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Student and Graduate Migration and its Effect on the Financing of Higher Education

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Student and Graduate Migration and its Effect on the Financing of Higher Education

Abstract

The number of tertiary students enrolled outside their home country has almost doubled in the last decade. In higher education systems that are partly tax-funded, a country's labor force might not be willing to subsidize the education of foreign students who can be expected to work abroad after graduation with high probability. This paper analyzes whether and how student mobility affects the governmental decision about the financial regime of higher education based on aggregated data of 22 OECD countries for the period 2000 to 2010. We find a small but significant positive correlation. Supported by robustness checks, this points into the direction that the larger the share of foreign students among all students in a country, the more a country shifts to private-based funding. We also study other possible determinants. Among others we find that the private financing share of higher education funding depends on a country's tax revenue, its GDP and the share of students enrolled in private universities.

JEL-Code: H520, F220, I220, I280.

Keywords: Higher education, education expenditures, immigration, international student mobility.

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1 Introduction

In all OECD countries higher education is financed by a mix of public contributions (i.e. income taxes levied on labor income) and private contributions (i.e. tuition fees paid by students). Often the public share clearly dominates. However, within the last two decades almost half of the countries have introduced or increased tuition fees. In the same period international student mobility rose rapidly. Whereas in 1990 1.3 million students were enrolled outside their country of citizenship worldwide, this number was 60% higher in 2000 and increased more than threefold until 2010 when more than 4.1 million students were internationally mobile (OECD 2013). The aim of this paper is, first, to investigate whether and how the mobility of students and graduates affects governmental decisions about the financial regime of higher education and, second, to study other possible determinants of this choice.

In tertiary education systems that are partly publicly funded, there are two possible causal relationships between student mobility and the financing of higher education. First it may be that students react to the institutional framework of higher education. It is likely that the migration decision of students is affected by cost considerations. Students take the extent of private contributions, i.e. tuition fees, into account. While comparably high public contributions may attract students from abroad, high tuition fees can prevent young people from studying in a foreign country. There is some empirical evidence in favor of this hypothesis even though the results are not fully clear-cut (e.g. Beine et al. 2014; Dwenger et al. 2012, Bruckmeier et al. 2013).

This motivates us to analyze whether the second causal link – namely that student mobility induces changes in governmental policies – may (additionally) exist. This relationship is built on the following theoretical ideas: In tertiary education systems that are partly publicly funded, the country that provides or “produces” human capital has to pay for higher education by levying income taxes on the labor force. Hence, the production principle applies (Gérard 2007). If students of one (home) country obtain tertiary education in another (host) country the labor force of the host country partly bears their education costs. Very likely not all students will later pay for their education (via taxes) especially if they leave the country after graduation. One country then free rides on the education system of another country. If there is a considerably large share of (domestic or foreign) students that move abroad after graduation, this places a heavy financial burden on their

former host country. Consequently, one may expect that different mobility patterns of students and graduates affect the financing structure of higher education. Increasing student mobility and a comparably low stay rate may force a government to shift the financing more towards private contributions if it aims at a sustainable financing system of tertiary education (Demange et al. 2014).

Additionally this idea is motivated by the current political debate on whether and how to react to the considerably large inflow of foreign students in some OECD countries. As governments cannot be sure that all foreign students will stay in the host country after graduation, a possible way to reduce the costs of their education could be to impose fees on foreign students. However, this is not an option for all host countries. EU-countries cannot charge different fees from domestic students and foreign EU-citizen students as this violates the non-discrimination principle. But there are no such restrictions with respect to students from non-EU countries. Within the last decade more and more EU countries decided to charge (higher) tuition fees from foreign non-EU students. E.g. Denmark and Ireland charge no tuition fees for domestic students but up to 16.000 Euro and 36.000 Euro per year, respectively, from non-EU foreigners (OECD 2012). Similarly in 2012, the Finish parliament agreed to increase tuition fees for non-EU students on the grounds that Finish taxpayers are not willing to educate workers for the non-EU Anglo-Saxon countries' economies. By contrast the law's opponents argued that being able to attract international students is an advantage since Finland is such a small country (European Commission 2012a). On the contrary, Germany and France do not react to the inflow by demanding a larger private contribution from those students they can discriminate against. As the anecdotal evidence is mixed, an empirical analysis is needed for a more comprehensive picture.

The paper is organized as follows. Section 2 reviews the relevant empirical literature. Section 3 presents the data of the regression analysis combined with some descriptive statistics. Key data capture the private expenditure share and the share of foreign students among all students in a country. Section 4 presents the estimation strategy that is used to estimate whether student and graduate mobility affects the financing of higher education. The results of our benchmark regression and robustness checks are provided in Section 5. Section 6 concludes.

2 Related empirical literature

Our paper combines two strands of empirical literature. First we complement the “student mobility”-literature by investigating if student and graduate mobility induces changes in governmental policies about the financial regime of higher education. Since there are various additional factors that determine the financing of higher education we will also refer to the “education spending”-literature that analyzes the socio-economic, political and institutional determinants of overall and tertiary public or private education spending.

So far the “student mobility”-literature concentrated on the question whether the financing structure, i.e. the amount of fees, is a determinant of student mobility, mostly taking micro data of one country. Hübner (2012) analyzes if the introduction of tuition fees in some but not all German federal states determines enrollment probabilities in Germany. By the use of this natural experiment he finds a significantly reduced probability of enrollment in those federal states that charge tuition fees. Similarly Bruckmeier et al. (2013) investigate the effects of tuition fees on enrollment of first-year students at German public universities taking the distance between a fee-imposing university and the nearest fee-free alternative into account. They conclude that there is a decrease in enrollment at universities that impose tuition fees and that are located close to fee-free universities. This decrease is twice as large as the decrease at universities that are located comparably far away from the next fee-free university. Beine et al. (2014) aim at identifying the most important factors of student mobility in a framework of student migration to 14 OECD countries between 2004 and 2007. Contrary to Hübner (2012) and Bruckmeier et al. (2013) they find a significant positive effect between fees and student immigration. Since it does not seem very plausible that students prefer higher fees to lower fees when universities are otherwise identical, Beine et al. (2014) interpret fees as a signal of quality.

These – somewhat – ambiguous results point towards the possibility of a (second) causal effect. Additionally to students reacting to the financing structure of higher education, a larger mobility of students (and graduates) may lead to higher private contributions for higher education. The first part of our analysis focuses on this.

As to the “education-spending”-literature, to our knowledge, there are no studies about the determinants of the public-private financing *share* of higher education finance. The literature investigates overall and tertiary (public or private) education spending and the economic, institutional, political and socio-economic factors contributing to it.

Regarding the economic factors, there is some evidence in the literature that GDP per capita, representing the level of economic development, is positively associated with public education spending as a percentage of GDP (Busemeyer 2007). Tandberg (2010), however, whose interest is in the determinants of state spending on higher education relative to total state spending in the US, finds a negative significant relationship between the gross state product per capita and relative state spending on higher education. Although Wagner's law suggests that there is a positive relationship between economic development and public spending, a possible interpretation may be that there are relatively larger investments in other public areas (e.g. health care) as economies grow (Tandberg 2010). When looking at the change of per capita income, Potrafke (2011a) finds a negative relation.

Partisan theory suggests that left-wing parties (e.g. social-democrats) increase total public spending on education, whereas right-wing parties (e.g. conservatives) make more intensive use of private alternatives. Left-wing parties that aim at maximizing redistribution usually receive their constituencies' support from working-class and low-income voters. By contrast, the electoral base of right-wing parties is typically located in the middle and upper income classes, who are interested in minimizing tax contributions (see e.g. Boix 1997; Busemeyer 2009). However, there is evidence that there are different incentives for parties to publicly spend money on different education levels. In an interesting study, Kauder and Potrafke (2013) use the introduction and subsequent incremental abolishment of tuition fees in some German federal states to examine how government ideology influenced the tuition fees policies. In line with partisan theory, they find that right-wing governments actively introduced tuition fees, whereas left-wing parties abolished existing tuition fees. By contrast, Jensen (2011) argues that left-wing governments do not increase total public spending on education because education can hardly be used for redistribution since access is universal for all income groups. In line with this argumentation, Oberndorfer and Steiner (2007) and Potrafke (2011b) find for Germany that social-democratic parties (left-wing) have admittedly increased public spending on primary and secondary schooling whereas there are relatively higher public expenditures on universities under conservative governments and conservative and social-democratic coalitions, respectively. As a possible explanation the authors argue that especially in Germany there is a comparatively low share of students with parents typically voting for left-wing parties. Since there is a rather small share of voters that profit from public expenditures in tertiary education there is little incentive for left-wing parties to increase public spending on universities.

In the second part of our analysis, we will follow the “education-spending”-literature and enlarge our analysis to include fiscal, political-economy and other factors as additional variables to explain the *share* of private contributions to higher education spending.

3 Data

The empirical analysis focuses on 22 OECD countries for the time period 2000–2010. Unless otherwise stated, all data is taken from the Education at a Glance publications (OECD 2001-2013). A more detailed description of all variables and their sources is available in Tables A.1 and A.2 in the Appendix.

3.1 Expenditures on higher education

Our dependent variable is the private funding of tertiary education as a share of total, i.e. private and public, funding.¹ While in most OECD countries the public funding share still constitutes the dominant part of the investment in tertiary education, the role of private funding sources is becoming increasingly prominent.

Figure 1 illustrates country averages from 2000 to 2010. It shows that the share of private expenditures on tertiary education is lowest in the Nordic countries and highest in the Anglo-Saxon countries as well as in Japan. Figure 1 also displays the minimum and maximum level of the private funding share for each country between 2000 and 2010. All countries exhibit variation over time in their private higher education funding. In some countries, the private share varies markedly, e.g. in the United Kingdom where the relative importance of private funding changed by more than 40% points. This also holds – albeit to a smaller extent – for Portugal (23.5% points) and the Slovak Republic (21% points) as well as for Italy (9.9% points) and Austria (8.4% points).²

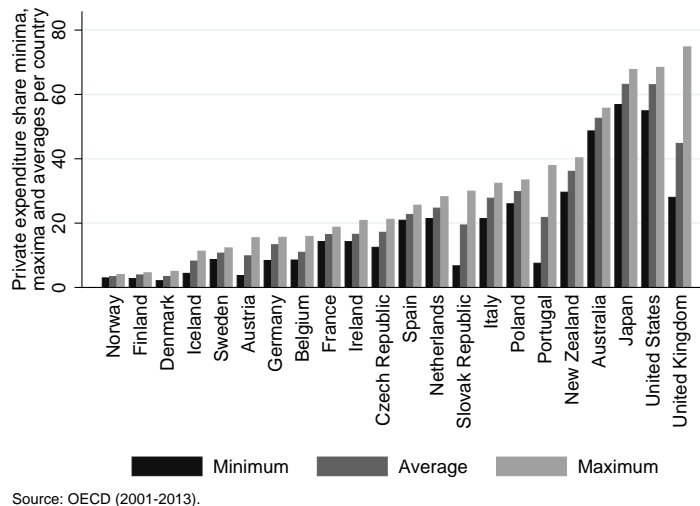
Our dependent variable has the shortcoming that it does not display the absolute level of monetary expenses per tertiary student. E.g. in 2010, Australia’s private share equaled 53.5% of the overall expenditure of 15.142 \$US per student, while Austria spent nearly the same amount of money per student (15.007 \$US) with a private share equaling 12.2%.

¹ We use the private financing share as data on tuition fees are not available for all countries and all years in our sample. Private spending includes household expenditures and expenditures of other private entities (e.g. private businesses). In most countries, individual households account for most of the private expenditure on tertiary education (OECD 2011).

² The change may also be due to rising tuition fees for non-EU students. In our regressions, we will control for the share of incoming students who can be discriminated against.

To correct for this, one of our control variables will be the total annual expenditure as a percentage of GDP.

Figure 1: Share of private expenditures on tertiary educational institutions – minima, maxima and averages (2000-2010)



3.2 Student and graduate mobility

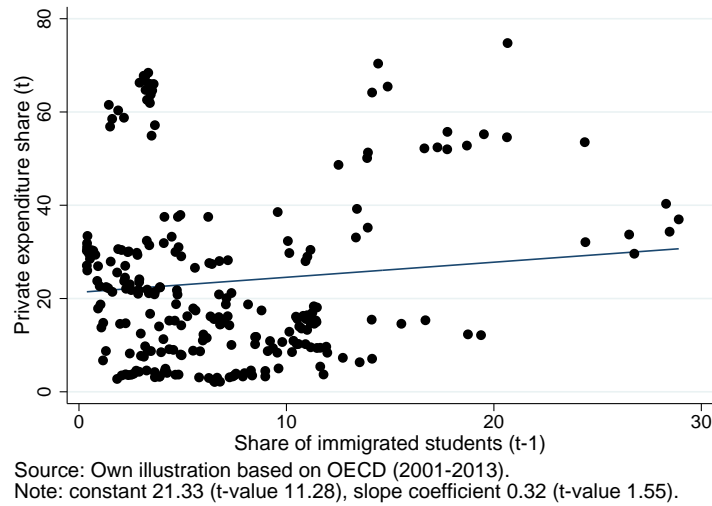
Our main independent variable refers to student migration. We use data on a country's share of immigrated foreign students among the total number of students. Data comes from the UNESCO-OECD-Eurostat (UOE) data collection on education statistics that provides online data on the number of students enrolled outside their country of birth or citizenship since 1998. The OECD provides the number of students that move from roughly 230 countries to individual OECD countries. A problem we face refers to the definition of the term *foreign student*. Until the year 2003 most countries reported the number of foreign students based on their citizenship. This definition not only encompasses students that solely migrate for education reasons, but also those who moved to another country before studying (e.g. for family reasons) without changing their citizenship. In 2004, the UOE agreed to only capture *international students*, who solely migrate for the purpose of education.³ Because there is no data on international students before the year 2004 but data on non-citizen students, we will use data based on citizenship. However, in

³ If destination countries report data on international students, they do so either based on the residence status (since international students usually are not permanent residents of the country they study in) or when students acquired education prior to their studies outside the reporting country.

our sample there is a strong correlation (0.90) between the share of foreign students and the share of international students among the total number of students.

In order to get a first impression of the correlation between student mobility and the private funding share of higher education, Figure 2 displays data for our sample of 22 countries over the period of 10 years. The share of immigrated students is lagged by one year. The panel shows no clear correlation between the share of immigrated students and private funding of higher education.

Figure 2: Correlation between private funding (2001-2010) and the share of immigrated students (2000-2009)



As mentioned in Section 1, the more a country finances students via taxes paid by the national labor force the more it should be interested in the number of foreign students and on how likely it is that they will stay after graduation. So far there are studies which show that the propensity of migration is higher for those graduates who have migrated before (see, e.g. Parey and Waldinger 2011) as well as that there is a positive link between student immigration and the subsequent stock of tertiary educated foreign workers (see, e.g. Dreher and Poutvaara 2011; Felbermayr and Reczkowski 2014). Unfortunately there is no data available on the number of foreign graduates that stay in the host country for work reasons. As a proxy for the stay rate we will use the private rate of return to higher education that equalizes the real costs of education during the period of study to the real subsequent gains from education when staying after graduation. In general the costs encompass tuition fees, foregone earnings net of taxes adjusted for the probability of being in employment minus the resources made available to students in the form of

grants and loans (OECD 2013). With this we will (similar to Beine et al. 2014) follow Bratsberg (1995) and Rosenzweig (2008) who show for foreign students in the US that they are less likely to stay in the host country if the return to education in the home country is higher than in the host country. Hence we proxy the economic attractiveness of a country for high skilled graduates by assuming that their decision on whether to stay or move is mainly based on wage incentives. Since we do not have data for each country in each year we have to take the average value as a constant for each country.

3.3 Further data

The empirical literature on the determinants of education spending guides our choice of further control variables. Since this literature usually concentrates on overall education we only use those fiscal, political and institutional variables which may be connected to tertiary education and which may explain the *share* of public and private contributions.

First we will control for tax revenue (excl. social security funds) as a percentage of GDP. Since the source of the public funding share is mainly income tax revenue it seems plausible that with a comparably large tax revenue policymakers may be able to publicly fund education more extensively. On the contrary a relatively small tax revenue might reduce a government’s ability to publicly finance tertiary education and instead induce a shift to more private-based funding. In line with this argumentation we also include GDP and the GDP growth rate in our regression.⁴ As economies grow we expect policymakers to anticipate that they have more public funds available, hence, we expect a negative relationship between GDP (growth) and the share of private funding (Busemeyer 2007).

To observe changes in governmental policies regarding the private funding share of higher education we have to account for the fact that not all higher education institutions are funded from government sources. Therefore we include the number of students enrolled in independent private institutions among the total number of students enrolled in higher education institutions. The OECD (2013) defines an “independent” private institution as an institution that receives less than 50% of its core funding from government agencies.

Additionally, we control for the share of foreign students that could be asked to pay higher tuition fees than a country’s domestic students. EU countries are free to charge

⁴ The correlations between GDP and the number of students is 0.988, between GDP and population 0.983 and between students and population 0.968. In order to avoid multicollinearity, we only included GDP. We obtain similar regression results if, instead, we include one of the other two variables.

higher tuition fees from non-EU students. For example in 2010, seven out of 17 EU countries charged higher tuition fees from non-EU students compared to domestic and other EU-students. The non-EU countries in our sample can discriminate against all international students. Whereas Norway does not charge fees from international students in public institutions, Australia, New Zealand, Japan and the United States charge higher tuition fees from all international students.⁵ For our estimation we calculate the number of foreign students that can be discriminated against for the case that the country does indeed discriminate and relate it to the number of all foreign students .

Finally, we will pay attention to political-economy variables such as the ruling party's ideology or the demographic structure of the electorate. As stated in Section 2, there is a broad consensus in the literature that government ideology influences the composition and allocation of the public budget (e.g. Oberndorfer and Steiner 2007, Potrafke 2011b, Kauder and Potrafke 2013). We therefore control for the share of parliamentary seats held by right-wing parties among all governmental parties, weighted by the number of days the government was in office in a given year. Data is taken from Armington et al. (2012).

Following the political-economy literature on intergenerational conflicts over the provision of education (see e.g. Poterba 1998; Ladd and Murray 2001), different shares of age ranges may place distinct pressures on the public education budget. Derived from the median voter's perspective, it's assumed that as a society ages, support for programs that target young people such as public education decreases. That is, because of the decreasing share of young people among the population demand for publicly funded education also decreases. In order to control for this effect we include the share of people younger than 20 relative to the individuals aged 20 to 64 (young-age dependency ratio) among the population.

4 Estimation strategy

In order to evaluate the link between student and graduate mobility and the private funding share of higher education we use a panel of aggregated data of 22 OECD countries for the period 2000 to 2010. As we assume the private financing share to be determined by the share of foreign students and other variables, we lag the independent variables by one year. We estimate a mixed effects model with the following form:

⁵ Only students from New Zealand who study in Australia and students from Australia who study in New Zealand are eligible to apply for Commonwealth supported places (OECD 2012).

$$\begin{aligned} \text{Private expenditures}_{i,t} = & \beta_0 + \beta_1 \text{Share of immigrated students}_{i,t-1} \\ & + \beta_2 \text{Stay}_i + \beta_3 X_{i,t-1} + \nu_t + \epsilon_{i,t} \end{aligned} \quad (1)$$

with countries $i = 1, \dots, 22$ and time periods $t = 2001, 2002, \dots, 2010$, where “Private expenditures $_{i,t}$ ” denotes the private funding share of higher education of country i in year t , “Share of immigrated students $_{i,t-1}$ ” denotes the share of immigrated students among the total number of students in country i in year $t - 1$, “Stay $_i$ ” is a time-invariant proxy for the stay rate of foreign graduates constant for each country i and “ $X_{i,t-1}$ ” denotes a set of control variables of country i in year $t - 1$ (e.g. the overall (public + private) expenditure as percentage of GDP⁶, tax revenue, GDP, GDP growth, the share of students enrolled in private universities and party composition of parliament). $\epsilon_{i,t}$ is the normally distributed error term for country i in year t . ν_t is a country-specific random effect.

There are three main reasons for estimating a mixed effects model: First, one of our main explanatory variables, the stay rate of graduates, is time-invariant. As the variable is of particular interest in the underlying theoretical framework of this paper we want to avoid losing this variable. Second, by controlling out higher-level variance we would forgo much information as for almost all of our variables the overall variation is mainly due to the variation between countries, not within (see Table A.2).⁷ In a fixed effects model, we could only capture the (mostly) small part of the within variance. Third, the Hausman test suggests a country-specific random effect.⁸ Nevertheless, we will provide the results of the respective fixed effects estimations (without the stay rate) – and also the random effects estimations – for comparison.

5 Results

The estimation results for the mixed effects models are presented first. The baseline estimations are followed by robustness checks that involve the inclusion of political

⁶ Since total expenditure per student is included here to control for the different total expenditure levels, it is not lagged.

⁷ Only for the GDP growth and the seat shares of right-wing parties in national parliaments the within variation contributes more to the overall variation.

⁸ The p-value of the Hausman test is 0.2132. Hence, we cannot reject the null hypothesis of a random effects model.

economy controls, separate regressions for country groups as well as additional regression models that help to analyze the underlying causal relationship.

5.1 Benchmark regressions

The first set of estimations includes six models where we subsequently add control variables in order to see how the other coefficients respond (Table 1). The respective results for the fixed effects and random effects estimation can be found in Tables A.3 and A.4 in the Appendix. As we are aware of the possible endogeneity problem that arises from the loop of causality between the private financing share (dependent variable) and the share of immigrated students (independent variable), we will first cautiously interpret our regression results as correlations. In Section 5.3 we present some additional evidence which supports some causal interpretation.

Without adding any further control variables, the share of immigrated students correlates with the share of private expenditures of higher education statistically significantly on the 10%-level (column (1)). The coefficient of the stay rate of graduates is, however, insignificant. In columns (2) to (4) we subsequently add a country's tax revenue (excl. social security funds), GDP growth rate and GDP. With this, we find a statistically significant and positive correlation on the 1%-level between the share of immigrated students and the private share of higher education. This positive correlation may indicate that the larger the share of foreign students among the total number of students in a country the larger the private funding share. The coefficient of the stay rate remains insignificant. Additionally the results indicate that a country's tax revenue is significantly and negatively linked to the private spending on higher education. Since the source of the public funding share is mainly income tax revenue it seems plausible that with a comparably large tax revenue a country has more financial scope to publicly fund education. Interestingly, GDP exerts a strong positive and significant influence on the private financing share of higher education which is in line with the findings of Tandberg (2010) who argues that countries might invest relatively more in other public areas as the economy grows. GDP growth, however, has no significant effect.

Table 1: Determinants of private higher education spending - benchmark regression

DV: private expenditure share	(1)	(2)	(3)	(4)	(5)	(6)
Share of immigrated students (t-1)	0.294* (0.153)	0.305*** (0.152)	0.317*** (0.155)	0.357*** (0.151)	0.350*** (0.150)	0.393*** (0.156)
Stay	-0.069 (0.821)	-0.708 (0.734)	-0.758 (0.734)	-0.460 (0.635)	-0.527 (0.572)	-0.447 (0.564)
Total expenditure (in % of GDP)	0.393*** (0.199)	0.371* (0.198)	0.385* (0.200)	0.216 (0.201)	0.202 (0.200)	0.246 (0.219)
Tax revenue (in % of GDP, t-1)		-0.789*** (0.263)	-0.848*** (0.289)	-0.714*** (0.278)	-0.603*** (0.277)	-0.525* (0.285)
GDP growth (t-1)			0.068 (0.157)	0.099 (0.154)	0.072 (0.154)	0.041 (0.159)
GDP (t-1)				2.733*** (0.727)	2.475*** (0.715)	2.589*** (0.756)
Share of students enrolled in private universities (t-1)					0.261*** (0.119)	0.321*** (0.125)
Share of discriminated students (t-1)						0.008 (0.023)
Constant	16.841* (10.077)	45.762*** (13.029)	47.501*** (13.423)	38.973*** (12.551)	34.780*** (12.099)	29.975*** (12.291)
Observations	242	242	242	242	242	220
Log-Likelihood	-808.500	-804.596	-804.504	-798.116	-796.014	-725.479
AIC	1629.001	1623.192	1625.009	1614.232	1612.027	1472.958

Note: Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

Variable description in Tables A.1 and A.2.

In models (5) and (6), we add the share of students enrolled in independent private universities among all students enrolled as well as the share of foreign students that can be discriminated against.⁹ The positive significant coefficient of the share of students enrolled in universities gives hints that our assumptions stated in Section 3.3 pertain. The larger the share of students enrolled in universities that receive less than 50% of their funding from the government, the larger a country's private funding share of higher education. However, the share of students that can be discriminated against (non-EU students in EU countries, non-domestic students in non-EU countries) does not have a significant influence on the private funding share. Hence, we cannot support the hypothesis that the private funding share is large because there is a comparatively large share of students which can be asked to pay high private contributions.

⁹ In column (6) the change in the number of observations is due to the fact that we do not have information on the share of students that can be discriminated against in one year, namely 1999.

5.2 Robustness checks

5.2.1 The role of political-economy variables

In Table 2, we conduct robustness checks by, first, including political-economy variables. Note that the statistically significant effect of the coefficient of the share of immigrated students is robust against these specification changes.

Table 2: Determinants of private higher education spending - robustness checks

DV: private expenditure share	Political-economy			Country groups		
	(7) Party	(8) Old-age	(9)	(10) English	(11) English	(12) No English
Share of immigrated students (t-1)	0.395*** (0.156)	0.324*** (0.157)	0.326*** (0.157)	0.695*** (0.219)	3.848*** (0.549)	-0.102 (0.242)
Share of immigrated students sqrt. (t-1)					-0.098*** (0.018)	
Stay	-0.421 (0.565)	-0.502 (0.604)	-0.480 (0.604)	0.848 (1.854)	1.901*** (0.920)	0.335 (0.366)
Total expenditure (in % of GDP)	0.232 (0.220)	0.174 (0.221)	0.164 (0.221)	-0.154 (0.439)	-0.318 (0.393)	0.315 (0.219)
Tax revenue (in % of GDP, t-1)	-0.497* (0.288)	-0.518* (0.290)	-0.495* (0.292)	-0.781*** (0.290)	-0.959*** (0.162)	-0.291 (0.268)
GDP growth (t-1)	0.030 (0.160)	0.063 (0.158)	0.053 (0.159)	0.168 (0.359)	0.274 (0.325)	0.024 (0.145)
GDP (t-1)	2.620*** (0.756)	2.595*** (0.772)	2.619*** (0.772)	4.310*** (1.300)	2.904*** (1.045)	3.262*** (1.545)
Share of students enrolled in private universities (t-1)	0.334*** (0.126)	0.219 (0.138)	0.232* (0.140)	-1.179* (0.681)	-0.246 (0.588)	0.379*** (0.078)
Share of discriminated students (t-1)	0.009 (0.023)	0.016 (0.024)	0.017 (0.024)	0.216*** (0.064)	0.186*** (0.048)	-0.024 (0.020)
Right-wing parties (seat share, t-1)	-0.010 (0.014)		-0.008 (0.014)	-0.027 (0.028)	-0.025 (0.023)	0.002 (0.014)
Young-age dependency ratio (t-1)		-0.452* (0.231)	-0.443* (0.231)	0.158 (0.681)	0.135 (0.453)	-0.413*** (0.158)
Constant	29.341*** (12.313)	50.502*** (16.696)	49.578*** (16.749)	21.330 (34.353)	6.105 (21.345)	28.141*** (12.997)
Observations	220	220	220	80	80	140
Log-Likelihood	-725.242	-723.722	-723.559	-277.690	-266.676	-410.986
AIC	1474.485	1471.444	1473.119	581.381	561.352	847.973

Note: Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

Variable description in Tables A.1 and A.2.

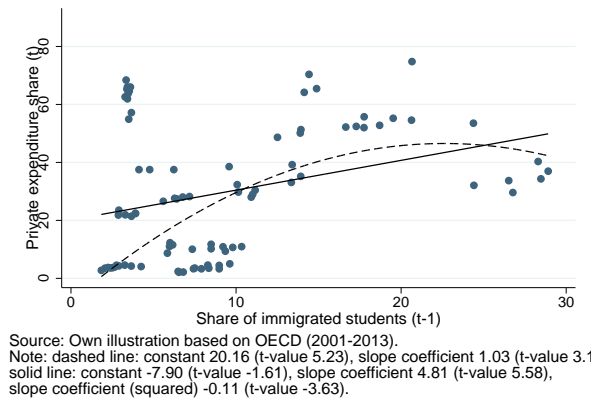
In model (7) we add the percentage of parliamentary seats of right-wing parties among all governmental parties. We do not find any statistically significant relationship between party composition of national parliaments and the private funding share of higher education.¹⁰ Following the political-economy literature on intergenerational conflicts over the provision of education (see Section 2), we control for the share of people younger than 20 relative to a country's population aged 20 to 64 (see column (8)). From the negative effect, which is only significant at the 10%-level, we conclude that because of rather little demand for an increase in public spending private spending can be enlarged.

5.2.2 Country groups

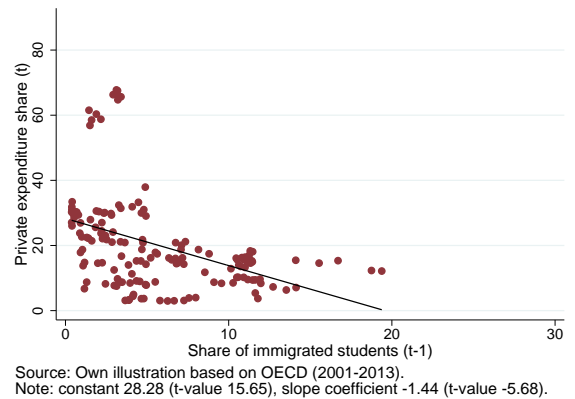
As argued in Sections 1 and 2, we expect a country's private funding share to increase with the share of foreign students that can be expected to work abroad after graduation with high probability. An important factor that attracts students from abroad is the language spoken and used in university courses. In OECD countries, courses held in English may attract many foreign students due to the mere fact that students are likely to have learned English in their home country (OECD 2011). We would expect countries that offer courses in English to have a comparably larger share of immigrated students and are therefore more likely to be concerned with cost considerations.

Figure 3: Correlation between private funding and student immigration – by degree of provision of courses in English.

(a) Countries with most or all courses offered in English



(b) Countries with few or no courses offered in English



¹⁰ We also controlled for the percentage of parliamentary seats of center and left-wing parties, the coefficients of which were also insignificant. Results can be provided upon request.

Based on information on course languages provided by the OECD (2003-2013), we are able to divide our sample into two groups: The first group encompasses those countries that offer all or many of their courses in English. This group consists, naturally, of the Anglo-Saxon countries Australia, Ireland, New Zealand, the United Kingdom and the United States as well as the Nordic countries Sweden, Finland and Denmark plus the Netherlands. All other countries in our sample (Austria, Belgium, the Czech Republic, France, Germany, Iceland, Italy, Japan, Norway, Poland, Portugal, the Slovak Republic and Spain) offer only few or no courses in English.¹¹ Panels (a) and (b) in Figure 3 replicate Figure 2 highlighting these two groups. This gives a first hint that the correlation may be strongly driven by the group of countries that offer many or all courses in English.

We run model (9), which is our preferred specification, again separately for the group of countries that offer most or all courses in English and those that do not. However, one has to keep in mind that we now have comparatively small numbers of observations that may make our results less reliable.

The results for the countries that offer courses in English are displayed in model (10). Since the plot in Figure 2 suggests an inverse u-shaped pattern we add the quadratic term of the share of immigrated student variable in model (11). The coefficient of the share of immigrated students is statistically significant at the 1%-level and positively related to the private funding share of higher education whereas the quadratic term of student immigration is negative and significant. It seems that countries that provide courses in English react to an increase in the share of immigrated students by an increase in the private share. But as the share of immigrated students reaches a certain threshold, the private funding share decreases.¹²

Contrary to these results, the countries that provide few or no courses in English do not seem to react to an increasing share of immigrant students with an increase in the private funding share (see model (12)). When interpreting the results, it should be taken into account that compared to the first group, the countries of this group are much more heterogeneous. While we control for some important factors, we likely miss other factors which might be particularly relevant for the bilateral or multilateral relations among (some) countries of this group. We do not consider, e.g., geographic or linguistic closeness nor the

¹¹ The OECD (2003-2013) provides these information for every country in each year. It incorporates the size of the respective population, that is, some countries such as Germany may have many programs offered in English in absolute terms but not relative to its population.

¹² This result remains robust even when we include a dummy variable for the Nordic countries.

relative size of “close” countries and specific regulations.

The examples of France and Belgium (the Walloon region) as well as Germany and Austria serve to illustrate this. Both pairs of countries share a common language and common borders; one country is relatively larger, and in both cases, the smaller country found a non-monetary way to react to the relatively strong increase of students from the larger neighbor. In 2007, Austria and Belgium introduced a quota for medical students from abroad. In particular, German and French medical students move to Austria and Belgium because they do not meet the access requirements in their home countries. Those students are likely to return home after graduation and therefore place a heavy financial burden on the Austrian and Belgian taxpayers.¹³ With the implementation of this regulation, the relative proportion of students that can be discriminated against increases. As this is a subject-specific discrimination, however, we cannot take this into account due to data limitations. At the same time, focusing on smaller, more homogeneous (sub-)groups leads to problems due to (too) small sample sizes. In general, the reliability of the estimates should be expected to be larger for the full sample.

5.3 Causality issues

Although we address causality to some extent by the use of lagged variables, as mentioned in Section 1, it might well be that it is not (only) student mobility that induces changes in tuition fee policies but (also) fees that induce changes in student mobility patterns. Even though causality is difficult to establish in this aggregated context, it may be possible to rule out some concerns about the interdependence between student mobility and the financing of higher education. In the following we propose two tests: First, we reverse the dependent and the independent variable, hence we test the effect of the private financing share (lagged by one year) on the share of immigrated students. We include a quality indicator to see whether high private contributions serve as a signal for high quality. Second, we use an instrumental variable approach to deal with the endogeneity of our student immigration share.

¹³ Although the quota violates the principle of freedom of movement within the European Union, the European Commission decided not to institute legal proceedings against the two countries until the year 2016 (European Commission 2012b) to secure the functioning of the health-care system.

Table 3: Determinants of private higher education spending - Accounting for reverse causality

	Reverse DV		IV approach	
	(13)	(14) Quality	(15) IV: Tertiary immigration	(16) IV: Import
Private expenditure share (t-1)	0.090*** (0.026)	0.093*** (0.026)		
Share of immigrated students (t-1)			2.276*** (0.715)	4.482*** (1.649)
Stay	-0.443* (0.248)	-0.162 (0.294)	0.154 (0.769)	1.273 (0.916)
Total expenditure (in % of GDP, t-1; t)	0.520*** (0.070)	0.516*** (0.070)	-0.585 (0.397)	-0.673 (0.531)
Tax revenue (in % of GDP, t-1)	0.010 (0.111)	-0.007 (0.110)	-0.830*** (0.394)	-0.603* (0.355)
GDP growth (t-1)	-0.172*** (0.057)	-0.168*** (0.057)	0.371 (0.239)	1.159* (0.622)
GDP (t-1)	-0.860*** (0.305)	-0.839*** (0.301)	3.367*** (1.026)	5.286*** (1.672)
Share of students enrolled in private universities (t-1)	-0.032 (0.056)	-0.007 (0.057)	0.283 (0.174)	0.586*** (0.108)
Share of discriminated students (t-1)	0.016* (0.009)	0.015* (0.009)	-0.014 (0.034)	-0.164 (0.154)
Right-wing parties (seat share, t-1)	-0.001 (0.005)	-0.001 (0.005)	-0.012 (0.019)	0.036 (0.043)
Young-age dependency ratio (t-1)	-0.179*** (0.086)	-0.161* (0.086)	0.109 (0.349)	0.200 (0.316)
Quality		2.924* (1.751)		
Constant	11.584* (6.455)	4.333 (7.702)	25.165 (22.655)	-16.370 (24.540)
Observations	220	220	220	220
Log-Likelihood	-503.660	-502.284		
AIC	1033.320	1032.567		

Note: The instrument in column (15) is the share of tertiary educated working-aged immigrants relative to a country's tertiary educated working-aged native population in the year 2000 (Docquier and Marfouk 2006). The instrument in column (16) is the import rate of goods and services obtained from the OECD database. Standard errors in parentheses; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Variable description in Tables A.1 and A.2.

Let us, again, consider the statistically significant positive effect of the share of immigrated students on the private financing share of higher education. With pure reverse causality, the positive coefficient in our estimation would indicate that international students are more likely to move to a country with higher tuition fees. If we assumed that individuals maximize their utility, hence, that costs of education are an important determinant of the migration decision, this is not very likely to be the explicit causality channel (Beine et al. 2014). As a simple test of reverse causality we run regression model (9) again but now test the influence of the lagged private share on the share of immigrated students. Our results

are displayed in model (13) in Table 3. The positive significant relationship between the private financing share and the share of immigrated students persists. Hence, from a pure utility maximizing (cost-minimizing) point of view it is not very likely that the higher the private contributions in a country are, the more students this country can attract. This at least should hold if we consider the quality of higher education to be the same.

However, a plausible interpretation why students might move to countries with high tuition fees is that private contributions can serve as a signal for quality.¹⁴ To account for this, we follow Beine et al. (2014) and use the average number of universities classified in the Shanghai top 500 ranking for each country relative to the total number of students. The Shanghai ranking provides a ranking of the first 500 universities by country according to several indicators such as the number of scientific publications and their citations. Although the criteria used for this ranking leave room for criticism, to our knowledge it seems to be the most suitable one for our research. Model (14) in Table 3 shows the quality control added to model (13). The coefficient of the private financing share remains positive and significant at the 5%-level after controlling for quality differences between countries' higher education systems.¹⁵

One concern is that it may be possible that students who move to countries that charge higher fees are only affected by part of the so-called private contributions. This is because they might be offered public support, such as grants, by which a country addresses issues of access and equality of opportunity. Unfortunately – due to a lack of data – we cannot test whether countries that increased their private contributions also enlarged public support available to students, which in turn, may attract students from abroad.

Our second approach to deal with the endogeneity of our independent variable is to run an instrumental variable regression (IV 2SLS). For this we need to instrument the share of immigrated students with a variable that is correlated with student immigration but uncorrelated with the private financing share of higher education. We propose two instruments here: For the choice of the first instrument, we follow to some extent Dreher and Poutvaara (2011) and Felbermayr and Reczkowski (2014) who show that there is a positive link between a country's inflow of students and subsequent immigration of skilled

¹⁴Beine et al. (2014) indeed find support for a signaling effect but also for a direct positive impact of fees on enrollment.

¹⁵We also included the quality variable in our preferred specification (9) with the private financing share as the dependent variable (which turned out to be positively significant at the 10%-level) and still obtained a positive significant relationship between the share of immigrated students and the private funding share.

workers to this country. Using the dataset of Docquier and Marfouk (2006) we calculate the share of tertiary educated working-aged immigrants relative to a country's tertiary educated working-aged native population in the year 2000. The results of the IV regression are reported in model (15) in Table 3. They are in line with those of Tables 1 and 2. However, the F-test of the instrument excluded from the second stage is only 4.39 which can mainly be attributed to the fact that data is available for the years 1990 and 2000 only in the dataset of Docquier and Marfouk (2006).

Our second instrument is the import rate of goods and services obtained from the OECD based on the idea that there is some substitution between a country's import of students and its import of goods and services. The F-test is now 15.04. The results of the IV regression can be found in model (16) in Table 3. They are again in line with those of Tables 1 and 2. Taking all the evidence together, the results suggest that the positive effect of student immigration on the financing of higher education is not due to reverse causality.

6 Conclusion

In this paper we have analyzed whether and how student mobility affects the governmental decision about the financial regime of higher education. Theoretical research suggests that in higher education systems that are partly tax-funded, a country's labor force might not be willing to subsidize the education of foreign students who can be expected to work abroad after graduation with high probability. Increasing student mobility and a comparably low stay rate of graduates may lead to a larger share of private contributions if a government aims at a sustainable financing system of higher education.

We estimate the effect of the student immigration share on the private financing share of higher education based on aggregated data of 22 OECD countries for the period 2000 to 2010. Since there are various additional factors that determine the financing of higher education we also include socio-economic, political and institutional determinants. Regarding student immigration we find a significant positive reaction for the total sample: The larger the share of foreign students among all students in a country, the more a country shifts to private-based funding. This result is also robust to changes in the specification but may be driven by some country groups. There is evidence that countries with all or many courses taught in English react to an increase in student immigration by increasing the

private funding while the other OECD-countries in our sample seem not to react. But as the existing quotas on foreign medical students in Austria and Belgium clearly show, even some of those countries react (non-monetarily) to an increase in the share of immigrated students. Additionally we find that the private funding share of higher education increases with decreasing tax revenues, higher GDP and a larger share of students enrolled in private universities.

With our paper, we want to highlight the importance of more empirical research on the question how, in general, mobility affects policy choice. For the case of student mobility, we have studied the impact on a country's political decision of an optimal, long-run sustainable financing scheme of higher education. In this context, the conclusion to be drawn is that research should not only focus on the determinants of student mobility but also on the fiscal consequences that may result from this.¹⁶ One next step – complementing our analysis – could be to study the determinants of the private financing share with micro-level data. Not only would this permit the use of more control variables but also to include exact data on the amount of tuition fees paid by different student groups, data on the number of foreign graduates that stay and start working in the host country as well as data on grants and scholarships.

¹⁶For a discussion of possible policy instruments to correct for the underprovision of higher education as a result of student and/or graduate mobility, see, e.g., Gérard and Uebelmesser (2014) and the literature cited there.

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8 Appendix

Table A.1: Definitions and sources of variables

Variable	Description	Source	Year	Remark
Private funding share of higher education	Private share of expenditures for tertiary education among total expenditures.	OECD Education at a Glance	2000-2010	Linear interpolation: Norway 2004 and 2005; Values for New Zealand of year 2002 taken for 2001; Value for Germany of 2009 taken for 2010.
Share of immigrated students	Net share of non citizen students among all students in a country.	OECD Education at a Glance	1999-2010	Value of Portugal for 2002 is taken from the UNESCO, value of 2001 is created by linear interpolation.
Stay	Internal rate of return for an individual obtaining tertiary education as part of initial education	OECD Education at a Glance	2009	Fixed values taken from year 2009 except Italy, Netherlands and Poland (2008), Japan (2007), value for Iceland taken from OECD Economic surveys: Iceland 2006 S. 108, Table 5.4, 2003.
Total expenditure (in % of GDP)	Public and private expenditures for tertiary education per student (\$US, PPP, current) in % of GDP.	OECD Education at a Glance	2000-2010	Linear interpolation: Denmark, Iceland and Japan 2003, Norway 2004 and Slovak Republic 2002 and 2003; Value for Germany of 2009 taken for 2010.
Tax revenue	Tax revenue (excl. social security funds) in % of GDP.	OECD	1999-2010	
GDP growth rate	Annual growth rate of the gross domestic product, in %.	OECD	1999-2010	
GDP	Annual gross domestic product (\$US, PPP, current, in 1.0000 \$US).	OECD	1999-2010	
Students enrolled in private universities (share)	Share of students enrolled in independent private universities (institution that receives less than 50 per cent of its core funding from government agencies) among all students enrolled in a country.	OECD	1999-2010	Linear interpolation: New Zealand 2004 and 2006.
Share of discriminated students	Share of foreign students that can be discriminated against (that potentially pay higher tuition fees than domestic students) if countries do charge higher tuition fees.	OECD Education at a Glance	2000-2010	
Right-wing parties (seat share)	Right-wing parties as a percentage of parliamentary seats of all governmental parties, weighted by the number of days the government was in office in a given year.	Armingeon et al. (2012)	1999-2010	
Young-age dependency ratio	Number of individuals younger than 20 relative to the individuals aged 20 to 64.	OECD	1999-2010	
Quality	Number of universities classified in the Shanghai top 500 ranking relative to the total number of students in a country.	Shanghai ranking, OECD	Average of 2003-2010	
Share of immigrated students (IV)	Share of tertiary educated working-aged immigrants relative to a country's tertiary educated working-aged native population.	Docquier and Marfouk (2006)	2000	
Import (IV)	Import of goods and services in % of GDP.	OECD	1999-2010	

Table A.2: Summary statistics

Variable		Mean	Std. Dev.	Min	Max	Observations
Private expenditure share	overall	23.62	18.50	2.11	74.78	N = 242
	between		18.06	3.38	63.15	n = 22
	within		5.44	6.86	53.62	T = 11
Share of immigrated students	overall	7.32	5.89	0.38	28.91	N = 264
	between		5.33	0.53	19.01	n = 22
	within		2.73	-7.57	17.22	T = 12
Stay	overall	10.95	4.49	6.80	21.70	N = 264
	between		4.59	6.80	21.70	n = 22
	within		0.00	10.95	10.95	T = 12
Total expenditure (in % of GDP)	overall	13.85	4.18	0.00	31.06	N = 242
	between		3.75	9.30	27.16	n = 22
	within		2.01	0.87	17.75	T = 11
Tax revenue (in % of GDP)	overall	27.37	7.11	15.55	49.73	N = 264
	between		7.15	16.79	47.54	n = 22
	within		1.23	23.81	31.31	T = 12
GDP growth	overall	2.22	2.78	-8.54	10.49	N = 264
	between		0.99	0.76	4.15	n = 22
	within		2.60	-8.58	8.56	T = 12
GDP (div. by 10000)	overall	1.33	2.58	0.01	14.42	N = 264
	between		2.60	0.01	12.11	n = 22
	within		0.41	-1.48	3.64	T = 12
Share of students enrolled in private universities	overall	9.71	17.77	0.00	80.0	N = 264
	between		18.03	0.00	78.50	n = 22
	within		2.07	4.04	21.21	T = 12
Share of discriminated students	overall	30.48	38.68	0.00	100.00	N = 242
	between		36.21	0.00	100.00	n = 22
	within		15.48	-14.40	90.49	T = 11
Young-age dependency ratio	overall	39.79	5.89	30.32	54.69	N = 264
	between		5.66	31.27	50.20	n = 22
	within		1.98	33.01	47.74	T = 12
Right-wing parties (seat share)	overall	41.90	39.95	0.00	100.00	N = 264
	between		27.45	0.00	97.96	n = 22
	within		29.56	-36.37	117.52	T = 12
Quality	overall	1.26	0.77	0.00	2.54	N = 242
	between		0.79	0.00	2.54	n = 22
	within		0.00	1.26	1.26	T = 11
IV (Share of immigrated students)	overall	11.60	9.50	1.45	37.37	N = 264
	between		9.70	1.45	37.37	n = 22
	within		0.00	11.60	1160	T = 12
IV (Import)	overall	40.56	18.89	8.58	88.52	N = 264
	between		18.95	12.24	79.21	n = 22
	within		3.59	27.01	50.1	T = 12

Table A.3: Determinants of private higher education spending - Fixed Effects

DV: private expenditure share	(A1)	(A2)	(A3)	(A4)	(A5)	(A6)
Share of immigrated students (t-1)	0.311*	0.316***	0.308*	0.306*	0.305*	0.324*
	0.158	0.158	0.161	0.160	0.164	0.172
Total expenditure (in % of GDP)	0.352*	0.331	0.324	0.254	0.255	0.319
	0.206	0.206	0.208	0.208	0.209	0.230
Tax revenue (in % of GDP, t-1)		-0.448	-0.407	-0.373	-0.372	-0.182
		0.305	0.348	0.345	0.346	0.374
GDP growth (t-1)			-0.040	-0.002	-0.002	-0.068
			0.163	0.163	0.163	0.172
GDP (t-1)				2.085***	2.083***	2.525***
				0.923	0.927	1.055
Share of students enrolled in private universities (t-1)					0.006	0.040
					0.205	0.238
Share of discriminated students (t-1)						-0.026
						0.025
Constant	16.546***	29.105***	28.214***	25.458***	25.393***	19.209*
	2.511	8.909	9.627	9.614	9.893	10.492
Observations	242	242	242	242	242	220
Log-Likelihood	-745.568	-744.371	-744.336	-741.497	-741.497	-671.966
AIC	1497.136	1496.741	1498.673	1494.995	1496.994	1359.932

Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1.
Variable description in Tables A.1 and A.2.

Table A.4: Determinants of private higher education spending - Random Effects

DV: private expenditure share	(B1)	(B2)	(B3)	(B4)	(B5)	(B6)
Share of immigrated students (t-1)	0.296*	0.304***	0.318***	0.348***	0.363***	0.438***
	(0.154)	(0.154)	(0.157)	(0.153)	(0.152)	(0.159)
Stay	-0.069	-0.733	-0.770	-0.436	-0.538	-0.504
	(0.884)	(0.706)	(0.728)	(0.695)	(0.547)	(0.486)
Total expenditure (in % of GDP)	0.388*	0.376*	0.387*	0.222	0.193	0.213
	(0.201)	(0.200)	(0.202)	(0.203)	(0.204)	(0.226)
Tax revenue (in % of GDP, t-1)		-0.821***	-0.863***	-0.678***	-0.617***	-0.581***
		(0.263)	(0.291)	(0.288)	(0.276)	(0.273)
GDP growth (t-1)			0.072	0.088	0.079	0.067
			(0.159)	(0.155)	(0.157)	(0.164)
GDP (t-1)				2.674***	2.496***	2.520***
				(0.754)	(0.711)	(0.715)
Share of students enrolled in private universities (t-1)					0.272***	0.352***
					(0.116)	(0.112)
Share of discriminated students (t-1)						0.020
						(0.023)
Right-wing parties (seat share, t-1)						
Young-age dependency ratio (t-1)						
Constant	16.900	46.824***	48.000***	37.794***	35.179***	31.632***
	(10.800)	(12.821)	(13.442)	(13.259)	(11.924)	(11.437)
Observations	242	242	242	242	242	220
R ² (overall)	0.059	0.424	0.428	0.508	0.593	0.629

Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1.
Variable description in Tables A.1 and A.2.