn out to be of increasing importance. This is especially the case in countries where tuition has increased markedly. Although grants are often generous as well in these countries, they typically have not kept up the pace, and classical loans are often used to pay for higher education. Tax-funded subsidies are one way to avoid credit constraints and fare better than classical loans in terms of insurance. However, income-contingent loans and graduate taxes offer credit and insurance as well. In addition, because the loan amount and the

graduate tax rate is dependent on study duration, these modes are better fit to deal with moral hazard during higher education.[2]

Third, behavioural economics may provide new arguments for intervention. Decision-makers are not always rational and students and their parents turn out to be no exception. In line with hyperbolic discounting, they tend to overestimate (current) costs and underestimate (future) benefits. Misprediction of the private rate of return may lead to too little investment from a social point of view. Tax-funded subsidies are again one way to deal with misprediction and fare better than classical loans (which do not correct misprediction). Yet again, income-contingent loans and graduate taxes provide the same advantages, as they postpone repayment of costs to the future. Moreover, these financing modes are less 'wasteful' towards rational students who would participate in higher education anyway. The behavioral economics literature also provides arguments against systems that combine high tuition rates with high targeted grants.

Section 6 concludes and summarizes the pros and cons of the different financing modes. We revisit the key points of each approach: who bears the cost (distribution), who bears the risk (insurance) and who will participate (credit constraints & hyperbolic discounting). In this section we will discuss in detail the alleged advantages of income-contingent loans and graduate taxes. Naturally, there are trade-offs involved in comparing the different financing forms. The key question in the financing of higher education can therefore be better described as finding a good balance, which is often country-specific. Still, we believe that for at least a large group of countries—either those with high levels of tax-financed subsidies or those with high tuition levels and classical loans—this balance would become more favourable by introducing graduate taxes or income-contingent loans.

[2] Admittedly, moral hazard in the labour market may increase if one shifts from upfront tuition to graduate taxes. This is discussed in the same section.

2 Financing modes

In this section we briefly review how higher education is financed in OECD member countries. Because most real-world schemes can be seen as a mixture of different financing modes—essentially taxes, savings, and loans—we describe the characteristics of these financing modes in detail. These characteristics will be crucial later on when we discuss which financing modes are more appropriate to deal with specific problems in the financing of higher education.

2.1 Financing higher education

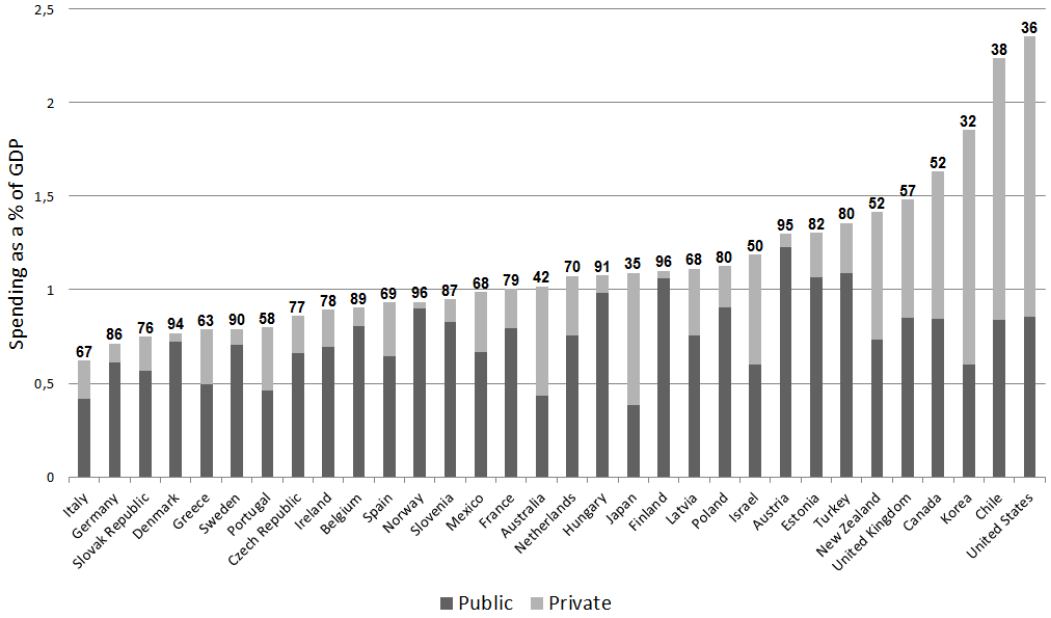
The financing of higher education has changed over the last 25 years. Tuition is on the rise in many countries. While grants have been adjusted in response, these adjustments do not necessarily keep up the pace. New financing modes, such as income-contingent loans and (de)merit fees, have been introduced or reinforced in several countries. Altogether, these changes have shifted a larger share of the costs and risks towards students and their families in many countries. Yet, despite these changes, the current financing still relies heavily on public funding in most countries.

Figure 2 shows the total amount spent on institutions of higher education in OECD member countries as a percentage of GDP. The figure excludes R&D expenditures (as we focus on education) and, by definition, it also excludes grants (as these are spent on families rather than institutions). The figures range between 0.6% of GDP in Italy and 2.3% of GDP in the United States. These differences partly reflect differences in the share of students that attend higher education, but are predominantly driven by differences in the amount spent per student.[3]

The total expenditures towards institutions in Figure 2 are further subdivided in private expenditures (mainly tuition, but also books and lodging when paid to institutions) and public expenditures. Public spending (on institutions) ranges from 0.5% and 1% of GDP for the majority of countries. Private spending is more heterogeneous, ranging from near 0% up to 1.5% of GDP. As a consequence, the share of public spending (mentioned at the top of each bar)

[3]The ranking by and differences across countries are highly similar when they are based on expenditure per student instead, such as those provided in Table B1.2 in OECD (2016).

Figure 2: Public and private spending on higher education



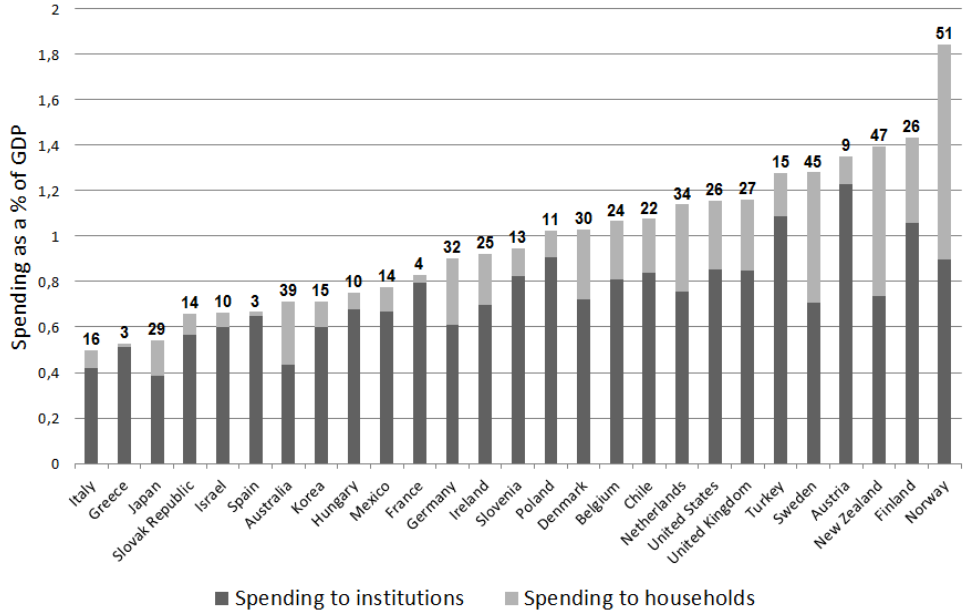
Notes: The figure shows public spending and private spending towards higher education institutions as a percentage of GDP, across OECD countries. Countries are ranked by the sum of the two. The percentage share of pubic spending is provided at the top of each bar. Source: own computations based on OECD data.

ranges from 32% in Korea to 96% in Finland and Norway. Countries with the highest total expenditures tend to have lower public shares.

In some countries (Austria and the Nordic countries) the share of public funding is more than 90% of total expenditures. In other countries (Korea, Japan, United States, Chile, and Australia) the share of public funding is less than 50% of total expenditures. Families must provide substantial resources in the latter countries, often paid from savings and, if needed, loans. Grants—tax-financed subsidies which are either universal or targeted towards needy but talented students and their families—could also help to pay for the costs of higher education, but were not discussed up to now.

Figure 3 shows the total public expenditures as a percentage of GDP, split up into subsidies to institutions (which were also indicated in Figure 2) and subsidies to households. The total public expenditure ranges from 0.5% up to almost 2% of GDP. Spending on families ranges between close to 0% and 1% and is more heterogeneous compared to spending on institutions. The share spent on families (mentioned on the top of each bar) ranges from close to 0% (France, Greece, and Spain) to more than 40% (in Sweden, New Zealand, and Norway).

Figure 3: Public spending on higher education: towards institutions and towards households



Notes: The figure shows public spending on higher education towards institutions (as also shown in Figure 2) and towards households a percentage of GDP, across OECD countries. Countries are ranked by the sum of the two. The percentage share of spending towards households is provided at the top of each bar. Source: own computations based on OECD data.

2.2 The features of different financing modes

The previous figures show a rather continuous spectrum of how higher education is financed across the OECD. Essentially, the financing in higher education is a mixture of public and private funding; and within public funding there are different uses of public money (subsidies to institutions versus grants to families). If these public subsidies do not suffice for some students to afford higher education, then loans can be an alternative. In recent years, multiple countries have introduced income-contingent loans (ICLs) as a new financing mode. Under an ICL, the loan repayment is dependent on income. Such schemes are used in Australia, Hungary, the Netherlands, New Zealand and the United Kingdom.[4]

We have alluded to two other financing modes before: tax-financed subsidies and (secured) classical loans. We elaborate on these further and add other financing modes in this section. Their characteristics are important to assess which financing modes are best fit to deal with

[4]Other countries also use loans with income-contingent features, but these are either targeted towards specific students (e.g. in Korea and the United States), or loans that revert back to mortgage style loans above a certain threshold (e.g. in Germany).

specific problems in the market for higher education. For the sake of the discussion later on, the different modes are presented in a highly stylized way.

First, we describe the laissez-faire situation, where financing is essentially based on private funding only. There is no government intervention and students are left to the private market to improve their skills and to take up credit if needed.

Second, the government can provide loans (or secure private market loans). Although loans are private in nature, they often require public expenditures. For example, in a so-called risk-sharing arrangement, loan default is covered by general tax means; the alternative is a risk-pooling arrangement in which borrowers together pay for the loan default, e.g., by increasing the interest rate with a risk premium.[5] A key feature is how loans are paid back. If it is a classical loan, then the amount repaid is fixed; if the loan is income-contingent, then the amount is expressed as a percentage of income.

Third, the government can introduce taxes to subsidize higher education institutions and/or students and their families. Because public funding is usually paid by general taxes, all taxpayers—irrespective of whether they participated or graduated in higher education—contribute to the costs of higher education. Although not used in reality so far, graduate taxes (GRTs) could be used as well: they would differ from general taxes because only participants and/or graduates would pay for the cost of higher education. Using a graduate tax rather than a general tax to finance the same amount of subsidies implies that the total tax rate (the graduate tax rate to finance higher education plus the general tax rate to finance other expenditures) will be higher for students and lower for non-students.

Table 1 summarizes the different financing modes (in columns) and their most important features (in rows); the laissez-faire is essentially not a financing mode and therefore not mentioned in the table (it rather serves as a benchmark in the discussion later on). We choose loans to be risk-sharing in the default scenario, as they typically are in reality, but will discuss other settings later on whenever appropriate.[6] Because graduate taxes are not used so far, there is no

[5] Another reason is that the interest rate on public loans is often subsidized.

[6] There are, to the best of our knowledge, only two examples of risk-pooling income-contingent loans: the (abolished) Yale plan and the Hungarian *Diákhitel*; see, e.g., Chapman (2006) for an overview.

formal benchmark, but we essentially assume it has tax features. In addition, it seems more reasonable to assume that it is based on participation, rather than graduation. Although we stick to the name, the graduate tax rate is thus assumed to depend on study duration.

Table 1: Default characteristics of selected financing modes

	GET	GRT	LOA	ICL
Compulsory	yes	yes	no	no
Capped	no	no	yes	yes
Income-contingent	yes	yes	no	yes
Study-contingent	no	yes	yes	yes
How long?	lifetime	lifetime	fixed	variable, but capped
Who pays?	all taxpayers	students	mainly students	mainly students
Default risk	shared	pooled	shared	shared

Notes: GET = general tax, GRT = graduate tax, LOA = (secured) loan, and ICL = income-contingent loan.

The two tax modes have some features in common: they are compulsory (row 1), not capped, i.e., you can pay back more than your total study costs (row 2), expressed as a percentage of income (row 3), and paid during a lifetime (row 5). The key differences between general and graduate taxes occur in other respects: the graduate tax rate depends on participation (row 4), graduate taxes are paid only by students (row 6) and the risks are therefore pooled over students (row 7).

The loan modes are different from the tax modes in several respects: loans are contracted on a voluntary basis (row 1), the amount repaid is capped over the lifetime (row 2), i.e., you cannot pay back more than the loan (usually augmented by interest payments), and loans are study-contingent (row 4) as they are taken up to cover yearly study costs. The installment plan is different, however. Classical loans usually require to pay back a fixed amount (row 3) during a fixed time period (row 4). In case of income-contingent loans however, the repayment amount varies with income (row 3) and therefore the duration is variable (row 4): shorter if your future income (and thus your repayment) is high and longer if your future income is low. Although the duration is thus variable in case of income-contingent loans, there is usually a maximum duration, which implies that incomplete repayment of a loan may occur without

breaching the contract. We assumed that loans are risk-sharing (row 7), so loan default and incomplete repayment are covered by general tax means. This implies that *mainly* students pay for the costs of higher education (row 5).

3 The private rate of return

In this section, we calculate the private costs, private benefits and the internal rate of return to higher education. Due to the limited availability of comparable data we restrict our analysis to OECD countries.[7] The main data sources for the reforms are OECD (2014), OECD (2016) and Eurydice (2014). For more detailed explanations of the calculations, we refer to the appendix.

3.1 Private costs

There are different types of private costs for higher education. First of all, there are the upfront investment costs. The discussion is typically focused on the direct costs: tuition fees, books, transport, lodging and the like. However, there are also substantial indirect costs, in terms of the opportunity costs of time. By studying rather than working, students forgo earnings in the labour market. Finally, there also non-pecuniary costs to higher education such as the cost of effort.

We examine how the private costs of education differ across OECD countries. For the direct upfront investment costs, we rely on comparable data on tuition and other fees paid within the educational institutions. Hence, books, transport and lodging costs are included when they are provided through the institution, but not when they are provided through other channels. For the opportunity costs, we use (extrapolated) data on the average wages of those aged 20. Measures of the effort costs of education across OECD countries are not available as these are very difficult to measure.

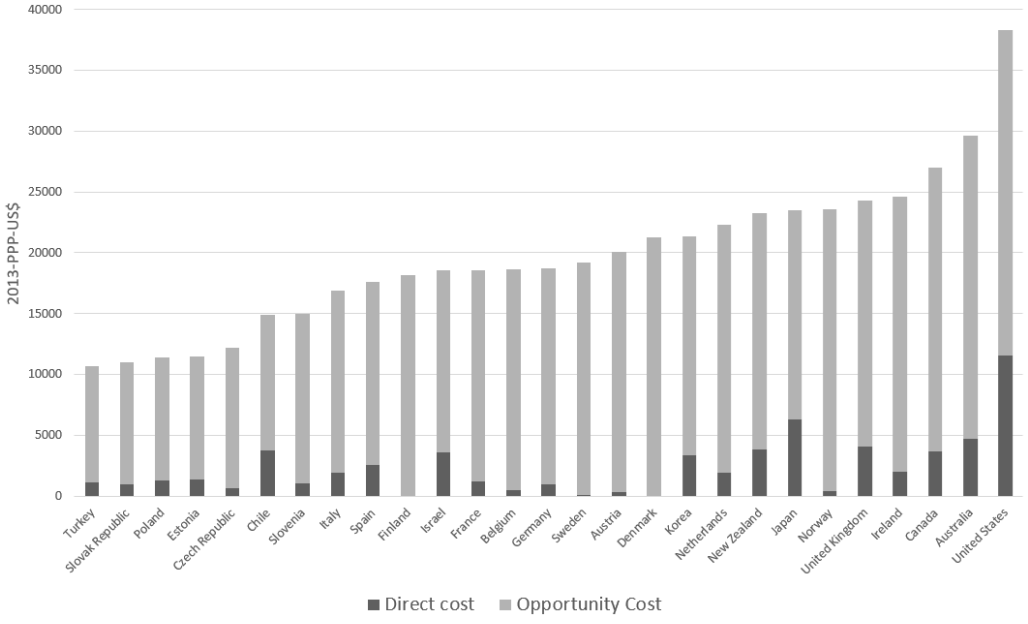
Figure 4 shows the total private cost per year of higher education as a sum of the direct private costs and the opportunity costs, for the OECD member countries. There is strong variation

[7]The analysis includes all OECD countries except Greece, Hungary, Iceland, Latvia, Luxembourg, Mexico, Portugal and Switzerland, for which no reliable data in one or more indicators could be obtained.

in the direct costs of higher education, as there are many countries in which public subsidies keep especially the tuition fees low, while others demand a substantial private contribution to higher education. The variation in these private contributions largely follows the size of the private shares in Figure 2.

The direct costs are relatively small compared to the opportunity costs, which are largely a reflection of the average standard of living in countries (as well as the steepness of age-earnings profiles). As such, countries with low direct costs such as Austria, Germany and Norway, still end up with relatively high total private costs, while a country with high tuition fees like Chili ends up with relatively low total costs. Nonetheless, most countries with high direct contributions also have high total cost in Figure 4. The private costs are shown to be especially large for the United States.

Figure 4: Private costs for higher education



Notes: The figure shows the average private cost of higher education, comprised of direct private costs and opportunity costs. Countries are ranked by the sum of the two. Source: own computations based on OECD data.

3.2 Private benefits

The most apparent private benefits of higher education are pecuniary; e.g. higher wages and lower unemployment probabilities. A part of the higher gross wage leads to higher tax payments. The remainder forms the net wage benefit. Non-pecuniary benefits, such as better jobs and better health, can arise as well.

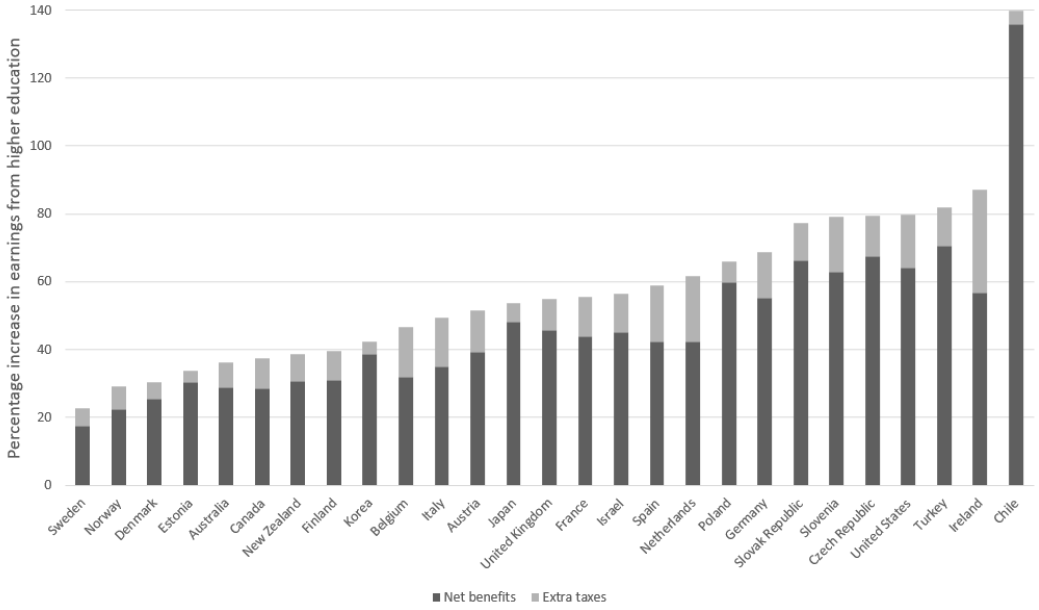
We first look at the pecuniary benefits. We use information on gross wages, taxes, unemployment probabilities, and replacement rates to calculate the expected (gross and net) income per year across different education levels. The difference in expected yearly income between tertiary education and post-secondary non-tertiary education is defined as the private income benefit from tertiary education. We refer to the appendix for further computation details and data sources.

Figure 5 shows the average private gross income benefit from completing tertiary education, by country. The figure splits up the gross benefit into the net benefit and the net taxes paid. Countries are ranked by the gross income benefit. Gross benefits are below 40% for all of the Northern European countries, and are relatively low as well for Korea, New Zealand and Australia. The net wage return exceeds 100% for Chile, and is also high in most Central European countries as well in Turkey, Ireland, and the United Kingdom. On average, the higher educated in countries with higher gross benefits from higher education also pay relatively more taxes, which somewhat reduces the differences across countries if we move from gross to net benefits.

3.3 Private return

Figure 4 presents the private cost per year of higher education. Figure 5 presents the expected net income benefit of a degree per year of working. In this section, we add country-level data on study duration to bring these pecuniary costs and benefits together. The internal rate of return (IRR) is the rate of return that balances the net present value of current investment costs with the net present value of future income benefits. To compute the IRR with the data at hand—expected average costs and benefits—we must implicitly make some simplifying assumptions: individuals are risk-neutral, time-neutral, and infinitely lived. The formula and the

Figure 5: Private pecuniary benefits of higher education

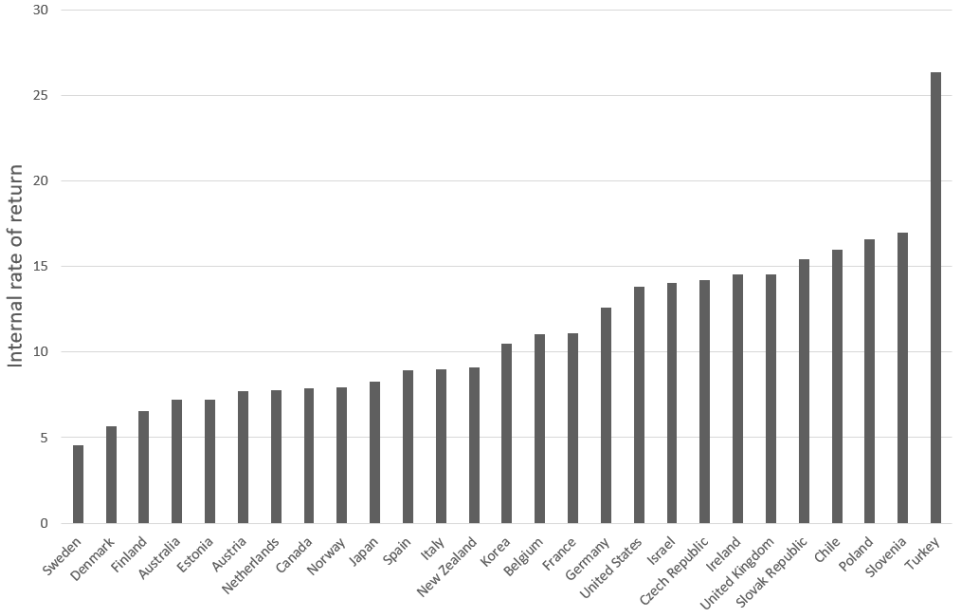


Notes: The figure shows the private income benefit from completing higher education, across OECD countries. It reflects both the net income benefit and the net taxes paid. Countries are ranked by the gross income benefit. Source: own computations based on OECD data

derivation are available in the appendix.

Figure 6 shows the IRR across the OECD countries. The ranking of countries by the size of the IRR largely follows that of the private benefits of higher education. Chile is a less extreme outlier compared to Figure 5, because the high benefits come at the expense of a long average study duration. Countries that were shown to have high private costs in Figure 4, such as Australia, the Netherlands and the United States, are situated somewhat more to the left compared to Figure 5, but even in these cases the difference is limited. The rate of return exceeds 5% in all countries. This is partly because countries with low net income benefits also have low costs of education (most notably the Northern European countries). Yet, even for a country with relatively high costs and relatively low benefits such as Australia, the IRR exceeds 5%. Hence, although the public and political debate is typically focused on differences in direct private costs across countries, these costs were shown already to be a limited share only of the total costs (see Figure 4), and these total costs are in turn only of limited importance with respect to the variation in the internal rate of return across countries.

Figure 6: Internal rate of return from higher education



Notes: The figure shows the internal rate of return to higher education across OECD countries. Source: own computations based on OECD data

3.4 Discussion and implications

Similar calculations to our rate of return are provided by OECD (2016). There are some differences in the approaches. Mainly, the OECD uses minimum wages for opportunity costs, which are lower than our measures. As such, the averages in our approach are slightly lower (11% in our approach vs. 13% for the OECD), but the results are rather comparable overall.[8]

Either of these calculations of the return to education are based on raw comparisons of pecuniary costs and benefits by educational level. However, differences in educational attainment are likely to be highly selective. In the econometrics literature, a wide range of studies uses different approaches to correct for such selection issues when estimating the private pecuniary returns to education. Originally, such estimates have been based on OLS regressions that control for characteristics such as age and experience. Seminal overviews by Psacharopoulos (1985, 1994) show that gross earnings increase by 8 percent per extra year of higher education in developed countries. This corrected rate of return is, as such, somewhat lower than the internal rate of

[8]On a country-level, relatively larger differences occur for countries for which the OECD reports very large figures, mainly Poland and Czech Republic. In general, the dispersion in the IRR is smaller in our approach.

return provided in Figure 6.[9]

More recent studies address selection bias more thoroughly and estimate true causal returns to education. Overviews are provided by Blundell et al. (1999), Card (2001) and Harmon et al. (2003). These causal estimates are very close to those provided by the OLS models. However, they are still focused on education in general. Studies that estimate the causal returns of *higher* education are relatively scarce.[10] A few exceptions exist, all based on American data. Heckman et al. (2014) identifies an average rate of return of around 14 percent for an extra year of college, but a marginal return of only 3.3%. Carneiro et al. (2011) identify marginal returns that range from 1.5% to around 8.5%, compared to an average return of 14%. Zimmerman (2014) strictly estimates returns at the margin, which amount to around 5% per year of college.[11] Hence, the evidence indicates that, in the United States at least, marginal returns to higher education are indeed lower than average returns to higher education.

Education has also been linked to non-pecuniary benefits. Positive relations have been identified with respect to fertility, occupational choice, and consumption/savings behaviour.[12] Evidence shows that at least a part of these links is causal. Direct causal evidence exists for the effect of higher education on health, in terms of lower obesity, better phyisical and mental health and lower incidences of smoking (Conti et al., 2010; Heckman et al., 2014; De Walque, 2007).

Hence, there is considerable evidence, both correlational and causal, of a substantial pecuniary and non-pecuniary private return to higher education. It is still important to emphasize that students at the margin (i.e., those that are induced to invest more in higher education when, e.g., tuition fees are lowered) appear to have lower (but still positive) pecuniary returns than the average student in higher education.

[9] It should also be noted that it is not standard in the econometric literature to subtract taxes and to include direct costs. If we recompute the internal rate of return for gross income benefits without direct costs, the average return is around 13%, so these differences cannot explain the lower return in the econometric literature.

[10] Several studies use college proximity as instruments to estimate the return to education; see Oreopoulos and Petronijevic (2013) for an overview. However, these do not necessarily capture solely the return to higher education, as college proximity can also affect other choice margins (such as the probability of graduating high school).

[11] The variation in estimates in these studies largely occurs because different margins are exploited. Zimmerman (2014) looks at students at the (academic) margin of the admission threshold, while Carneiro et al. (2011) look at several margins, depending on the exact policy change that is exploited. Heckman et al. (2014) provide a dynamic extension of the model in the latter study.

[12] See Vila (2000); Wolfe and Haveman (2002); Lochner (2011); Oreopoulos and Salvanes (2011) for overviews.

Implications The private return to higher education is relatively high in many countries. The more sophisticated econometric literature points to several problems, especially on the benefit side, but dealing with these problems does not seem to alter the message: there are sufficient incentives to invest in higher education.

High average private returns are sometimes used as an argument to reduce tax-financed subsidies to higher education. Because the incentives are so high (and because direct costs are only a limited part of the total costs, as seen in Figure 4), reducing subsidies will not affect participation substantially and can reduce the budgetary pressure.

However, economic theory tells us that low or high average private returns do not tell us whether more or less subsidies in higher education are desirable from a societal point of view. What matters is the marginal social return, which includes but is not restricted to, the private return. Using a comprehensive social welfare perspective, the marginal social welfare gain from subsidizing higher education can differ from the private gain if there are equity gains by making the distribution of income more equal or if there are efficiency gains by correcting failures. The next two sections will look at both possibilities in the context of higher education and discuss, in each case, the implications for the financing of higher education.

4 Perverse redistribution

We have seen that the direct private costs of education are low in many countries, because many countries strongly subsidize higher education institutions (see both Figures 2 and 4). Yet, someone must ultimately bear the cost of these subsidies as a private person. We call these costs 'fiscal' as we assume that the subsidies are financed through earnings taxation. The difference between the fiscal costs and the received subsidies are the so-called net fiscal costs.

We compute the fiscal costs from two different viewpoints. The parental view assumes that parents are the beneficiaries of the subsidies, but also pay the taxes to finance these subsidies. The student view, in contrast, assumes that the students benefit from these subsidies, but pay the taxes based on their future earnings. These views are sometimes called the cross-sectional and

longitudinal view in the literature.[13]

In both approaches, the net fiscal costs differ depending on educational background. In the parental view, high-skilled parents are more likely to have children who participate in higher education and thus, to receive subsidies. At the same time, they also pay more taxes because their gross earnings are higher and because taxes are progressive. If the fiscal cost is smaller than the received subsidy, then the net fiscal cost of high-skilled parents is negative, leading to a perverse redistributive effect: low-skilled (poorer) parents subsidise the children of high-skilled (richer) parents. In the student view, the high-skilled automatically receive all subsidies from higher education, but all future taxpayers, students and non-students, pay for these subsidies. As such, the system is regressive by definition. Yet, there are at least three good reasons to look at the student view. First, the *degree* of regressivity can still differ strongly between countries, depending on relative tax contributions and on the size of the public subsidies. Second, there can be strong relative differences in the two approaches (as we will see later on). Because different factors are weighted differently, countries that are progressive compared to other countries in the parental view can be highly regressive compared to other countries in the student view, and vice versa. Third, unless both views lead to the same results for a country, the implications for financing higher education will depend on the adopted view.

It is important to understand the precise meaning of our net fiscal cost index. If our computations indicate that the financing of higher education is, for example, progressive in some country, then it means that the current financing makes the overall system of redistribution more progressive than the level of progressivity that would otherwise be reached. If the idea is to use the financing of higher education also to increase redistribution, then a more progressive scheme is better. However, if the idea is that the 'user pays', then neither progressive, nor regressive schemes are optimal. In this view, neutral financing schemes are ideal because the subsidy is exactly covered by the taxes paid in each group. Note that this potential contrast only applies to the parental view. In the student view, a more progressive financing system is automatically also a more neutral financing system.

[13] We do not use this terminology because we approximate, in both approaches, the tax contribution on the basis of the taxes that individuals (parents or students) pay over their lifetime.

There are limitations to the data we use. Most importantly, we must assume that the subsidy is equal across students. Especially in countries with targeted financial aid towards disadvantaged students, the fiscal costs as calculated can overestimate the degree of regressivity (in the parental view). We elaborate on how sensitive results are to this in the discussion that follows.

4.1 Parental view

The parental approach assumes that the parents bear the net fiscal costs of their children. The net fiscal cost is defined as the difference between the fiscal cost and the subsidy. We briefly explain the two key assumptions and refer again to the appendix for further details.

We write the total subsidy as

$$n_L s_L q_L + n_H s_H q_H,$$

with n_i the number of parents of each type, s_i the average public subsidy for higher education (in 2013-PPP-US$), and q_i as defined before. Similarly, the total fiscal cost of all parents can be written as

$$n_L c_L + n_H c_H,$$

with c_i the fiscal cost of an i-skilled parent.

We introduce two key assumptions.

1. The budget balances, i.e., the total cost of the subsidies received by the cohort of current graduates must be equal to the total fiscal cost paid by the cohort of their parents:

$$n_L s_L q_L + n_H s_H q_H = n_L c_L + n_H c_H,$$

or equivalently,

$$n_L(c_L - s_L q_L) + n_H(c_H - s_H q_H) = 0, \tag{1}$$

where the terms between brackets correspond to the net fiscal costs that we report in the following figures.

2. The fiscal cost of the parents is entirely collected via earnings taxation and in such a way that the ratio of the fiscal costs is equal to the ratio of the earnings taxes for both types:

$$\frac{c_L}{c_H} = \frac{t_L}{t_H}, \tag{2}$$

with t_i the average earnings tax amount paid by an i-skilled parent.

While the first assumption is natural, the second one essentially imposes that the (elasticity of) progressivity remains the same with and without the contribution.[14] These two assumptions provide two equations that allow for computing the two unknowns: the fiscal costs for each type. The resulting fiscal costs have a simple interpretation: they are equal to the tax share of an individual multiplied with the total cost of higher education, i.e., for an individual of type $i = L, H$ we have:

$$c_i = \frac{t_i}{n_L t_L + n_H t_H} \times (n_L s_L q_L + n_H s_H q_H).$$

The *net* fiscal cost are then equal to:

$$c_i^N = c_i - s_i q_i.$$

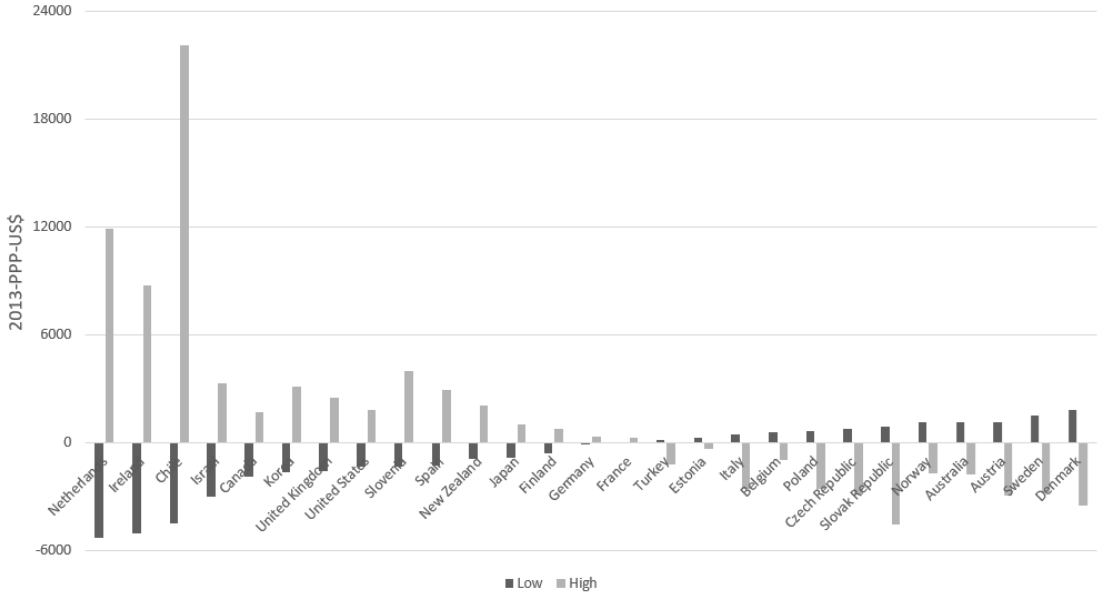
Figure 7 reports the average net fiscal cost for low-skilled and high-skilled parents in the different countries, ranked by the net fiscal costs of the former group. Countries with positive net fiscal costs for the high-skilled automatically have negative fiscal costs for the low skilled. If this is the case, there is subsidization from the (richer) high-skilled towards the (poorer) low-skilled and therefore a progressive system of subsidization. This applies to the left of (and including) France. France and Germany are closest to 'neutral financing'.

The tax ratio t_L/t_H and the subsidy ratio $s_L q_L/s_H q_H$ determine whether the subsidization of higher education is regressive (if the tax ratio is largest) or progressive (if the subsidy ratio is largest). For example, Korea and Czech Republic have very similar tax ratios, but its much

[14] The elasticity of progressivity measures the percentage change in the average tax rate for a percentage change in gross income. Formally, let y_i be the gross income of type $i = L, H$. The elasticity of progressivity without and with the contribution is equal to $((\frac{t_H}{y_H} - \frac{t_L}{y_L})/\frac{t_L}{y_L})/\frac{y_H - y_L}{y_L}$ and $((\frac{t_H + c_H}{y_H} - \frac{t_L + c_L}{y_L})/\frac{t_L + c_L}{y_L})/\frac{y_H - y_L}{y_L}$. Both expressions are equal if and only if equation (2) holds.

higher usage ratio (q_L/q_H) makes subsidization in Korea decidedly more progressive. Chile and the Czech Republic, on the other hand, have very similar usage ratios, but its much lower tax ratio leads to strong progressive subsidization in Chile. Even when tax ratios and usage ratios are both similar, countries can still differ in the degree of progressivity or regressivity (i.e. the height of the bars). For example, Austria and Poland are highly comparable in both tax and subsidy ratio, but regressivity is stronger in Poland because the absolute levels of q_L and q_H are higher, i.e. there is a higher overall use of higher education per parent. Differences in the public subsidy level between countries can further add to differences in the height of the bars. Italy represents an interesting case in this respect, as the mismatch between the use of higher education and the tax contributions of low vs. high skilled is especially large there (mainly because of low q_L). However, because the costs per student are low in Italy, the fiscal cost for the average low-skilled parent is still relatively limited.

Figure 7: Fiscal costs of higher education (parental view)



Notes: The figure shows the average net fiscal cost for a low- and high-skilled parent for the higher education of his or her child. Countries are ranked by the cost level of low-skilled parents. Source: own computations based on OECD data.

The net fiscal cost for the high-skilled is especially high in Chile, the Netherlands and Ireland. This is mainly because there are large earnings differences between low- and high-skilled in these countries, which leads to a very low t_L/t_H. Regressive subsidy is especially apparent

in Scandinavian and Eastern-European countries. For the Scandinavian countries, this is predominantly because a relatively low wage return to higher education and low tax progressivity lead to a relatively high tax ratio t_L/t_H. This is only partly compensated by their comparatively stronger degrees of intergenerational mobility of educational attainment.

While variation in the private return to higher education is an important factor, the figure also shows that countries with higher private contributions, including those with income-contingent loans such as the Netherlands, New Zealand and the United Kingdom, tend to be more progressive, while countries with almost full tax financing are all regressive in Figure 7. Australia provides an exception here, as it also uses an ICL system but shows regressive subsidization. This is mainly because the private return to education is especially low in Australia, which leads to a relatively low tax contribution of the high skilled. Moreover, despite the ICL system, still 42% of the costs of higher education are publicly funded.

As stated before, because of data limitations, Figure 7 portrays the regressivity of the financing of higher education net of any progressivity in grants. As such, countries in which the targeting of grants to disadvantaged students is common would end up with a more progressive scheme when this would be taken into account. OECD data show that average grants are high especially in Nordic countries, and also substantial in New Zealand, the United Kingdom and the United States (OECD, 2011). However, grants in Nordic countries are highly universal and therefore the assumption is reasonable there. For the mentioned Anglo-Saxon countries, grants are typically targeted so we are likely underestimating progressivity there. However, these countries are already progressive in Figure 7, so the general conclusions remain. Additionally, we assess how sensitive results are to targeting. Based on the information from Figure 3, we instead assume that all public funding distributed to households goes to low-skilled households. This is a rather extreme assumption, as not all high-skilled earn high incomes and grants can also be merit-based, so this represents an upper bound of the progressivity. In this exercise, the United States would move virtually to where the Netherlands is situated now, while the United Kingdom would become even slightly more progressive than that. If we assume two thirds of the household funding goes to the low-skilled, both countries would move to between Israel and

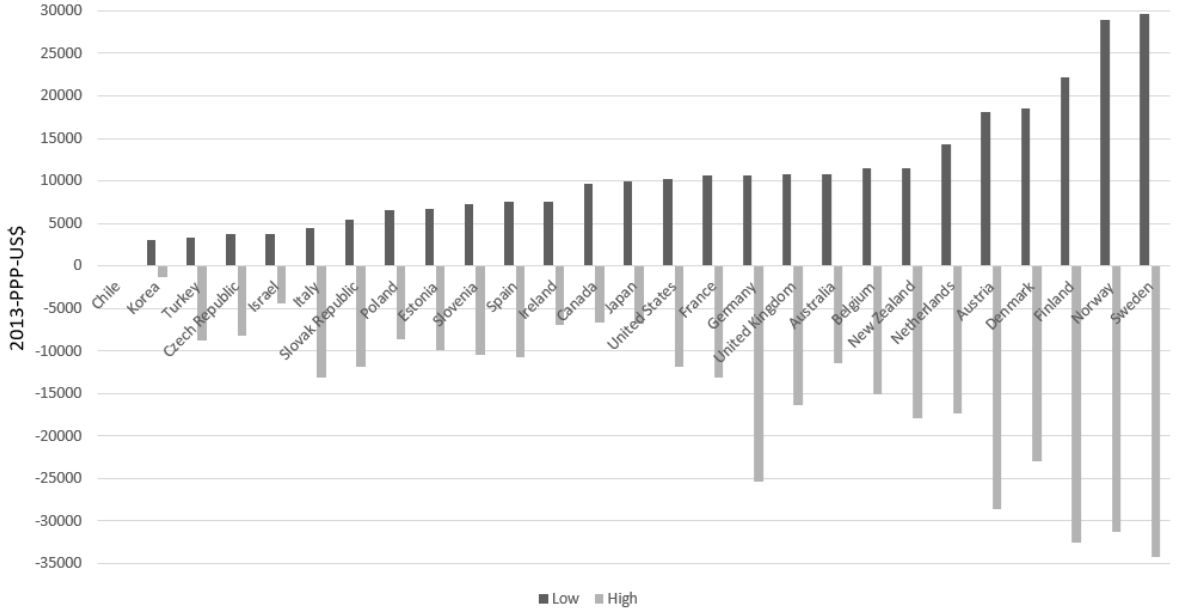
Canada. Hence, although sensitivity to targeting of grants is not negligible, it does not appear to lead to major shifts in the figure.

4.2 Student view

The student view assumes that the cohort of current graduates itself bears the direct and net fiscal costs of higher education. Because only the high-skilled in this age cohort obtained a degree, the formulas are the same as in the parental view, but now with $q_L = 0$ (non-students) and $q_H = 1$ (students). We refer to the appendix for further details.

Figure 8 reports the average net fiscal cost for the low-skilled (non-students) and high-skilled (students) in the different countries. Because non-students do not use higher education, but partially pay for it via future earnings taxes, the net fiscal cost of a non-student is always positive. As non-students are on average poorer than students over their life-time, the system of subsidization is by definition regressive in the student view.

Figure 8: Fiscal costs of higher education (student view)



Notes: The figure shows the average net fiscal cost for higher education for a low-skilled (non-student) and a high-skilled (student). Countries are ranked by the cost level of non-students. Source: own computations based on OECD data.

The net fiscal costs are zero for both groups in Chile because the average earnings of the

non-students are too low to pay income taxes. Hence, Chilean students pay back their subsidy completely. If we compare the country rankings in Figures 7 and 8, then a positive rank correlation emerges—the Scandinavian countries are most regressive in both figures—but it is far from perfect (the rank correlation equals around .35 for the low skilled and .42 for the high skilled. Part of the differences occur because intergenerational mobility does not play a role anymore in the student view (as q_L and q_H always equal 0 and 1, respectively). This explains somewhat of the comparatively higher regressivity for countries such as Canada and Finland (who have a high value for q_L/q_H) and of the comparatively lower regressivity for countries such as Italy and Turkey (who have a low value of q_L/q_H). More importantly, however, is that the size of the subsidy becomes a major factor, as it is not spread anymore across both groups but fully incurred by the high-skilled. As such, countries with low absolute levels of public spending are relatively less regressive (Korea, Italy and Turkey) while countries with high public spending become more regressive, relative to the previous figure. The shift is most prominent for the Netherlands, which is most progressive in Figure 7, but among the most regressive in Figure 8. The Scandinavian countries are high spenders as well, but are already largely on the far right in Figure 7. The difference compared to the other countries is, however, substantially higher in Figure 8.

4.3 Discussion and implications

We first look at the theoretical and empirical literature on perverse redistribution. Afterwards, we look at the implications of perverse redistribution for the different financing modes. These implications crucially depend on whether one adopts the parental or the student view.

First, a prominent argument in the theoretical literature is that the optimal allocation of resources in higher education can be input-regressive; see, e.g., De Fraja (2002), Fleurbaey et al. (2002) and Jacobs and Bovenberg (2011).[15] If a planner decides about education and redistribution simultaneously, then it can be optimal to allocate the resources in education regressively (for efficiency reasons) and to reallocate the resulting earnings progressively (for equity rea-

[15]These papers extend the seminal work of Arrow (1971) and Bruno (1976) by introducing taxation.

sons). Note, however, that regressivity has a different meaning in our context as we do not only look at how public resources are allocated but also how they are financed through the tax system.[16]

Second, the empirical literature points to several difficulties—caused by general equilibrium effects and non-linear spillover effects—that we cannot address in our computations. General equilibrium effects occur if subsidies to higher education lead to a relatively higher supply of skilled workers and a lower college premium in equilibrium.[17] This may counteract the alleged regressivity of education subsidies (Johnson, 1984). The same would apply when positive wage externalities exist such that graduates affect the wages of non-graduates more than the wages of other graduates. Whether subsidies lead to sizeable general equilibrium effects or non-linear spillover effects is not clear at this stage.[18]

The results on perverse redistribution in the more sophisticated econometric literature are largely similar to our computations. Taking the parental view, Hansen and Weisbrod (1969) show that educational subsidies are regressive in the Californian higher education system, but Pechman (1970) contests this. In his overview of the empirical literature, Barbaro (2005) concludes that both progressivity and regressivity occur in the parental view. Studies for the United States, Austria, the city of New York, Canada, and Japan find progressive effects, while studies for Quebec, Kenya, and Switzerland find regressive effects. Although these studies are based on data from the end of the 20th century (1970-2000), they are in line with our less sophisticated but more recent analysis, with the exception of Austria. Gruske (1994) is one of the few studies that looks at both views. He shows that the financing of higher education in Germany is progressive in the parental view and regressive in the student view. This is, according to our analysis, still the case 20 years later.

Although the theoretical and empirical literature show that distributional considerations in

[16]Moreover, there is no variation in the size of the subsidy across students in our exercise. Because $q_L < q_H$ in all countries, there is always regressivity of inputs in our case as well, but countries can still be progressive through their taxation.

[17]Acemoglu (1998) provides the theoretical argument that supply increases can also increase college premiums in the long run, because they can induce skill-biased technological change.

[18]See, Heckman et al. (1998a) versus Lee (2005) for a contrasting view on general equilibrium effects in the context of higher education and see Moretti (2004) and Ciccone and Peri (2006) for a contrasting view on non-linear spillover effects.

higher education are complex, the important message is that all interventions in higher education have distributional effects, which should be weighted against other considerations (e.g. the efficiency of a perverse distribution). Recall that all financing modes, except tax-financed subsidies, are student-centered. Shifting from tax-financed subsidies to one of the other modes will shift a larger share of the costs towards students and their families. The distributional consequences of such a shift depend therefore on the adopted view. Financing higher education is regressive in the student view, so a shift away from general taxes will make the distribution less perverse. In the parental view, the answer varies. In the case of progressive countries (i.e. countries to the left of Figure 7), the subsidies received by poorer families are larger than the taxes these families pay. Hence, shifting from tax-financed subsidies to one of the other modes will actually lead to a *less* progressive system in this case.

5 Externalities and beyond

In this section we turn to efficiency arguments pro and contra government intervention in higher education. Such arguments are typically based on failures at the individual, market, or government level. The aim is not to review this extensive literature here, but to focus on what we consider the most important messages of the empirical literature over the last decades: externalities are hard to identify, uninsurable risks and credit constraints are on the rise, and misprediction (of the costs and benefits of higher education) might pose new concerns.[19]

These arguments have implications for how we should ideally finance higher education. We therefore discuss these failures in light of the different financing modes that we introduced in Section 2 and assess which type(s) of financing are most appropriate to counteract the discussed failures.

[19] We refer the interested reader to Diris and Ooghe (2015) for a comprehensive survey.

5.1 Classical externalities

Theory. Externalities have been frequently used to justify intervention in education, including higher education. A classical externality occurs if someone's decision directly affects other individuals in society, but this external effect has not been taken into account by the decision-maker. If positive externalities exist, then there is too little investment in higher education from an efficiency point of view. Encouraging higher education, e.g., by reducing its cost, could be a desirable policy intervention. To do so, tax-financed subsidies and grants stand out among the different financing modes. Loans and graduate taxes would be less appropriate as they assign a larger share of the cost of higher education to students, who would therefore be relatively less inclined to participate. But this argumentation is valid only if positive externalities in higher education can be identified.

In the context of higher education, there could be positive externalities if graduation increases the productivity of other individuals in society (Lucas, 1988). Graduates can also accelerate economic growth via learning-by-doing, technological diffusion, and innovation (Arrow, 1962; Nelson and Phelps, 1966; Romer, 1993). Non-pecuniary externalities may exist as well, if the number of graduates has an impact on, e.g., crime, public health, the environment, social cohesion, or the education and health of later generations.

Evidence. Both the public debate and the empirics have been largely focused on pecuniary externalities. Macro-economic studies claim that the average educational attainment of a country has positive effects on macro-economic performance over and above the enhancement of individual productivity. Sianesi and Van Reenen (2003) review the evidence and conclude that there is some justification for this hypothesis, but that the estimates are likely to grossly overstate the true effects. Another review by Lange and Topel (2006) reaches similar conclusions and state that the private benefits outweigh the externalities by far. Krueger and Lindahl (2001) argue that estimates of the effect of education on growth rely on restrictions that are rejected by the data. Their results cast doubt on the external benefits of higher education especially. Another critique is provided by Ciccone and Peri (2006), who argue that traditional Mincerian approaches to estimating the social return to education are overestimated because they do not

correct for the role of downward sloping demand curves. Their corrected estimates identify externalities of around 2% (for average years of education).

A few studies report comparatively large returns. Moretti (2004) finds that the wages of those without a college degree are 1.2-1.9 percent higher for every one percentage point increase in the share of college educated workers in the metropolitan area, while Iranzo and Peri (2009) use state-level data to estimate an excess social return of 3% to 9%.[20] However, such studies rely on instrumental variable estimation and it is notoriously difficult to find truly exogenous instruments for the share of higher educated workers in a city or state; see also the critique by Lange and Topel (2006) and Winters (2012) on the validity of these instruments.[21]

Causal evidence on non-pecuniary externalities from higher education is relatively more robust.[22] Such externalities have been found for voting—although they tend to be lower in Europe compared to the United States—and trust. Additionally, externalities can be intergenerational. Holmlund et al. (2011) review evidence for Scandinavia and the United States to show that more educated parents 'produce' more educated children. The causal estimates indicate an increase in a child's educational attainment by 0.1 years for every extra year of schooling of the parents. With respect to crime, there is clear evidence of externalities for compulsory education (Lochner and Moretti, 2004; Machin et al., 2011), but very limited evidence for *higher* education. As argued by Lochner (2011), policies that affect crime are mainly successful among the least able, most disadvantaged groups in society and, therefore, the (marginal) effect of higher education on crime is likely to be limited.

Finally, it should be acknowledged that there can also be reasons why the (marginal) social return is *lower* than the private return. An extensive literature discusses such negative 'externalities'.[23] These can be caused by information asymmetries (signaling), and interactions in

[20] A related study by Ciccone and Hall (1996) identifies very large external effects to density, which is consistent with education externalities, but also with alternative explanations.

[21] Lange and Topel (2006) further strongly question the plausibility of the effect sizes estimated by Moretti (2004). As they show, the results of Moretti (2004) imply that the excess social return to higher education equals 50%. This appears highly implausible in light of all other research in this area.

[22] See McMahon (2004) for an overview of macro-economic evidence of externalities in general education, and Lochner (2011) for a focus on causal evidence.

[23] These are not externalities in the classical sense, but they still are based on the premise that the take-up of higher education by one individual can impact the payoff of others.

preferences (social status, peer pressure) or in constraints (academic peer effects). Because of the same difficulties of identification that plagues the literature on positive externalities, the empirical literature in this area is mixed too.[24] Nonetheless, there is credible evidence that signalling does occur in the United States.

Implications While the evidence on non-pecuniary externalities is comparatively robust, the magnitude and extent of such externalities are not overwhelming. Taken together with the limited evidence on pecuniary externalities and the potential for negative externalities, the case for a social return that far exceeds the private one is thin.[25] Heckman and Klenow (1998) claim for example that, to justify the subsidy levels in the United States, the *excess* social return of college education should be about 12%, which is markedly above even the higher end of the more robust estimates from the literature. Moreover, one can expect that this required excess social return must be even higher in those parts of Europe where the subsidy levels are higher than in the United States.[26] Hence, externalities alone are not enough to justify financing higher education through tax-financed subsidies and grants, compared to financing schemes with higher private contributions.

5.2 Fiscal externalities

Theory. Subsidizing higher education is a cost for society. However, because subsidies encourage investment in human capital, they will lead to higher earnings and lower unemployment at the individual level and thus to higher tax revenues and lower welfare benefits at the government level. If the revenue gain is larger than the subsidy cost, then a Pareto improvement is possible.

These budgetary windfalls are sometimes referred to as fiscal externalities. To understand why they are called externalities, one can imagine a government that consists of separate departments responsible for, e.g., taxation, welfare, and education. Without sufficient coordination

[24]This literature is extensively reviewed in Diris and Ooghe (2015).

[25]This conclusion confirms earlier claims by Arrow (1993), who raised doubts about the external benefits of higher education.

[26]The evidence from the literature is exclusively focused on the average social return to education. There is, to the best of our knowledge, no empirical study that estimates externalities for the marginal student, which is what is relevant for policy. Given that private returns are lower at the margin, it is plausible a priori that their social returns are comparatively smaller as well at the margin.

between these departments, the budgetary windfalls accrue to the departments of taxation and welfare and are therefore an externality of the decision taken at the department of education to increase subsidies.[27]

Absent supranational institutions, coordination failures are even more likely at the international level. Increasing subsidies in one country may attract more international students in another country. Depending on whether these students return or not, this could be a disadvantage or an advantage for the host country and could trigger a so-called race to the bottom or race to the top. Although the share of international students is still rather low (6% in the OECD), it is rapidly increasing, and there is a large heterogeneity across countries as well as degree levels (OECD, 2016). In Australia, New Zealand and the United Kingdom, for example, the shares are near 20%.

If fiscal externalities exist, Pareto improvements are possible. Because fiscal externalities are essentially coordination failures, more coordination at the national or international level offers an obvious solution to the problem. At the national level, also other policies could be used. At the national level, policies that encourage investment in higher education, such as tax-financed subsidies and grants, may generate Pareto improvements. Financing modes which increase private contributions, such as loans and graduate taxes, would in contrast not be useful. Again, the argument pro tax-financed subsidies is conditional, so we look at the empirical evidence.

Evidence. Several studies have aimed to quantify fiscal externalities at the national level. The OECD computes the internal rate of return on public investment in higher education, which is mainly caused by 'fiscal externalities' at the national level. The figures amount to 10.6 percent for men and 8.6 percent for women in OECD countries (OECD, 2015). However, these computations are based on raw differences in earnings by educational attainment and therefore do not take selection issues into account. Moreover, they only refer to average rather than marginal effects. As such—as is also acknowledged in the same report—these figures do not tell us whether countries should, from a purely fiscal revenue point of view, subsidise higher education more or less.

[27] In other words, if the government would jointly set educational subsidies and earnings taxes, then there would not be fiscal externalities (these revenue effects would still be present, but internalized).

Some recent papers have tried to calculate the marginal fiscal externality. Findeisen and Sachs (2014), who further control for several confounding factors including ability, estimate that a one dollar increase in subsidies to higher education in the United States increases future discounted tax revenues by at least 0.7 dollars on average and up to 1.65 dollars if targeted to children of low income parents. Holter (2015) finds that applying the Danish subsidy scheme to the United States would lead to an increase in net tax revenues in a partial equilibrium setting. Lawson (2015) shows that the fiscal externalities of increasing financial aid in the United States are large enough to generate a Pareto improvement.

However, when translating these results into policy recommendations, we have to take general equilibrium effects into account. Increases in financial aid would increase college enrolment and therefore reduce both the (private and fiscal) returns to college. Lawson (2015) conducts a sensitivity test which shows that his results are very sensitive to the presence of general equilibrium effects. Direct evidence from related fields confirm this. Studies using structural models and simulations have shown that changes in tuition, grants or taxation lead to strong increases in enrolment in a partial equilibrium (i.e. short run) setting, but also that these effects are substantially lower once general equilibrium effects are introduced (Heckman et al., 1998a,b; Abbott et al., 2013). It is highly likely that such effects are of comparable importance when considering the tax returns of changes in subsidization.

To the best of our knowledge, there exist no detailed studies that quantify fiscal externalities at the international level. Tuition fees of international students are often higher than of national students, which is partly motivated by the fact that many international students move to outside of the host nation after their studies.[28] However, this solution is not always politically feasible. Within the EU, for example, member states must be charged the same tuition. Coordination agreements may offer a way out. Rizzo and Ehrenberg (2004) report on tuition reciprocity agreements between public colleges in different states in the United States. Such agreements allow non-resident students to enrol at a lower tuition than the normal out-of-state tuition. When the flow of students between states is not balanced, then interstate transfers may

[28] OECD (2011) reports that only around 25% of international students who study in OECD countries stay in the same country afterwards.

occur to compensate.

Implications. At this stage, the empirical evidence for fiscal externalities is limited and restricted to evidence at the national level. Further analysis is especially needed to assess whether the results are different outside of the United States and to identify what remains of fiscal externalities in the long run, including general equilibrium effects. For now, fiscal externalities cannot be used as a strong argument to encourage participation by, e.g., increasing tax-financed subsidies (to needy families). It is more likely that, at the margin, the cost of increasing subsidies is larger than the resulting gain via higher taxes and lower benefits in most countries. If one turns the argument around, reducing tax-financed subsidies will be a revenue gain in most countries, which should be weighted against the higher costs that will accrue to students and their families. For highly regressive countries, this extra cost might receive a relatively lower weight.

5.3 Beyond externalities

There exist other theoretical arguments which could potentially warrant government intervention in higher education. We discuss those that are best supported by current and recent evidence and are most relevant for the policy discussion on the financing of higher education. These failures are: uninsurable risk, credit constraints, and misprediction.[29]

5.3.1 Uninsurable risk

Theory. Students do not know the costs and benefits of higher education for sure. On the cost side, yearly expenses in higher education are generally observable, but study length is partly uncertain. On the benefit side, uncertainty likely is even stronger. Income risks include uncertainty about future wages, employment opportunities, and tax legislation.

Although investment in higher education is risky, so is not investing. Risk will therefore only reduce the investment in higher education if investing is more risky compared to not investing.

[29] Several other potentially relevant failures, such as signalling, social status and peer effects, were already discussed as negative externalities in Section 5.1.

This is not clear a priori: successful investment in higher education can, e.g., lead to a higher wage volatility, but also reduce the risk of unemployment. More importantly, uninsured risk always leads to an inefficiency, irrespective of its impact on participation. For example, if the income risks of graduates and non-graduates were of similar magnitude, then these risks have limited impact on the level of investment in higher education, but students (as well as non-students) would still benefit from insurance provision. To sum up, uninsurable risks may create two plausible inefficiency losses. First, there is always a direct loss of welfare if individuals are risk-averse. Second, there may be an indirect loss of welfare if the actual level of participation does not coincide with the efficient level (if all risks could be insured).

It is important to understand why some risks are difficult to insure in free markets; if not, government intervention is not needed. First, shocks to earnings and unemployment during an economic downturn affect the whole labour market. Thus, a considerable part of income risk has a collective component that is difficult to insure in a private market. Second, insuring against graduation risk could lead to moral hazard and adverse selection if there is asymmetric information between insurers and students. Moral hazard would occur if students exert less effort once they are insured against graduation risk. Adverse selection would occur if students with a high success probability find the insurance premium too high and withdraw from the insurance market. Moral hazard and adverse selection lead to inefficiently low insurance levels in private markets.

The key question is whether governments can do better. Given softer budget constraints, governments are better equipped to provide insurance against collective shocks at the cohort level. Adverse selection and moral hazard, however, are caused by asymmetric information and remain therefore problematic. To deal with adverse selection, a government could make the insurance compulsory. Although compulsory insurance schemes in higher education do not exist, some financing modes offer insurance against certain risks. The different financing modes furthermore have different implications for moral hazard, both during studies and during

working life. We discuss the empirical evidence on each issue. [30]

Evidence on risk. We first focus on the direct effect of uninsurable risk. There is clear evidence that college graduates face substantial income risk. Kahn (2010) and Oreopoulos et al. (2012) both show that graduating from college in a recession has large and persistent negative labour market effects. Moreover, income risk has become a more pressing issue over time. Lochner and Monge-Naranjo (2016, section 2) show that wage uncertainty has risen since the 1980s, both in the United States and in Europe. It is not a priori clear, however, whether (increasing) variances in earnings also reflect (increasing) risk because part of his variation can be predicted by the individual based on private information. In addition, it is also not clear whether individuals, and students in particular, are risk averse. Although exact magnitudes differ across studies, there is clear empirical evidence that a substantial share of the variation in college earnings is not foreseeable (Cunha and Heckman, 2007; Chen, 2008; Mazza et al., 2013), while there is also indicative evidence that students are indeed risk-averse (Belzil and Leonardi, 2007). To sum up, risks are substantial, and given risk aversion, the direct welfare gains from insurance will be substantial too.

Second, we turn to the indirect effect of uninsurable risk via participation. What matters is whether wage uncertainty is larger for college entrants relative to high school graduates. Chen (2008) and Mazza et al. (2013) find that wage uncertainty does not necessarily increase with educational attainment; it is comparatively higher for college graduates compared to high school graduates in the United States, but lower in Germany and the United Kingdom. Other studies have aimed to directly estimate the effect of eliminating uncertainty on participating in higher education, for the United States. Simulations based on structural models by Carneiro et al. (2003) and Navarro and Zhou (2016) indicate that there is an increase in participation by 6 tot 9 percentage points. Belzil and Leonardi (2007), on the other hand, finds that *more* risk averse individuals are more likely to enter higher education (in Italy), although the magnitude of this effect is very small. This result suggests that eliminating uncertainty would not

[30] Our discussion of empirical evidence focuses on risk and moral hazard. Although there are examples of funding schemes (such as the Yale Plan mentioned before) that were abandoned because of adverse selection, hard evidence on this topic is lacking.

increase college attendance in Italy, which contrasts with the previously discusses findings from the United States. This could be related to the earlier result that the risk differences are opposite in the United States compared to Europe, but the different studies also have completely different methodological approaches. Hence, in general, there is no strong evidence that insurance provides indirect efficiency gains through participation.

Another approach is taken by studies that relate risk aversion to schooling decisions. Belzil and Leonardi (2007) find that *more* risk averse individuals are more likely to enter higher education (in Italy), although the magnitude of this effect is very small. This indicates that the *perceived* differences by prospective students in risk between studying and not studying are relatively low (and not higher for college). This result suggests that eliminating uncertainty would not increase college attendance, which contrasts with the previously discusses findings from the United States. This could be related to the earlier result that the risk differences are opposite in the United States compared to Europe, but the different studies also have completely different methodological approaches.

Evidence on moral hazard. The direct welfare gains from insurance could be substantial, but could come at the expense of moral hazard. We first focus on moral hazard during studies. Causal evidence shows that study effort and performance vary with incentives. Rates of delayed graduation reduce substantially when students are financially sanctioned for such delays; see Garibaldi et al. (2012) and Fricke (2013) for evidence from Italy and Switzerland, respectively. The effects are substantial, pointing to increases in on-time graduation by 5 to 10 percentage points for sanctions of around 750 to 1000 euro (without reductions in performance). There is also evidence on improvements in achievement in case of financial rewards, but these tend to be more modest and ambiguous.[31] Additionally, increased insurance through, e.g., taxation can affect the participation decision for higher education. Higher taxes can discourage human capital investment (Trostel, 1993). Direct empirical evidence on the effect of the tax rate and tax progresssivity on enrolment is relatively limited, but suggests a weak relation, especially when general equilibrium effects are taken into account; see, e.g., Heckman et al. (1999).

[31] An overview on the relation between rewards and achievement in higher education provided in Lavecchia et al. (2016).

Moral hazard can occur in the workplace as well. College graduates could exert less effort knowing that they face income-contingent repayments (Nerlove, 1975). A few studies have examined this in the exact context of student debt. Rothstein and Rouse (2011) finds that students take lower-paying jobs when their debt is converted to a grant. In other words, graduates were induced to earn more under the loan. However, there is no evidence on such effects for *income-contingent* loans.[32] Many studies have analyzed the relation between taxation and work effort. The general conclusion in this literature is that the elasticity is low, on average, with respect to labour supply, and modest with respect to taxable income.[33] The evidence further suggests that elasticities are higher for very low income, while elasticity estimates are mixed for very high incomes. Hence, although there is no consensus on the exact size, the large majority of economists would agree that there is a distortion cost of taxation.

Implications. The evidence indicates that insurance will probably not lead to large indirect welfare gains by correcting inefficient participation levels. However, while the relative difference in earnings risk between tertiary and non-tertiary education appears limited, the absolute levels of risk faced by both students and non-students are substantial, and increasing over time. As such, insurance in itself can lead to considerable direct efficiency gains, but will also increase moral hazard. The different financing modes provide different degrees of insurance for both income risk and study risk, and consequentially also differ in their vulnerability to moral hazard.

With respect to risk and moral hazard *during studies* in higher education, a general tax provides the highest insurance to study risk, because students do not carry the risk of study failure or delay (they do carry the opportunity costs, but that applies to all schemes). In all the other modes, students do bear that risk as the costs or repayments depend on study length. Consequently, general taxes are sensitive to moral hazard during the study, while this is not an

[32] The loan that students were taking had subsidied interest rates, but fixed repayments.

[33] See, e.g., Blundell and MaCurdy (1999); Saez et al. (2012) for an overview. See also Keane and Rogerson (2012) for an opposing view, advocating much larger estimates.

issue in the alternative financing modes.[34]

With respect to *risk during working life*, classical loans require repayments irrespective of future earnings and therefore do not insure against income risks (but also do not suffer from moral hazard). General taxes provide more insurance than classical loans, as one pays higher taxes when income is higher. As we have assumed risk-sharing public loans, some insurance is provided by such loans for students who default on their loan. Graduate taxes offer even more insurance for students than general taxes. Recall that the total earnings tax rate for graduates (the graduate tax rate augmented by the general tax rate to finance other revenue requirements) is higher than under a general tax scheme, leading to a more compressed income distribution.[35] Whether general taxes provide more insurance against income risk than ICLs depends on the considered time frame. Overall, the level of insurance offered by ICLs is somewhere in between the limited level offered by classical loans and the more generous level offered by general taxes.[36]

Moral hazard during working life can be an automatic drawback. The general rule is simple: the more insurance is offered, the higher the potential for moral hazard. Graduate taxes are therefore most likely to suffer from moral hazard, followed by general taxes, ICLs and classical loans. The trade-off is exactly opposite for non-students. For them, moral hazard and income insurance are high under a general tax, and low under a graduate tax (as their total tax rate is lower in that case).

[34]The literature on sanctions and rewards referred to before can provide additional policy tools in handling moral hazard in higher education. Sanctions appear more effective then rewards, but are probably more difficult to implement in light of recent student protests. Rewards are relatively more effective when thresholds are set low (high reward requirements have been shown to demotivate low achieving students), but would also be more costly. ICLs and GRTs would also allow for flexibility in this sense, e.g. by letting repayments increase non-linearly with study length.

[35]A related disadvantage of graduate taxes, being uncapped, is what is labeled by Barr (2001) as the Mick-Jagger effect. It refers to the lead singer of the Rolling Stones who briefly studied at LSE and who would therefore have faced massive repayments under a graduate tax, which would be unrelated to either costs or return.

[36]First, when one looks at one period during early working life, students face a higher total earnings tax rate under an ICL scheme (the usual tax rate augmented with the ICL-rate) compared to a general tax scheme. In other words, the income per period of students is better insured under an ICL scheme. Second, when one looks at one period during later working life, the previous argument turns around when the loan is repaid or forgiven. Third, when one looks at the complete life-time, many students will pay back their loan under an ICL-scheme. The ICL-scheme does not offer insurance on this time horizon and therefore general taxes offer more insurance. Admittedly, some students have low life-time earnings such that they will not pay back their loan completely, but figures show that loan forgiveness rate are rather low across the OECD (OECD, 2016).

Two additional points are worth noting. First, we focused on risk in the previous analysis, but benefits in terms of consumption smoothing are connected. Again, the more insurance is offered by a scheme from an ex ante perspective, the more consumption will be smoothed from an ex post perspective (Chapman, 2006). So, graduate taxes will offer most smoothing, followed by general taxes, ICLs, and finally classical loans. Second, if an ICL is risk-pooling rather than risk-sharing, adverse selection may occur. The terminated Yale plan is a typical example. Graduate taxes are not vulnerable to adverse selection no matter whether they are risk-pooling or risk-sharing, because they are compulsory.

To sum up, graduate taxes appear to have especially favourable features with respect to uncertainty. They offer most insurance against income risk and are not sensitive to moral hazard during studies, two issues that are prominent according to the empirical literature. In addition, graduate taxes offer high consumption-smoothing and are not sensitive to adverse selection. We cannot say that graduate taxes are unambiguously optimal however, because more insurance always comes at the expense of more moral hazard during working life. From a broader perspective, both graduate taxes and ICLs allow for more flexibility in dealing with the trade off between risk and moral hazard, as they allow to differentiate repayment on income and study costs.

5.3.2 Credit constraints

Theory. Income risk can lead to default risk, i.e., the risk of not being able to repay a loan that is used to finance higher education. Default rates of students in higher education are substantial, especially in countries and institutions with high tuition fees and high student debt. Three-year default rates (i.e. the share of students facing repayments that default on their loan within three years) reach up to 15 percent in the United States in recent years (Steinerman et al., 2011; Lochner and Monge-Naranjo, 2016). Figures from OECD (2016) on the prevalence of loan forgiveness, although difficult to compare, provide suggestive evidence that repayment issues are less prominent in other OECD countries.

Like income risk, default risk is difficult to insure in a private market. As before, asymmetric

information about the default risk of students may cause adverse selection (low risk students are driven out of the market by high risk students) and moral hazard (students exert less work effort to pay back their loan). In addition, students have little collateral to offer to secure their loan in a non-slave society (Friedman, 1955) and parents are often reluctant to provide security (Mazzeo, 2007).

The lack of insurance may imply that capital markets do not provide sufficient credit.[37] Especially poor, but otherwise talented students will be financially constrained and refrain from participating in higher education (Gross et al., 2009). An inefficiency results: poor and talented students would benefit from higher education, but credit constraints prevent them from participation.[38] It would also hamper equality and intergenerational mobility. The most obvious first-best policy intervention is to provide either security or credit, especially for poor and talented students. However, the necessary information on who is needy and talented is not perfectly available and may hinder implementation. We review the most important empirical evidence on credit constraints and discuss the implications for the different financing modes.

Evidence. Correlations between family income and college attendance in the United States are found to be very strong, and increasing over time. Carneiro and Heckman (2002) show that the difference in college attendance between the top half and the bottom quartile of the household income distribution is around 20 percentage points in the 1980s and 30 percentage points in the 1990s. However, these correlations are not necessarily caused by an inability to pay at the time of enrolment. The literature distinguishes between short-run and long-run constraints. The former refers to a lack of means to finance the costs of higher education at the time of enrolment. The latter refers to a lack of means to make investments earlier in life that improve the child's learning and therefore its future access to higher education.

The available research generally indicates that long-run constraints are dominating. Carneiro and Heckman (2002) compare enrolment rates for those with similar early family circumstances

[37] Lochner and Monge-Naranjo (2011) explain that the cost of defaulting on a student loan can be lower than the cost of paying back the loan. This is especially true for low income individuals because their incomes are often protected against seizure by law. If true, then it can be rational to default on the loan. However, lenders could anticipate losses from rational default and constrain credit.

[38] Lochner and Monge-Naranjo (2016, section 6) discuss the design of optimal credit programs in more detail.

and conclude that at most 8 percent of the population faces short-run credit constraints with respect to college enrolment.[39] Other studies directly estimate the effect of credit constraints on college enrolment, using structural dynamic optimization models. Keane and Wolpin (2001) and Johnson (2013) both find that relaxing financial constraints has little effect on participation in higher education. It mainly affects other margins: students work fewer jobs while in college and consume more.

More recent findings, however, indicate that estimates on the presence of short-run credit constraints are sensitive to the exact context of the study. First, constraints appear twice as high in the early 2000's compared to the 1980's in the United States (Belley and Lochner, 2007), and also double for the combined effect of income and wealth compared to the effect of income alone (Lochner and Monge-Naranjo, 2011). Winter (2014) shows that the increase in constraints over time is not caused by tighter borrowing constraints: increased earnings risk has made low- and middle-income parents less inclined to fund the college participation of their children.[40] Hence, credit constraints in the United States currently appear more pressing than earlier research has suggested, although it is still dominated by long-run constraints. At the same time, credit constraints are likely to be substantially lower across Europe, given the much lower private contributions. Chowdry et al. (2013) find that enrolment gaps (controlled for achievement) between rich and poor families equal 1.0 percentage points for males and 2.1 percentage points for females in the United Kingdom, hence markedly smaller than what is found for the Unites States in the same period. The cohort studied by Chowdry et al. (2013) was eligible for higher education just before tuition increased in the United Kingdom from 2006 onwards, hence private contributions were still very low, which likely explains the difference. These results also indicate that credit constraints could become a more pressing issue if tuition increases, which are common practice across OECD countries in recent years, are not accompanied by complementary policies.

Finally, recent studies have analyzed the participation effects of the joint introduction of

[39]They look at differences in enrolment rates controlled for maternal ability. It is assumed that maternal ability captures variation in long-run constraints, such as early family circumstances.

[40]This also suggests that there might be intergenerational benefits from increased insurance against income risk.

ICLs with higher tuition fees. Although these policy changes increased the average costs for students, the participation rates of students from low income families in Australia and the United Kingdom have not decreased (Blanden and Machin, 2008; Dearden et al., 2011; Chapman and Ryan, 2005).[41] Hence, the claim that ICLs do not limit access for those that are credit constrained compared to alternative schemes with lower private contributions is corroborated by the empirics. In fact, participation rates in Australia were not negatively affected by the ICLs across population groups. Chapman and Ryan (2005) show that, despite the cost increase, the decrease in the internal rate of return is only small under the new ICL scheme in Australia. This confirms our earlier results that the direct costs are not a big driver of the return to higher education. Hence, there are still very large incentives to invest in higher education under these schemes.

Implications. A modest share of students is credit constraint in the short run, mainly when private contributions are high. Tax-financed grants targeted towards needy and talented students can alleviate short-term credit constraints, which could improve both efficiency and equity compared to a system with laissez-faire and classical loans. However, other policies—securing private loans, providing (income-contingent) public loans, or using graduate taxes— will have similar effects.

For addressing long-run credit constraints, additional policy tools are necessary, independent of the financing mode. A promising approach would be to invest in the early life circumstances of the disadvantaged. Evidence by Heckman and Masterov (2007); Cunha et al. (2006) and others has shown that such investments at younger ages are very effective in promoting school achievement and college attendance. From a long-run perspective, such policies are likely to be much more effective in raising the educational attainment of the disadvantaged than targeted grants at the time of enrolment.

[41] The UK reform also involved considerable increases in support for those from low income families. In fact, Chowdry et al. (2012) finds that lifetime repayments are lower for the poorest 29 percent under the new system. Hence, the UK reform is not that informative on the participation effects of the poor when increasing private contributions through an ICL. The studies on the Australian reform are, however.

5.3.3 Misprediction & psychological mechanisms

Theory. We implicitly assumed up to now that individuals behave like a homo economicus, a decision-maker that rationally weighs the costs and benefits of each action before choosing the best one. Over the past decades, a flourishing literature in behavioural economics has analysed how individuals make decisions in real-world settings; see, e.g., Rabin (1998, 2002) and DellaVigna (2009) for an overview. It shows that the rational homo economicus is often not a good model for decision-making. The investment decision in higher education made by students and their parents is no exception.[42] The evidence below indicates that mispredictions occur. Students tend to overestimate the costs and underestimate the benefits of higher education. Too little investment in higher education results from an efficiency point of view. Again, a possible reason for encouraging investment through tax-financed subsidies emerges.

First of all, there is clear evidence for misprediction. Students tend to overestimate the costs of higher education, especially for public education (Horn et al., 2003). Grodsky and Jones (2007) identify that Canadian parents overestimate the true yearly tuition fee by 75 percent on average. In contrast, benefits are more likely to be underestimated (Usher, 2005). Students are also largely unaware of financial aid, and this is especially true for those who are eligible (Chan and Cochrane, 2008). They often assume incorrectly that their family income is too high or that good grades are required to be eligible (Matus-Grossman and Gooden, 2002; Zarate and Pachon, 2006). Furthermore, there is evidence that misprediction disproportionally affects disadvantaged students (Grodsky and Jones, 2007).

What are the underlying reasons for misprediction? First, misprediction could simply be a matter of wrong information or a lack of information. Yet, even if all information is available, bounded rationality may still cause too little investment in higher education.[43] Second, deeper psychological reasons could also underly misprediction. We discuss two deviations from standard economic theory as described by DellaVigna (2009): non-standard preferences and non-

[42] For reviews of behavioural economics in an educational context, see Jabbar (2011) for higher education and Levitt et al. (2016) and Lavecchia et al. (2016) for education in general.

[43] It is often hard to distinguish between bounded rationality and other potential explanations. Incomplete take-up could also be explained by rational decision-making with costly information.

standard decision-making. In order to design appropriate policies to counteract misprediction, it is crucial to understand the underlying mechanism. Yet, we stress that policy intervention in case of behavioural failures is hotly debated, as it raises issues of paternalism, especially if individuals identify themselves with their irrational choices. In addition, behavioural mistakes are far from universal. For this reason, it seems wise to use policies that try to remove irrational choices, while safeguarding as much as possible the choices made by rational individuals; see Camerer et al. (2003) for a defense of asymmetric paternalism.

Information and complexity. If misprediction is a matter of wrong information or a lack of information, then the appropriate policy follows immediately: provide the correct information. However, information provision and updating alone does not seem to be effective for most students. Information on tuition costs and financial aid has been shown to have no effect on enrolment patterns,[44] and the same applies to providing information on the labour market prospects of higher education graduates.[45] At the same time, these studies all point to small positive effects for disadvantaged students.

The complexity of application procedures, in combination with bounded rationality, may explain why providing information only is not sufficient. One possible policy intervention is therefore to simplify the application procedure. Although there is no direct evidence that program simplification would increase take-up, Deming and Dynarski (2009) and Dynarski and Scott-Clayton (2013) both conclude their review stating that more complex aid programs are less effective. There is direct evidence on the effectiveness of other policy interventions in increasing college enrolment. Bettinger et al. (2012) show that providing information in combination with direct help in completing the application procedure, had a positive and persistent impact. Hoxby and Turner (2013) show that sending information in combination with a "no-paperwork" application fee waiver to high-achieving low income students in the United States leads to more applications, admissions, and enrolment, especially at more selective colleges.

Non-standard preferences. Non-standard time preferences, e.g., a preference for imme-

[44] See Bettinger et al. (2012); Carrell and Sacerdote (2013) for evidence for the United States

[45] See Kerr et al. (2015); Hastings et al. (2016); Bonilla et al. (2016) for evidence for Finland, Chile, and Columbia, respectively.

diate over delayed utility, is another possible explanation for misprediction. Frederick et al. (2002) review the evidence, which is often elicited from students in higher education.[46] Empirical research shows that discount rates decline over time. In addition, benefits are discounted more than costs. Thus, overweighting the current costs and underweighting the future benefits can irrationally reduce investment in higher education. Relatedly, Dynarski (2003) indicates that grant programs with higher aid in the first year of college are more effective in inducing students to enrol.[47] A study by Cohodes and Goodman (2014) shows that providing tuition waivers for (relatively low-quality) public colleges to high-ability students led to very large increases enrolment at these colleges at the cost of college quality. As the predicted returns to college quality would have been substantially larger than the cost reduction in tuition, it appears that students indeed strongly underweight future benefits relative to current costs. In relation to the different forms of financing, it can therefore matter greatly whether costs are paid upfront or postponed to the future. Hyperbolic discounting could also further explain the earlier discussed results on the effect of the joint introduction of ICLs and higher private contributions in Australia (Chapman and Ryan, 2005). The fact that participation did not respond to the increase in costs could occur because these postponed costs are not incorporated in the participation decision by myopic students (recall that the decrease in the internal rate of return was small, but not negligible).

Non-standard decision-making. Students might also not be fully rational in their decision process. The framing of different choice options can matter, even if the choices are otherwise equivalent. A combination of high tuition and high grants can be made financially equivalent to a combination of low tuition and low grants. But if tuition (the sticker price) is a more salient feature, then too much weight is put on tuition relative to grants, and the second combination leads to more investment in higher education. The evidence on framing effects in higher education is mixed, however. For the United States, Heller (1997) finds some evidence that enrolment appears to be more sensitive to changes in tuition than to changes in financial aid, but there are many contradictory findings. For Europe, a review by Falch and Oosterbeek (2011) concludes

[46] See also Rubinstein (2003) for a critique.

[47] This could also be explained by the fact that costs tend to be higher in the first year of college.

that aid and tuition have similar elasticities. One plausible reason for the difference, also in light of the previous evidence, is that aid is more universal and less complex in Europe compared to the United States. There is also evidence that especially students with lower cognitive ability and students from lower income families are sensitive to framing (Heller, 1997; Peters et al., 2006). This is suggestive evidence that framing could be (partly) the result of bounded rationality.

Apart from responding differently to changes in tuition versus grants, students can also have deviating responses to loans because of loan aversion. Loan aversion implies that credit take-up by students is lower if credit is explicitly labelled as a loan. Experimental studies in hypothetical settings show that students are indeed less likely to choose contracts that are labeled as 'debt' or 'loan' compared to financially equivalent contracts with other labels (Caetano et al., 2011; Johnson and Montmarquette, 2011). However, evidence outside of lab environments is less conclusive. The earlier mentioned review by Heller (1997) shows that studies that compare elasticities of subsidized loans to those of grants and tuition are often contradictory. A more recent study by Field (2009) finds, using a real-life experiment for NYU law students, that students are considerably less likely to enrol under an income-contingent loan scheme versus a financially equivalent tuition scheme. Dearden et al. (2011) directly uses the recent introduction of the income-contingent loan system in the United Kingdom (which also involved changes in tuition and grants) to assess elasticities. They find a comparable elasticity for grants versus loans and a slightly higher elasticity to tuition. Hence, although the empirical evidence is inconsistent, there are some indications that debt aversion can influence enrolment decisions.[48]

Implications. Research on misprediction and complexity indicates that there is a trade-off between the targeting of financial aid and lack of take-up by those who are eligible. Although certain policy interventions appear effective, they would also be costly when administered on a large scale. This provides an argument against financing schemes that rely on a combination of high tuition and high targeted grants. This is underlined by the evidence in the previous section

[48]The relatively higher responses in the lab studies could occur because students act more rational with respect to real-life decisions that they have time to reflect on. The comparatively higher sensitivity in Field (2009) compared to, e.g., Dearden et al. (2011) could occur because the NYU students could more easily attend other schools that would not require loans, which could lead even small aversions to debt to have large responses in enrolment.

that other financing schemes such as ICLs and GRTs are at least as effective in addressing the short-run credit constraints of low-income students.

There also exist deeper psychological explanations for misprediction. Admittedly, these mechanisms have not always been tested in the specific context of higher education, which would be an interesting avenue for future research. Nevertheless, many experimental results are based on student responses and it seems therefore not too far-fetched to take these behavioural failures into account in the financing of higher education. Given the long-term nature of investment decisions in education, hyperbolic discounting is likely to be a crucial behavioural failure in this context. Postponing a larger share of the upfront costs of higher education to a later date can be effective for students with non-standard time preferences, while causing relatively little harm to rational students.

Hyperbolic discounting could justify financial encouragement of irrational students, so classical loans are not useful. Tax-financed subsidies could be used, but they will affect irrational and rational students alike. As such, potential efficiency gains from encouraging irrational students would coincide with efficiency losses for rational students because they are subsidied too much. Given that misprediction appears to be higher among the disadvantaged, providing targeted grants might fare better. However, again, complexity might limit the effectiveness of such an approach. Income-contingent loans and graduate taxes provide an alternative. As they postpone upfront tuition costs to later, irrational students—who underestimate these future costs—will be encouraged to participate, while rational students will internalize these future costs and are therefore not affected. Although the evidence on loan aversion is mixed and such effects appear unlikely to be very large, loan aversion be a reason to prefer graduate taxes over income-contingent loans in dealing with the behavioral failures.

6 Conclusion

This paper has reviewed the economics of financing higher education. We have established that the private incentives to invest in higher education are high, also in countries where public

investment in higher education is relatively low (Section 3). Because the social, rather than the private return must guide policy, we further analyzed the equity and efficiency implications of financing higher education. We show that subsidizing higher education can be regressive, depending on the country and the generational perspective (Section 4) and have scrutinized the different arguments for government intervention in the market for higher education (Section 5).

In this final section, we relate the financing modes discussed in Section 2 to the regressivity implications presented in Section 4 and to the main failures identified in Section 5. The previous discussion has highlighted that externalities in higher education as a potential justification for tax-financed subsidies are not convincing. In addition, to deal with the more credible failures in higher education (uninsurable risk, credit constraints, and misprediction), tax-financed subsidies are blunt instruments. Shifting towards income-contingent loans or graduate taxes seems more appropriate from both an efficiency and equity point of view. The exact pros and cons of introducing these policy instruments are heavily dependent on current financing approaches, however. As we have seen in Section 2 to Section 4, these differ substantially across the OECD.

On the basis of the analysis in Section 4 on the regressivity of subsidies in higher education, we can distinguish two broad groups of OECD countries. Some countries are regressive in both the parental and student view, while other countries are also regressive in the student view, but progressive in the parental view.

Among the first group, the Scandinavian countries are the most prominent example. These countries provide almost full subsidization through general taxes, and are highly regressive in both the student and the parental view. Shifting towards income-contingent loans and graduate taxes would therefore provide several benefits. Such a shift would still provide insurance and consumption-smoothing for students (even more so in case of graduate taxes), and reduce both the regressivity of the system and moral hazard during studies. Moreover, suboptimal choices of irrational students caused by hyperbolic discounting would be corrected, without distorting the choices of rational students. The choice between ICL and GRT is a more subtle one. Given the centrality of taxation in this group of countries, graduate taxes could be more appropriate.

Among the second group of countries, of which the United States is the most prominent

example, private contributions are high (Canada, Israel, Japan and Korea can also be considered to be part of this group). On the one hand, because tax contributions of the higher educated are very high in the parental view, introducing ICLs or GRTs would actually increase regressivity (although not in the student view). It should be noted, however, that it is largely a political question whether less progressivity is a disadvantage in this case, as 'neutral' financing can also be the desired outcome. On the other hand, introducing these instruments in these countries would avoid the adverse efficiency and equity effects of both credit constraints and hyperbolic discounting, by postponing upfront costs. Moreover, research shows that attempts in some of these countries to counteract high tuitions by high grants is often not effective, partly because of complexity. Finally, evidence from the United States shows that income risk is comparatively high and also increasing in recent years. As such, the benefits of income-contingent loans and (especially) graduate taxes in terms of insurance and consumption-smoothing are likely to be large as well, although they may come at the cost of moral hazard. To sum up, a shift towards ICLs or GRTs in the second group of countries may reduce progressivity (in the parental view), but also leads to a wide range of benefits. If these efficiency gains are judged more important than the equity cost, then the choice between ICL and GRT pops up again. Given the centrality of loans in this group of countries, income-contingent loans seem closer to the current practice.

Outside of these broad two groups, other countries provide a more ambiguous picture, but the same general principles apply. A country such as Ireland is progressive in the parental view without large upfront costs. Hence, the advantages towards credit constraints and hyperbolic discounting would likely be smaller (but could still exist; concrete evidence on credit constraints in 'medium tuition countries' is still lacking). Such countries have to weigh progressivity considerations (including their perceived relevance of the parental versus the student view) against the trade-off in terms of risk and moral hazard of these different schemes. Additionally, most Eastern European countries also have relatively high public funding and are regressive, but less to than the Scandinavian countries, so the trade-offs are also comparatively more nuanced in these countries.

To be clear, the message is not that ICLs and GRTs are always optimal financing tools.

Higher insurance comes at the cost of higher moral hazard, and vice versa. The key question is to find a reasonable balance and ICLs and GRTs can contribute to fine-tuning this balance. Additionally, postponed repayment can be complicated when students are internationally mobile.[49] International agreements between countries could guarantee that these systems function optimally and that there is enough public support for their implementation. Nonetheless, our discussion of the pros and cons of the different financing modes has indicated that there are several reasons for countries to adopt such schemes, and this is especially true for countries with either very high or very low shares of public subsidization of higher education.

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[49] Note that this is problematic in all financing modes, although loans, being contractual arrangement, may have some advantages here.

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Appendix

Private costs

We compute the private costs on the basis of the following data:

- **The average direct private expenditures** per year of higher education (spent towards educational institutions) are assumed to be the same for both types of parents (because of data limitations). We compute it as the product of two factors: the annual expenditure per student (Table B1.2 in OECD (2016); exclusive of R&D costs) and the share of household expenditure in tertiary education (Table B3.1b in OECD (2016)).

- **The net opportunity costs** per year of higher education are based on extrapolated average earnings of those aged 20. To extrapolate age-earnings profiles, we rely on Eurostat, as they offer average earnings across a wide range of age categories. We fit the age-earnings profile using data for all available OECD countries in Eurostat and specifying a logarithmic function (which provides the best fit). We predict age 20 earnings and calculate the ratio of average age 20 earnings to total average earnings for the sample as a whole (we take the sample average since we only have European OECD countries available, but the ratio's are remarkably consistent across countries). We apply this ratio to calculate the age 20 earnings from the average earnings reported by country by the OECD. We use the OECD tax-benefit calculator to subsequently calculate net opportunity costs (using singles without children as family type). Finally, we incorporate the probability of employment by multiplying the net opportunity costs with the probability of not being unemployed, retrieved from Table A5.2 from OECD (2016), and by adding the product of the probability of unemployment and the replacement wage (retrieved from OECD Benefits and Wage Statistics). In other words, the expected net opportunity cost is equal to $(1-p)(y-t)+p\rho(y-t)$, with p the probability of unemployment (for the medium-skilled), $y-t$ the net opportunity cost and ρ the net replacement rate.

Private benefits

We calculate the private benefits by first comparing the gross earnings of those with higher education with those with post-secondary non-tertiary education:

- The gross earnings are computed by combining two data sources: the low- to high-skilled and the medium- to high-skilled gross earnings ratios for the 25-64 age cohort (reported in Table A6.1 in OECD (2015)) and the average gross earnings for the 25-64 age cohort (reported via OECD stats based on the Labour Force Survey). Combined with the numbers of individuals in each group (n_L, n_M, and n_H) we obtain three equations and three unknowns which allow us to solve for the gross earnings in each group (of which we only use y_M, and y_H here).

We then split the gross private benefit into a net benefit and an extra tax payment:

- The earnings tax amounts (consisting of both income tax and social contributions) are computed by applying the online OECD tax and benefits calculator to the gross earnings of the medium-skilled and the high-skilled. As taxes depend on family situation, we calculate a weighted average of the four possible family forms the OECD reports data on (single without children, single with two children, married without children and married with two children).[50] Data on the weights for the four family forms are retrieved from the OECD family database, Table SF1.1.A.

Internal rate of return

The internal rate of return is the return that balances the net present value of (expected) net income streams with and without a degree in higher education. We use E as a prefix to denote expectations: the expected gross income is equal to $Ey_i = (1 - p_i)y_i$ and the expected net tax (taxes minus benefits) becomes $Ent_i = (1 - p_i)t_i - p_i\rho(y_i - t_i)$. The difference $Ey_i - Ent_i$ is

[50] In the two 'married' cases, taxes depend on the income of the partner. The OECD calculator allows four options for the wage of the partner relative to the average wage: 0%, 67%, 100% and 167%. We take the average over two opposite cases: 'random sorting' (the partner always earns the average wage) and 'perfect sorting' (the partner earns 67% for low educated, 100% for medium educated and 167% for high educated).

the expected net income. Using continuous discounting (with d study duration), the net present value with a degree is equal to

$$NPV_H = \frac{1 - exp(-rd)}{r}(-adpe) + \frac{exp(-rd)}{r}(Ey_H - Ent_H),$$

with $adpe$ the average direct private expenditures as described before. The net present value without a degree is equal to

$$NPV_M = \frac{1 - exp(-rd)}{r}(Enoc) + \frac{exp(-rd)}{r}(Ey_M - Ent_M),$$

with $Enoc$ the expected net opportunity cost as described before. Equating these net present values, we obtain

$$\frac{exp(-rd)}{r}((Ey_H - Ent_H) - (Ey_M - Ent_M)) = \frac{1 - exp(-rd)}{r}(adpe + Enoc).$$

In other words, the internal rate of return ensures that the expected gain in net income of a degree (the left-hand side) is equal to the total cost of a degree (the right-hand side). Solving for r leads to

$$r = \frac{1}{d} ln \left[\frac{(Ey_H - Ent_H) - (Ey_M - Ent_M) + (adpe + Enoc)}{adpe + Enoc} \right].$$

It is easy to verify that the internal rate of return decreases with study duration d, increases with the expected net income gain ($(Ey_H - Ent_H) - (Ey_M - Ent_M)$), and decreases with the (expected) costs ($adpe + Enoc$).[51]

- Study duration is retrieved from Table B1.3a in OECD (2014); 'average duration of tertiary studies in 2011 (in years)', for all tertiary education. For countries with missing information, we use the data from Table C1.6 ('Expected years in education'). Because these figures are naturally lower, we multiply figures for these countries with the ratio of

[51] The latter being true if, e.g., the expected net income gain is positive, which is usually true.

the average duration from Table B1.3a to the average expected years from Table C1.6, calculated across the OECD as a whole.

Net fiscal costs in the parental view

In the parental view, the cohort of parents bears the direct and net fiscal costs of the cohort of recent graduates. We approximate the cohort of recent graduates by the 25-34 age cohort and the cohort of their parents as the 45-54 age cohort when we calculate the absolute sizes of each group (but look at *lifetime* income to calculate fiscal cost shares *in both cases*).

We classify parents in two groups according to education level. We follow the OECD classification, which is based on the highest degree obtained. The low-skilled (group L in the main text) are those without a tertiary degree. In OECD terminology they are the low-skilled (below upper secondary education) and medium-skilled (upper secondary or post-secondary non-tertiary education) together and we will therefore refer to this group as LM in the appendix. The high-skilled (group H) are those with a tertiary degree.

Equations (1) and (2) allow to compute the fiscal costs as

$$c_{LM} = t_{LM}\frac{n_{LM}s_{LM}q_{LM} + n_H s_H q_H}{n_{LM}t_{LM} + n_H t_H}, \tag{3}$$

and

$$c_H = t_H\frac{n_{LM}s_{LM}q_{LM} + n_H s_H q_H}{n_{LM}t_{LM} + n_H t_H}. \tag{4}$$

The net fiscal costs for each type ($c_i - s_i q_i$, $i = LM, H$) follow immediately.

We compute the net fiscal costs on the basis of the following data:

- The number of individuals per type ($n_{LM} = n_L + n_M$ and n_H) is obtained from the shares of low-, medium-, and high-skilled adults in the 45-54 age cohort multiplied by the number of adults in this age cohort. Table A1.3 in OECD (2016) reports the shares per age cohort and per country. Table S.6 in of Economic and Affairs (2015) reports the total number of adults per age cohort and per country.

- The average number of children with a bachelor degree per parent of either type (q_{LM} and q_H) is the product of two factors. We write $q_i = \pi_i b_i$ for each type, with π_i the probability that a child of an i-skilled parent obtains a bachelor degree in tertiary education and b_i the birth rate (the average number of children of an i-skilled parent). The conditional probabilities (π_{LM} and π_H) are reported per country in Table A4.3 of OECD (2016a).[52] The birth rates (b_{LM} and b_H) are assumed to be the same for both groups (because of data limitations). We will come back to its computation later on.

- The public subsidy for a bachelor degree (s_{LM} and s_H) is assumed to be the same for both types (because of data limitations). Table B4.1 in OECD (2016) reports the total public expenditure on higher education, in % of GDP (we use the figures exclusive of R&D).[53] We convert these numbers to average expenditure per student, by using the ratio of the numbers provided in Table B1.1 (annual expenditure per student by educational institutions) and Table B2.1 (expenditure on educational institutions as a % of GDP) to calculate a 'conversion factor' for each country.

- The earnings tax amounts (t_{LM} and t_H) are computed by applying the online OECD tax and benefits calculator to the gross earnings of each type (calculated as described before). We look at income taxes here, as we assume that public spending on higher education is funded from this source. We again weigh taxes by family situation as explained before. For the low-skilled, we compute the average tax amount, i.e., $t_{LM} = (n_L t_L + n_M t_M)/(n_L + n_M)$.

Net fiscal costs in the student view

In the student view, the cohort of recent graduates itself bears the direct and net fiscal costs. As mentioned before, we approximate the cohort of recent graduates by the 25-34 age cohort when determining the absolute sizes of each group, but look at *lifetime* earnings (average earnings of

[52] This table reports conditional probabilities according to the highest education level of one of the parents of a family.

[53] For countries that only report this spending inclusive of R&D, we correct these numbers based on the ratio of R&D spending to total spending based on Table B1.2.

those aged 25-64). Again, we follow the OECD classification to split up this cohort into low-skilled (again referred to as LM following the OECD classification) and high-skilled (H). The net fiscal costs are again calculated on the basis of equations (1) and (2), but now based on the following data:

- The number of individuals per type ($n_{LM} = n_L + n_M$ and n_H) is based on the shares of low-, medium- and high-skilled adults in the 25-34 age cohort multiplied by the number of adults in this age cohort. Table A1.3 in OECD (2016) reports these shares per age cohort and per country. Table S.6 in of Economic and Affairs (2015) reports the total number of adults per age cohort and per country.

- The public subsidy per bachelor degree (s_{LM} and s_H) is assumed to be the same for both types (because of data limitations) and has been defined before.

- The earnings tax amounts (t_{LM} and t_H) are computed as before.

Linking the parental and student view

To make our results comparable, we impose that the total subsidy cost of higher education is the same in both approaches. To distinguish between the parental and student view, we introduce a superscript P and S where needed. Using the previous definitions and assumptions, we impose

$$n_{LM}^P s \pi_{LM} b + n_H^P s \pi_H b = n_H^S s,$$

and the birth rate that we use in the parental approach must therefore be equal to

$$b = \frac{n_H^S}{n_{LM}^P \pi_{LM} + n_H^P \pi_H}.$$

Overview of the data

Tables A1 and A2 summarise all the data.

Table A1: Data on population, education, income and taxation

	n_{LM}^{PV}	n_{H}^{PV}	n_{SV}^{LM}	n_{H}^{SV}	π_{LM}	π_{H}	b	q_{LM}	q_{H}	y_{LM}/y_{H}	t_{LM}/t_{H}
Australia	1902863	1174137	1743386	1639614	0,337	0,693	1,127	0,380	0,781	0,697	0,578
Austria	995252	376168	684422	430759	0,156	0,404	1,401	0,219	0,567	0,622	0,449
Belgium	1057485	563636	820651	622742	0,351	0,729	0,796	0,280	0,569	0,667	0,544
Canada	2489726	2894809	1983145	2875459	0,495	0,747	0,847	0,419	0,618	0,710	0,503
Chile	1991825	406510	1936376	726132	0,234	0,630	1,005	0,235	0,751	0,345	0,000
Czech Rep.	1074529	268204	1036567	465928	0,158	0,671	1,332	0,211	0,839	0,557	0,367
Denmark	531936	271885	362545	290396	0,348	0,581	0,846	0,295	0,568	0,721	0,662
Estonia	114177	64295	111501	75922	0,384	0,673	0,871	0,335	0,506	0,756	0,713
Finland	412127	331873	409783	279217	0,457	0,762	0,633	0,289	0,426	0,727	0,641
France	6352492	2297137	4336652	3509124	0,351	0,568	0,993	0,348	0,757	0,619	0,453
Germany	9957551	3605053	7033644	2955719	0,234	0,681	0,617	0,145	0,351	0,574	0,399
Ireland	376539	218661	339571	367929	0,383	0,758	1,188	0,455	0,844	0,538	0,278
Israel	420017	387507	619507	525562	0,434	0,650	1,211	0,525	0,918	0,605	0,306
Italy	8078754	1264526	5442500	1828706	0,194	0,752	0,727	0,141	0,472	0,621	0,442
Japan	8508912	7631088	5848024	8643976	0,415	0,819	0,884	0,367	0,664	0,637	0,479
Korea	5449499	2951422	2285597	5080349	0,562	0,627	1,034	0,581	0,847	0,650	0,357
Netherlands	1747564	785276	1119262	918995	0,352	0,700	0,789	0,278	0,495	0,599	0,292
New Zealand	435443	190217	334268	214312	0,464	0,638	0,662	0,308	0,464	0,696	0,549
Norway	420719	271281	350064	324936	0,355	0,794	0,891	0,316	0,568	0,725	0,605
Poland	4168878	1004876	3612863	2747113	0,324	0,650	1,371	0,444	1,089	0,614	0,487
Slovak Rep.	613692	114413	595522	271486	0,198	0,602	1,426	0,282	0,927	0,570	0,429
Slovenia	230640	78406	173454	119338	0,297	0,686	0,976	0,290	0,588	0,559	0,346
Spain	4824932	2162483	3772475	2617194	0,346	0,531	0,930	0,321	0,638	0,551	0,380
Sweden	842039	439961	657562	569438	0,309	0,731	0,979	0,302	0,519	0,762	0,663
Turkey	7912459	924721	9287633	3525979	0,181	0,622	1,757	0,318	1,286	0,406	0,265
Untd Kingdom	5419708	3534699	5419708	3534699	0,366	0,715	0,783	0,287	0,600	0,542	0,381
Untd States	24647302	19198548	22945084	19957126	0,295	0,766	0,908	0,268	0,564	0,545	0,381

Table A2: Data on costs of higher education

	Direct cost/y	*Opp. cost/y*	*Pub. exp/y*	# *yrs*	*s*
Australia	4709	24930	7793	3,86	30056
Austria	320	19776	12880	5,34	68777
Belgium	511	18095	12066	2,99	36076
Canada	3669	23298	7306	3,52	25686
Chile	3778	11112	3499	5,48	19165
Czech Rep.	631	11518	4438	4,10	18198
Denmark	0	21285	9799	5,20	50957
Estonia	1327	10182	4386	4,42	19406
Finland	0	18127	14164	4,74	67138
France	1199	17381	9144	4,02	36759
Germany	920	17810	12460	4,19	52206
Ireland	1961	22689	10522	3,24	34093
Israel	3582	14962	6089	2,71	16480
Italy	1884	15015	5723	4,04	23106
Japan	6318	17192	6178	4,46	27561
Korea	3316	18050	2900	3,43	9947
Netherlands	1890	20442	12578	5,26	66163
New Zealand	3839	19421	11483	3,37	38689
Norway	405	23195	23361	3,39	79186
Poland	1298	10102	6685	3,29	21974
Slovak Rep.	945	10071	6396	3,82	24432
Slovenia	1029	13944	9808	3,21	31467
Spain	2519	15070	6552	4,66	30533
Sweden	58	19121	17524	4,51	79032
Turkey	1093	9551	8052	2,65	21372
Untd Kingdom	4039	20276	16263	2,74	44560
Untd States	11556	26735	12223	3,17	38748

Data links

Population statistics: http://stats.oecd.org/Index.aspx?DatasetCode=POP_FIVE_HIST

Population by education: https://stats.oecd.org/Index.aspx?DataSetCode=EAG_NEAC

Family composition: http://www.oecd.org/els/family/SF_1_1_Family_size_and_composition.xlsx

Total public expenditure on higher education: http://dx.doi.org/10.1787/888933397862

Average duration of tertiary studies: http://dx.doi.org/10.1787/888933116965

Public and private shares in total expenditure: http://dx.doi.org/10.1787/888933397770

Intergenerational mobility in education: http://dx.doi.org/10.1787/888933396875

Relative earnings: http://dx.doi.org/10.1787/888933285052

OECD tax calculator: http://www.oecd.org/els/soc/benefitsandwagestax-benefitcalculator.htm

Eurostat data on earnings by age: http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=earn_ses14_28&lang=en

Unemployment rates by educational attainment: http://dx.doi.org/10.1787/888933396971

Replacement ratios for unemployment benefits: http://www.oecd.org/els/soc/benefits-and-wages.htm