Do international classes pay off? A cost-benefit analysis of the internationalisation of higher education in Flanders

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Do international classes pay off? A cost-benefit analysis of the internationalisation of higher education in Flanders[1]

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Abstract

Internationalisation is a major trend in higher education worldwide. Yet, little evidence is given on the net impact of international students on national economies. This study addresses this gap by estimating the benefits against the costs driven by international students in Belgium and its Flemish region in particular. Using a unique combination of various sources of micro-data, the results show net positive benefits that exceed costs by a factor ranging between 2.4 (lower bound) to 3.1 (upper bound) times. The results vary highly with the level of education, as the ratio is the lowest for doctoral students (1.2-1.6) and highest for master students (5.1-6.3). The effect is mainly driven by a high stay rate of international students, who are likely to work in the country after graduation. When considering indirect effects, our results show that there are no significant peer effects due to the presence of international students in the classroom.

Keywords: Higher education; Internationalisation; Cost-benefit analysis; Student mobility; International students.

JEL-classification: I21; I23.

1. Introduction

The number of students moving to a different country with the purpose of studying has grown steadily and represents a significant proportion of the student body in a number of countries (Knight, 2013). The European Economic Area (EEA) attracts almost half (as estimated approximately 45% in 2017) of the entire number of international students (OECD, 2019a). However, the increasing pressure on education budgets and the use of migration targets that include international students results in increased awareness of the costs of internationalisation.[2] Providing empirical evidence on the net effects of internationalisation has become an urgent matter for several countries (Münch and Hoch, 2013; MAC, 2018; Inspectie van het Onderwijs, 2019). However, previous research focused on the empirical application, while the state-of-the-art would benefit from an extensive theoretical framework and methodological details on both the direct economic impact and the indirect (i.e. externally induced, often neglected) effects of internationalisation (Throsby, 1991; 1998; CPB, 2012).

This paper contributes to this debate by using a unique combination of micro-administrative data, survey data as well as regional expenditures in the Flemish context. The methodology relies on a composite framework, by which the benefits and costs associated with public spending, social expenditure and consumption of goods are assessed, in addition to the induced effects such as student-related tourism. Moreover, the long-term impact of internationalisation is examined by building a proxy for the estimation of international students' stay rate after graduation and their subsequent contribution to the national economy. The heterogeneity of results by students' nationality, level of education attained and field of study is explored. Further, the indirect effects of the presence of international students in the classroom are analysed by estimating the peer effect that internationalisation may drive. This combination of detailed data and methodology on the direct benefits and costs of international students and on the measurement of the (indirect) peer effect induced by internationalisation are the main empirical contributions of the paper.

This paper focuses on Belgium in general, and its Dutch-speaking Flemish region in particular. The reasons are threefold. The primary reason is that the Flemish higher education system is highly international, such that our estimates can be considered as upper bounds for the impact of internationalisation in other countries. About 12% of the entire student population has an international background in 2016, and their share increased by 37% from 2013 to 2016, despite a reduction in 2017 (OECD, 2018a; 2019a). Second, the upper bound estimates are further reinforced

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[2] Following earlier literature (Rumbley, 2012; OECD, 2018a, Inspectie van het Onderwijs, 2019), international students are characterised in the present paper as "those who left their country of origin and moved to another country for the purpose of studying", where the country of origin was that of secondary education.

as Belgium is a net receiving country. For each Belgian student studying abroad, around four international students select the country for their studies (OECD, 2018a). Hence, the possibility of a brain drain at the national level is highly unlikely, while the point of assessing the impact of incoming students – on whom this study focuses – is particularly urgent. Third, using the Belgian case, we can exploit micro-data from various sources such that a more comprehensive picture can arise. Given these premises, the results of the paper at hand have significant policy implications for other national and supranational authorities.

The article is organised as follows: Section 2 provides a review of the relevant literature, while Section 3 presents a theoretical framework to study internationalisation. Section 4 explains the data sources and methodology used, while a next section describes the results obtained. A final section discusses and derives conclusions.

2. Related literature

The literature on internationalisation in higher education has focused on three main pillars. First, the previous literature identifies a number of economic and cultural-related factors that drive internationalisation. This includes economic factors, such as overall economic performance and education costs, and non-economic factors such as the political stability or cultural and language proximity (e.g., Naidoo, 2007; González et al., 2011; Kahanec & Králiková, 2011). In terms of economic features, the expenditure for tertiary education, the GDP per capita and the degree of openness of the economy have been found to be positively correlated to the share of international students (Caruso and de Wit, 2014). Mixed evidence emerges on the role of tuition fees, as they are often considered as a proxy by students for educational quality, however, the amount of fees discourages student mobility if it passes a threshold (Naidoo, 2007). A number of social-related factors have also been found to influence the attractiveness of a country for international students, especially in terms of closer cultural and religious proximity, university reputation, language of instruction and peers' influence (e.g., Van Mol and Timmerman, 2014; OECD, 2018a).

The second stream of research examines the stay rates of international students after graduation and links this to the stock of high-skilled workers. Weisser (2016) reports a substantial level of between-studies variability. For instance, evidence from the Netherlands reports stay rates between 29-94%, while the numbers vary between 3 and 64% for the United Kingdom, with most of the variation depending on underlying data, level of education of graduate students and time horizon (Weisser, 2016). Also, PhD students are found to be more likely stayers after obtaining a degree. Kim et al. (2011) find that the percentage of doctorates staying in the US has increased over time,

from nearly 50% in the 1980s to 66% in the 2000s. However, as Han et al. (2015) point out, the difficulties in getting visas in the US may discourage international students from staying, therefore affecting the overall attractiveness of the country. Felbermayr and Reczkowski (2012) match multinational data about bilateral student mobility and stock of international high-skilled migrants, finding that, in the year 2000, the increase of tertiary-educated workers was 71% of the increase in international students, with high cross-country heterogeneity particularly between non- and Anglo-Saxon states. Additionally, scholars investigated the relationship between having an international education experience and the propensity to work abroad, and found a positive correlation quantified by an increase from 2-4% to 30% in the probability of entry in a foreign labour market (Wiers-Jenssen, 2008; Oosterbeek and Webbink, 2011). Independently from the country of work, Van Mol et al. (2020) analyse the relationship between student mobility and graduates' wages and education-to-work transition length, using data from the Netherlands. In so doing, they show that positive labour market returns to student mobility disappear when controlling for selection into international education experience, probably due to the limited vertical mobility of the Dutch educational and labour markets.

A third stream of literature, and most connected to our research, discusses the most comprehensive way to assess costs and revenues generated by the presence of international students, by means of cost-benefit analyses at institutional or national levels (Chishti, 1984; Throsby, 1991; 1998; De Villé et al., 1996). Recently, there are quantitative contributions to this discussion by analysing the costs and benefits in national contexts such as the Netherlands (CPB, 2012, Inspectie van het Onderwijs, 2019), Germany (Münch and Hoch, 2013) and the UK (London & Partners, 2018; London Economics, 2018; MAC, 2018).

3. Theoretical Framework

The studies assessing the costs against the benefits of internationalisation for the hosting economy agreed on the general categorisation between direct and indirect (or external) effects. The theoretical framework on which the present study is grounded takes advantage from the previous contributions in the field moving from the general categories provided by Throsby (1998). According to the author, costs and benefits of internationalisation may be traced back to four categories: (i) resource costs borne by institutions; (ii) administrative costs borne by governments; (iii) direct economic benefits; and (iv) external effects. A detailed description of dimensions related to each of the cost/benefit categories mentioned in the literature is given in Table 1. Costs that arise at the institutional level are mainly due to the programme delivery and the functioning of facilities. Their size is proxied by the

level of public expenditure in tertiary education (referred to category 1.a in Table 1). Second, costs may be driven by the number of scholarships and subsidies granted to international students (1.b), and by specific student support expenditures (1.c) (e.g. admission administration). Besides, there are also public social costs due to the presence of international students in the country, mainly because of healthcare and social security (2.d).

On the other hand, direct benefits arise from private social contributions that are again related to healthcare or social security expenditures (3.e). The direct benefits also derive from tuition fees, which might vary according to the country of residence, as it is the case for non-EEA students in Europe (3.f). Additionally, benefits come from non-tuition fee expenses, which are due to students' purchases of goods and services that generate income for the supplying industries and, hence, for the national economy (3.g). The benefits further originate from students' relatives and friends, who visit the hosting country and spend money that again affects the overall economy (3.h).

Besides, an important element of internationalisation are the long-term effects, as measured by labour market outcomes and by the contributions given and received by international students staying in the host country after graduation. Their estimation is subject to significant variation depending on the stay rate of international students and requires a dynamic approach to be estimated (CPB, 2012; Weisser, 2016).

Finally, the framework includes the indirect effects of internationalisation, which consist of various sources. First, there might be externalities that are driven by a peer effect in the classroom (4.a). Earlier research provided evidence on peer effects in higher education (Sacerdote, 2001; Zimmermann, 2003). The report by CPB (2012) provided a descriptive measure of the phenomenon in the Netherlands, suggesting that international students have higher educational outcomes than domestic ones. An additional indirect effect that is measured in the literature is the radial effect on the economy that is produced by international students. The report by the London Economics (2018) estimated the impact through the estimation of economic multipliers and observed a net positive effect of internationalisation (4.i). Besides this, additional indirect effects were reported in earlier studies, however, they were not measured in any way in their economic impact. The effects may have been related to the integration of different cultures that may result in cultural barriers (4.b) or, on the contrary, in a positive multicultural environment (4.c). Moreover, internationalisation leads universities to compete for a global pool of talents, fostering competition (4.d) and increasing visibility and reputation (4.g) that is expected to be beneficial especially for a restricted sample of prominent universities, which generally attracts international students for their already prestigious reputation. The presence of international students is also expected to play a positive role in attracting

foreign trades and investments (4.e) and in increasing the diplomatic power (4.f) of the hosting nations, given the closer relationship with the students' countries of origin.

As a possible drawback, internationalisation may cause the displacement of domestic students (4.h). This is due to capacity constraint of university facilities and to the possible interest of universities to enrol more international students than domestic ones, because of the higher revenues and positive expected externalities. The monetary value of these dimensions is rarely computed because of the difficulty to make them measurable. Still, it is important to consider them in a theoretical framework that analyses the overall impact of internationalisation. In fact, they indirectly affect human capital or economic dimensions that in turn generate financial effects linked to internationalisation.

Table 1. Theoretical framework – Dimensions and indicators related to each of the cost/benefit categories.

Reference category (adapted from Throsby, 1998)	Dimension	Expected impact
	"Hard" – Direct effects	
(1) Costs borne from institutions	a. Public spending for education	(-)
	b. Scholarships/Subsidies	(-)
	c. International students support	(-)
(2) Costs borne from governments	d. Public social costs (social security; healthcare)	(-)
(3) Direct economic benefits	e. Private social contributions (social security; healthcare)	(+)
	f. Tuition fee income	(+)
	g. Consumptions (non-tuition fee expenditure)	(+)
	h. Income from visitors	(+)
(3) - (2) - (1)	i. Long term labour market outcomes and net contribution to GDP (conditional on the probability of staying after graduation)	(+/-)
	"Soft" – Indirect effects	
(4) External effects	a. Classroom peer-effect	(+/-)
	b. Cultural barriers due to a composite student population	(-)
	c. Multicultural environment	(+)
	d. Global status of domestic universities	(+)
	e. Induced investments and trade	(+)
	f. Soft diplomatic power	(+)
	g. Competition across institutions	(+/-)
	h. Displacement of domestic students	(-)
	i. Indirect and induced effects on local economy by means of economic multipliers	(+)

Note: All the dimensions of costs and benefits are traced back to the reference categories proposed by Throsby (1998) to explain the economic impact of international students. For each of the direct and indirect effects, we report the direction of the expected impact based on the literature that mentions the dimension as a source of cost or benefit due to the presence of international students.

4. Data and Methods

The paper exploits various sources of administrative data to provide a comprehensive cost-benefit analysis of internationalisation in higher education. In particular, it answers the following research questions: (1) *From the perspective of the national economy, what are the monetary benefits of internationalisation in higher education?* (2) *What is the indirect impact of internationalisation in higher education in terms of peer effects of international students in the classroom?*

To answer our first research question, we perform a cost-benefit analysis, in which the direct effects are monetised to estimate their actual value (Levin, 1987; Levin et al., 2017). All data refer to the latest year for which complete data are available, which corresponds to the academic year 2015/2016 (further denoted by 2016). However, when data for 2016 were not available, the data from the most recent year was utilised and the costs were adjusted accordingly to 2016 prices by making use of the harmonised consumer price index (similar to Schreyer & Koechlin, 2002). The present paper also estimates the peer effects induced by the presence of international students in the classroom. A detailed description of the data and methodology is provided below and complemented by the Online Supplementary Appendixes A and B.

To assess the number of international students, we rely on data provided by the Flemish Ministry of Education. This allows to observe the precise number of international students enrolled in Flemish education in 2016 (equal to 21,898 students) as well as the level of education they are enrolled in. This further element makes possible to observe students' distribution across educational levels. Moving from this reference information, the following paragraphs describe the data sources and the formulas used for computing each component of our theoretical framework: the costs and benefits during education, the costs and benefits after graduation and the evaluation of the indirect peer effects.

4.1. Costs and benefits during education

Making reference to our theoretical framework, we first compute the costs related to public spending for education by combining the yearly expenditure per tertiary student (OECD, 2018b) with the number of international students and the average duration of studies. The regular duration of study is considered for bachelor and PhD students (i.e., 3 and 4 years, respectively), while for master students we use as a proxy micro-data from KU Leuven, given the possible variability (formally, either 1 or 2 years) in the duration of master programmes. Despite potential selection effects of students in a specific institution, we consider the distribution observed in KU Leuven as a proxy for Flanders, given that this university counts nearly half of the total number of international students.

The observed duration of studies for master students amounts to 33% of the students completing the study programme in one year; 47% takes two years to complete; 14% needs three years, while 6% takes four years or more. The formula used for the calculations of the public spending for education is the following:

$$\text{Total costs} = \sum_t^n [\text{N}(tertiary\ students) * \text{expenditure}(tertiary\ education) + \text{N}(PhD) * \text{expenditure}(PhD)]_t * (1+i)^{t-1} \tag{1}$$

where n represents the duration of studies as presented above, while the factor $(1+i)^{t-1}$ allows to consider all the values in 2016 prices adjusted for an inflation rate i (similarly to Thompson, 2009). This permits to account for the fact that the students graduated in 2016 enrolled in the educational system t years before. The inflation rates are those referred to the period 2012-2015 as reported by OECD (2018b).

As a dimension of costs, public social costs have been proxied considering public spending for social security services and healthcare. Data have been retrieved by OECD (2018b; 2019b) and have been stratified by age in order to avoid under or over allocation. The mathematical formula can be expressed as follows:

$$\text{Total costs} = \sum_t^n [\text{N}(international\ student) * \text{expenditure}(healthcare) + \text{N}(international\ student) * \text{expenditure}(social\ security)]_t * (1+i)^{t-1} \tag{2}$$

Concerning benefits, private social contributions are firstly considered and computed by using data provided by OECD (2018b) through a formula that can be expressed as follows:

$$\text{Total benefits} = \sum_t^n [\text{N}(international\ student) * \text{expenditure}(social)]_t * (1+i)^{t-1} \tag{3}$$

As a second source of economic benefits, tuition fees income are considered for the academic year 2016. In detail, we consider separate fees for EEA and non-EEA students, as well as for bachelor/master and PhD students (who pay a fee only in the first and last year of attendance, thus for half of the four-year cycle). This can be specified through the following calculation:

$$\text{Total benefits} = \sum_t^n [\text{N}(EEA) * \text{fee}(EEA) + \text{N}(PhD) * \frac{\text{fee}(PhD)}{2} + \sum_k^m \text{N}(non\ EEA)_k * \text{fee}(non\ EEA)_k]_t * (1+i)^{t-1} \tag{4}$$

where, in addition to the previous subscripts, we add the summation of the fees for non-EEA students (decided by the single university) in each of the *k-th* universities in Flanders, where *m* represents the total number of universities.

To estimate the benefits generated by 'good consumption' we used data from the Household Budget Survey (HBS), a representative survey taken every two years by the Belgian Statistical Office (StatBel) that is filled out by Flemish families about their purchases of goods and services. In the

2014 wave, 6,131 households completed the survey, reporting monthly expenditures for food and beverages, clothes, maintenance and repair of personal transport, facilities, furniture, communication devices, culture and leisure, education and private healthcare. The survey data is used to compute the expenditure for goods and services, as well as to compute the non-fee income generated by international students. The computation of the total costs can be expressed as:

$$\text{Total benefits} = \sum_t^n [N(international\ student) * expenditure(consumption)]_t * (1+i)^{t-1}$$

(5)

To estimate the income from students' visitors, we started from the number of tourists that came to Flemish art cities to 'visit relatives and friends' and we traced the number of visitors related to international students by computing a ratio to indicate the proportion of international students by nationality over the overall number of foreign people from that country (OECD, 2018a). Having the information about the average expenditure and length of stay for each of the main nationalities visiting Flanders (Toerisme Vlaanderen, 2017; 2018), we could analytically compute the total benefits through the following formula:

$$\text{Total benefits} = \sum_t^n [\sum_y^p [\text{Ratio} * N(visitors) * \text{Length} * \text{Expenditure/day}]_y *$$

$$\text{Proportion}(international\ students)]_t * (1+i)^{t-1} \qquad (6)$$

where the subscript *y* refers to each country considered in the analysis (i.e. the main EU countries separately and the average for the remaining ones).

4.2. Costs and benefits after graduation

A first step to compute the long-term benefits and costs related to international students is to build a proxy of student retention after graduation. Hence, micro-level data is used from the Flemish Government Social Security Data to estimate the student stay rate. The data link education outcomes of all individuals graduated (or dropped out) from tertiary education in 2011 to labour market outcomes in the consequent ten quarters after leaving tertiary education. Unfortunately, it is not possible to link these data with the specific information on international students provided by the Flemish Ministry of Education. For this reason, we define a proxy to identify international students and measure their stay rate. Overall, 53,305 individuals are observed in the Social Security dataset, which correspond to all students irrespective of the university (or university college) attended. As also citizenship is recorded, an indicator is constructed to measure the presence of international students in the Flemish labour market. Also, to disentangle the population of people coming with the

purpose of studying from those already living in the country but being born abroad, the subpopulation of foreign graduate students is considered who were not granted a scholarship during their studies, as students are only entitled to scholarships if they live or work for a substantial period of time in the country.[3] This way, 2,027 international graduate students are observed, who make up 4.6% of the sample. Linking the degree of the student to the Social Security data, the stay rate is measured by examining whether the student appears in the Social Security data (either as employed or unemployed) as this means that they remained in the country after graduation.

Moreover, given that the decision to stay in a country is dynamic phenomenon, but no data on the length of stay of international students in Flanders is currently available, the likelihood of staying over time has been proxied by using the DIOC database[4] (Database on Immigrants in OECD Countries, OECD, 2013a). The database enables the creation of a proxy for the length of stay of international students, assuming that the average length of stay of highly educated immigrants in the past reflects the behaviours of graduate students in the future.

Moreover, we consider aggregate OECD data to account for drop-out rate in tertiary education, social expenditure and unemployment rate (OECD, 2013a; 2013b; 2018a; 2018b; 2019b). Data related to students' earnings after graduation are based on projections valid for the entire Flemish populations and presented in the salary calculator of the website Vacature.com.[5]

After this preliminary data collection, we compute the long-term benefits as represented by good expenditures, private social contributions, taxation on gross salaries (average taxation amounts to 53.9%; OECD, 2018a), and employer contribution (average contribution amounts to 32.8%; OECD, 2019b). The underlying reason for the increase in salaries is due to work experience (i.e. seniority), while other values are held constant and discounted to the average inflation rate between 2010 and 2017 (1.8%; OECD, 2018b). Long-term costs are made by social expenditures incurred by the government, which are composed of (i) income support to the working-age population; (ii) family services (since five years after graduation); and (iii) pensions (since forty years after graduation). These values are kept constant over time and discounted to the average inflation rate of 1.8% (OECD, 2018b), in order to estimate their present value. The number of international graduates working in the national job market is highly dependent on the drop-out rate during tertiary education, which is equal to 24% in Flanders. The drop-out rate provided by OECD has been triangulated using data from KU Leuven, showing that drop-out among international students is slightly lower, i.e. 21-22%.

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[3] Ignoring this assumption in the data delivers robust findings, as the full number of foreign citizens amounts to 2,209 people. Although the stay rate is with 55.5% slightly higher without the assumption on scholarships (instead of 52.8%), our main findings hold.

[4] http://www.oecd.org/els/mig/dioc.htm (Accessed July 2019)

[5] https://www.jobat.be/en/salary-calculator (Accessed November 2019)

Nevertheless, given the uncertainty in the data and the importance of graduation for the findings, we use the drop-out rate to provide upper and lower bound estimations. In particular, the upper bound corresponds to the best case scenario in which all international students graduate, while the lower bound assumes a drop-out rate of 24% among the international students. Finally, we compute the Net Present Value (NPV) which measures the difference between the discounted value of benefits and costs as follows:

$$NPV = \sum_{t=1}^{n} \frac{B_t}{(1+i)^{t-1}} - \sum_{t=1}^{n} \frac{C_t}{(1+i)^{t-1}} \qquad (7)$$

where B_t and C_t are, respectively, the benefits and the costs; t refers to the reference year, ranging from 1 to n; and i is the discount rate, which is assumed to be equal to the inflation rate.

The NPV has been used also as economic measure to estimate the overall economic impact of internationalisation, by considering both the costs and benefits arising during education and those arising after graduation. In addition, the Benefit-Cost (BC) ratio, where the present value of benefits is divided by that of the costs, has been computed.

4.3. Evaluation of the indirect peer effects

To evaluate the second research question (i.e. the peer effects induced by the presence of international students in the classroom) the population of students that are enrolled at master and advanced master level (master after master) at the KU Leuven is considered (cohorts 2007-2017), as further detailed in the Online Supplementary Appendix B.

Starting from an Education Production Function (EPF) the peer effects are estimated by the following regression model:

$$y_{ijt} = \theta_0 + \theta_1 X_{ijt}^1 + \theta_2 X_{jt}^2 + \theta_3 P_{-ijt} + \varphi_j + \rho_t + \varepsilon_{ijt} \qquad (8)$$

where y_{ijt} refers to a number of educational attainment measures for the student i within the programme j in the cohort t. Output measures refer to (i) time to graduation (in years); (ii) grade point average (GPA); (iii) exam success measured by courses succeeded by the student over the number of courses in the study plan (hence ranging between 0 and 1); and (iv) student drop-out (a dummy identifying students who never got a degree). The controls are captured by X_{ijt}^1 , which specifically refers to students' level characteristics (e.g., gender, scholarship, age); X_{jt}^2 refers to a set of controls at programme level (e.g. two years program, English program); P_{-ijt} is a measure of the peer effect which is equivalent to the proportion of international students within programme without including the student i; φ_j indicates program fixed effects to capture observed and unobserved differences at program level and ρ_t controls for time fixed effects.

5. Results

The direct costs and benefits of internationalisation in higher education are summarised in Table 2. First, we compute all the costs and benefits related to international students during their studies, then we consider the long-term benefits and costs based on students' stay rate. Following the structure of the theoretical framework, dimensions of costs are composed of public spending for international students in higher education and of welfare costs as social security and healthcare for international students. Educational expenditure per student in tertiary education, as provided by OECD (2018b), is multiplied by the 21,898 international students in Flanders in 2016, as given by the Flemish Ministry of Education. Of them, 31.5% are doctoral students, while remaining students are almost evenly distributed between bachelor and master level (34.7% and 33.8%, respectively). Moreover, yearly expenditure is multiplied by the average duration of studies as specified in Section 4.1. As the yearly public expenditure per student amounts to nearly €17,700[6] per student in tertiary education and to € 45,000 for doctoral students (that is the value of the doctoral scholarship)[7], a total amount of around € 1,902 million is derived for educational provision to international students (see Appendix A.1.a).

A second dimension of costs consists of the amount of money allocated for tertiary education scholarships and subsidies (see Appendix A.1.b). The scholarships and subsidies are ignored as international students are typically not entitled to them in Flanders (although there are some very specific scholarship programs like the one provided to the top 2% performers of non-EER students, for most scholarships students have to live or work in the country for a substantial period of time before being eligible for a scholarship).

A third dimension in the theoretical framework considers the budget allocation within HE institutions to provide support for international students (see Appendix A.1.c). Institutional support for international students is ignored as there is a lack of reliable data about costs borne by HE institutions for international activities. Most institutional support for international students is spread between the central level in universities and the different faculties, which make it intricate to measure the costs in a reliable way. Hence, the costs may be underestimated in this respect. However, in the Flemish context, financial transfers by the government account for the proportion of international

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[6] The variable is defined as "Spending includes instruction and ancillary services for students and families provided through educational institutions." (OECD, 2019a).

[7] We acknowledge the fact that not all the doctoral students receive a scholarship. Hence, our estimates can be considered as upper bounds in this respect.

students enrolled, thus these costs are partially included in the expenditure per student previously specified.

As a fourth dimension of costs, the amount of money incurred for the provision of social services is computed, in terms of social security and healthcare for international students (a detailed discussion on the measurement of these costs is provided in Appendix A.1.d). For the estimation of healthcare costs, the health costs for young people are proxied assuming that public costs for this category of social services are strongly differentiated along the citizen's life, with elderly people and children outweighting and young adults underweighting the average. For social security costs, we consider the social expenditure for support to the working age population that represents 7.5% of GDP per capita as given by OECD (2019b) and includes incapacity benefits, family cash benefits, unemployment benefits and other social supports in cash[8]. Given that this percentage may be overallocated to international students, we apply the same reduction used for healthcare costs to calculate the cost per student. Indeed, we may assume that a similar age stratification holds for healthcare as well as for social security costs. The sum of the social security and healthcare costs makes up € 3,283 per student, which is multiplied by the overall number of international students and by the average duration of studies. This gives a total amount of nearly € 213 million.

A second main reference category in the theoretical framework refers to the direct economic benefits. The benefits are represented by private social contributions, tuition fee income, non-tuition fee income (good expenditure) and income from visitors. Moreover, the long-term labour market outcomes and net contribution to GDP (conditional on the probability of staying after graduation) are estimated. The private social contributions made by students (e.g. due to student jobs) are approximated by OECD (2018b) as making up 1.80% of the GDP per capita, equal to € 737 per person. That multiplied by number of international students makes up an amount of nearly € 48 million.

A second dimension in the benefits consists of the tuition fee income (Appendix A.2.b), which varies by the level of education and student's nationality. The general tuition fee in 2016 is equal to € 890 per student, with the exception of non-EEA master students, whose average tuition fee corresponds to € 2,283, and doctoral students, whose tuition fee is € 450 only in the first and last years of attendance. Summing up the different components and multiplying by the duration of studies, a total amount of nearly € 57 million tuition fees of international students is obtained.

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[8] Despite not being specifically related to international students, this is the best proxy available to account for any social security costs incurred for social or community services provided to students.

A third dimension considers the benefits from non-fee income, which includes all expenditures for purchases related to food, beverages, transports, personal care, leisure activities, but also rent and private healthcare (Appendix A.2.c). In the Household Budget Survey, households with and without children with a tertiary education age (18-30 years) are distinguished and the household expenditure is divided by the number of family components[9]. This is carried out by means of micro-data related to Flanders, ensuring a high level of accuracy despite the fact that data are not specifically related to international students. Multiplying the monthly expenditure per person in 2016 prices (€ 808) by the total number of international students and duration of studies, the total spending of international students on food, beverages, transport, leisure activities and personal care of € 630 million is obtained.

Finally, as a fourth dimension, income generated by tourists visiting relatives or friends who study in Flanders is obtained by using data collected by the Flemish Tourism Office (more detailed discussion in Appendix A.2.d), disentangling the expenditure by tourists coming to Flanders to visit relatives working in the region from those coming because of students. In total, an amount of nearly € 139 million per year is obtained that is spent on visiting international students.

As a third reference category, the long-term effect induced by international students is assessed (Appendix A.3). This is profoundly related to the estimation of the probability of living and working in the country after graduation. The results based on the analysis of the Flemish Government Social Security Data show a stay rate by 52.8%, suggesting that more than half of international students stay in Belgium for at least a few months after graduation. This is an interesting result on itself, even though the intertemporal variation has to be considered in this decision to estimate its long-term effect. The use of the DIOC database allows to build this projection, as outlined in the Appendix A.3 and shown graphically in Figure 1.The resulting distribution of students is structured as follows: about half of the international students stay after graduation at least a quarter. From the students who stay at least one quarter, 13% of graduate students leave within one year. 45.9% of the international students stay for more than one year but less than five years. About 37.2% of the international students stay for five to ten years; 29.4% of them will stay for ten to twenty years; the final 22.3% will stay for life.

This distribution of the stay rate is the basis for the computation of future benefits and costs. In line with the general theoretical framework, we estimate the NPV to actualise the yearly difference between benefits (good expenditures, private social contributions, taxation on gross salaries and employer contribution) and costs (income support to the working-age population, family services

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[9] We are aware that these data are not specifically referred to international students. However, it is the best proxy available to account for good expenditure.

and pensions). The results show that the long-term benefits outweigh the costs, and the net lower bound corresponds to a present value of € 4.2 billion; the net upper bound constitutes a value of € 5.6 billion.

Table 2. Estimation of the direct costs and benefits of internationalisation.

Direct effects	
1. Costs	**2. Benefits**
a. Public spending	a. Private social security
€ 1,902,195,573	€ 47,873,210
b. Social costs (social security; healthcare)	b. Student fees
€ 213,345,385	€ 57,445,418
	c. Consumptions (accommodation costs; subsistence; direct course costs)
	€ 630,560,695
	d. Income from visitors
	€ 139,421,564
	e. Taxation and contribution to GDP (subsequent net revenues conditional on the probability of staying after graduation) net of costs
	€ 4,230,178,084
	€ 5,566,023,795
TOTAL	**TOTAL**
€ 2,115,540,958	€ 5,105,478,971
	€ 6,441,324,682

Source: Authors' elaboration on OECD (2013a; 2013b; 2017; 2018a; 2018b; 2019); Flemish Government Social Security Data; HBS survey; Toerisme Vlaanderen (2017; 2018).
Note: Direct costs and benefits driven by the presence of international students in the short and long run are given. For total benefits, we compute a lower bound (in case all students got a professional bachelor degree) and an upper bound (in case all students got an academic master degree) of estimation.

Table 3. Cost-benefit measures of internationalisation of higher education in Flanders.

	Lower bound	Upper bound
Overall NPV	€ 2,989,938,014	€ 4,325,783,724
Benefit-cost ratio	2.4	3.1
Net contribution per student	€ 136,539	€ 197,542

Note: Overall Net Present Value (NPV) is computed by means of actualisation of future benefits and costs derived from the presence of international students, both during studies and afterwards. Benefit-cost ratio is computed as the ratio between the overall benefits and costs of internationalisation. The net contribution per student is obtained by dividing the overall NPV by the number of international students estimated in 2016.

Figure 1. Estimated stay rate of international students over time in Flanders.
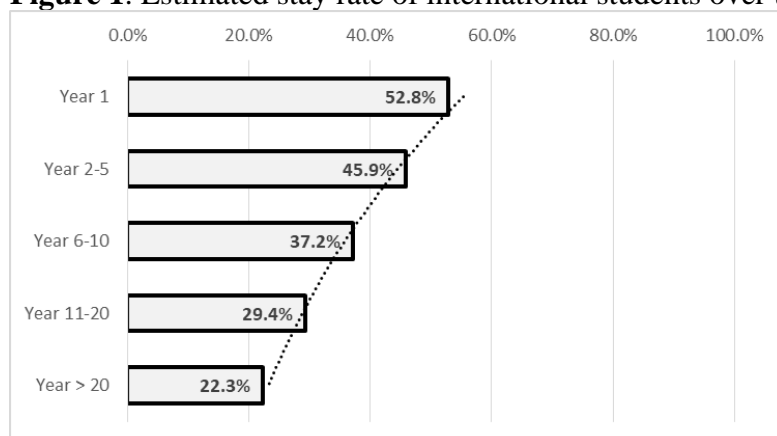
Comparing the estimated costs and benefits, overall, cost-benefit measures given in Table 3 report a net benefit from the presence of international students in the country of € 2,990 million to € 4,326 million euro, corresponding to 1.2% to 1.7% of GDP in Flanders. The total benefits are a factor of 2.4 to 3.1 times the total costs, with a net contribution to the national economy per student ranging between € 136,539 and € 197,542. Additional insights about the robustness of our findings in relation to alternative stay rates and students' length of stay are given in the Online Supplementary Appendix C.

The paper reports heterogeneous results by nationality, level of education and field of study selected by international students, as summarised in Table 4. The highest benefit-cost ratios emerge for students coming from neighbouring countries (namely France, Germany and the Netherlands) and for those pursuing a bachelor or a master degree. Moreover, when analysing results by field of study, the benefit-cost ratio is the highest for biomedical degrees. The first result is driven by the higher stay rate for students from neighbouring countries relatively to non-European students. The second result is led jointly by lower costs of education because of the shorter duration of studies for master students, and by a high stay rate for bachelor students. On the heterogeneity by nationality, given the increase in the number of students coming from extra-European countries (OECD, 2018a), the issue of stimulating the stay rate for this subgroup of students is central and highly related to the national immigration policies. On the heterogeneity by level of education, the high benefits deriving from the presence of international master graduates should be interpreted carefully. Master graduates represent a highly skilled labour force, whose wage growth is faster than that of bachelor graduates. Though, before entering the master level, the costs for the bachelor degree might be incurred by the

hosting country or by the country of origin. In the former case, the current calculation underestimates the real costs that should actually consider the costs for students' overall tertiary education. In the latter case, the competition across countries would go even further, encouraging hosting education systems to attract international students whose tertiary education was already partially fulfilled (also in terms of costs incurred) in another country. Finally, on the heterogeneity by field of study, the fact that biomedical degrees present the highest benefit-cost ratio should be interpreted in line with the cost per study program, which is usually higher for biomedical degrees than for other study fields. The lowest benefit-cost ratio is observed for STEM disciplines, whose stay rate should be increased in order to observe a growth in the net benefits. This is especially relevant in a context in which the rise of STEM graduates would be particularly beneficial for innovation and entrepreneurship (VARIO, 2017).

Table 4. Analysis of heterogeneity in stay rates and benefit-cost ratios by international students' nationality and level of education attained.

	Proportion of the international students population	Stay rate	Benefit-cost ratio
Panel A. By nationality			
Neighbouring countries	36.10%	64.90%	2.9-3.8
Other EU countries	10.50%	60.40%	2.8-3.6
Other Europe extra EU	1.60%	51.70%	2.2-2.8
Rest of the world	51.80%	38.40%	1.8-2.3
Panel B. By level of education			
Bachelor degree	34.70%	63.00%	3.7-4.6
Master degree	33.80%	45.40%	5.1-6.3
Doctoral degree	31.50%	56.60%	1.2-1.6
Panel C. By field of study			
Humanities	62.50%	55.90%	2.5-3.2
STEM	24.50%	48.10%	2.3-2.9
Biomedical	12.50%	60.10%	2.8-3.6

Source: Authors' elaboration on OECD (2013a; 2013b; 2017; 2018a; 2018b; 2019b); Flemish Government Social Security Data; HBS survey; Toerisme Vlaanderen (2017; 2018).
Note: The proportion of international students population presents the breakdown of students across categories. The stay rate reports the proportion of students who stayed in Belgium at least one quarter after graduation. The benefit-cost ratio is computed considering all the components of benefits and costs. The two values of the benefit-cost ratio reported by nationality refer to the upper and lower bounds of estimation (the first in the case that the entire population gained a professional bachelor degree, the second in the case of academic master degree). The benefit-cost ratio reports an upper and a lower bound, depending on the fact that the computation is made net or gross the students drop-out rate.

On the peer effects estimation, our analysis does not present any statistically significant effect of the percentage of international students on their peers' attainment, except for a small negative effect on study success (measured as a number of courses succeeded over the courses booked during the last year before graduation). In particular, an additional 1% of international students are related to an average 0.7% decrease in the ratio between courses passed and booked at master level, as discussed more extensively in the Online Supplementary Appendix B.

6. Discussion and Conclusion

This study analyses the benefits against the costs of internationalisation in higher education, with an empirical application to Flanders, Belgium. Direct costs and benefits have been compared in the short run (i.e. during students' education) and the long run (i.e. after graduation, conditional on the probability to live and work in the host country). This study is one of the first taking full advantage of the amount of data increasingly available on the topic, offering a quantification of the impact of internationalisation on a western economy based on sound data at different levels of aggregation. Moreover, it contributes by giving clear evidence on the methodology used for the estimation of both direct and indirect effects (this latter being measured as the peer effects generated by having international students in the classroom).

Results show a net positive impact of internationalisation, with direct benefits counting from 2.4 to 3.1 times the costs and highlight a net contribution of € 460-666 per Flemish inhabitant. A similar study conducted in the USA by the Institute of International Education (2019) reported a net contribution of $ 41 billion due to international students in 2018/19. Despite the large value, this is equal to nearly € 116 per inhabitant, which is lower than the estimated effect in Flanders.

Our findings confirm the relevance of international students, as their presence is associated with net benefits to the local economy. However, there are a number of considerations to be discussed. First, the favourable benefit-cost ratio is primarily driven by the long-term impact of international students on the local economy. We observe a high stay rate, equal to 52.8% of graduate international students. Bijwaard (2010) estimated a stay rate of 19% for students in the Netherlands, even though other studies reported a probability of stay ranging between 29-94% in the Netherlands, while the numbers vary between 3 and 64% for the United Kingdom (Weisser, 2016). Second, it can be noted that during studies costs exceed benefits, creating a net balance that is represented in Figure 2 (Year 0, when a net loss of nearly € 1,240 million is highlighted). We are aware of the fact that education expenditure is not a pure cost, as it contributes to the national stock of human capital and generates positive "soft" externalities. However, we need to limit our assumptions in order to make

our model measurable. Despite this semplification, already one year after graduation benefits prevail, due to the wage taxation. We see that the pay-back time for an international student amounts to nearly four years, which means that if students stay for four years or more after graduation, the costs for their education would be rebalanced by their contributions to the job market, especially in terms of wage taxation. This result is partially driven by the labour market conditions in Flanders, where the unemployment rate is relatively low (around 5% on average, 8% one year after graduation as retrieved by the Social Security data) and the level of taxation is relatively high (53.9% plus 32.8% of employer contribution). Third, the prevalence of net benefits persists along the entire time horizon as long as students work and live in the country, except for the last few years, in which costs for pensions outweigh the net benefits.

Figure 2. Students' stay rate and total benefits and costs of internationalisation over time.
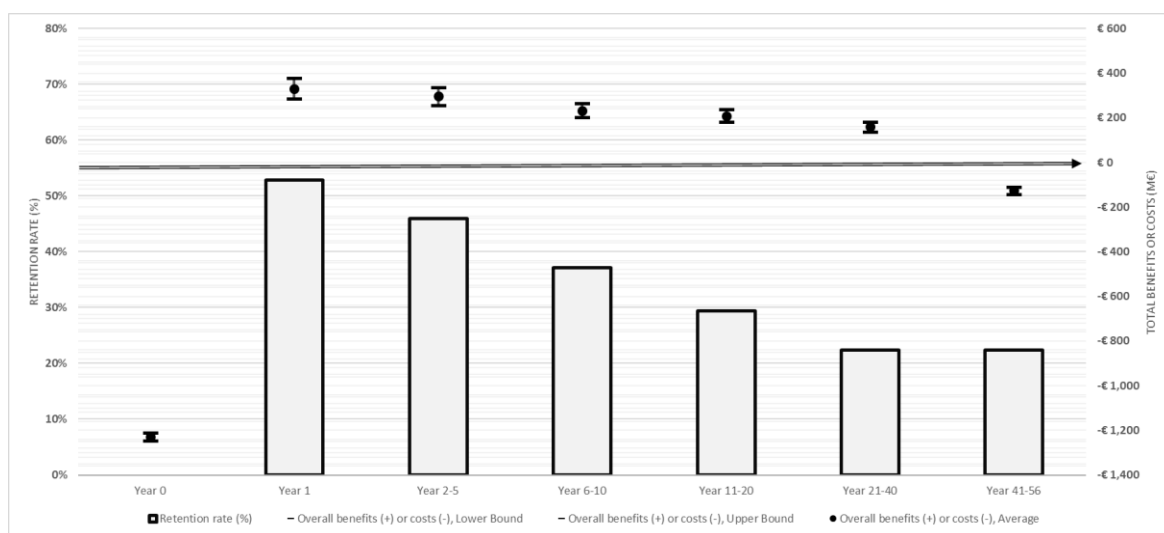
Note: Year 0: Year of student graduation. Years 1-56 refer to the years after student's graduation, considering an average graduating age of 25 and an average life expectancy of 81 (56 years after graduation). The left axis refers to the stay rate, defined as the probability that a graduate student continues to stay in Flanders after graduation (as such, it is computed since the first year after graduation, which is Year 1) and it is represented by means of histograms. The right axis refers to the net total benefits (if greater than zero) or net total costs (if lower than zero) in each of the years represented in the time span, with lower and upper bounds of estimation. The reference line indicates the threshold between net benefits (upper part) and net costs (bottom part).

The study also contributes to the debate on the indirect impact of internationalisation, finding no peer effect due to the presence of international students at master and advanced master levels at the KU Leuven. The results may be due to the fact that the peer effect is not detectable as an impact on "hard" measures of educational attainment, like time to graduation or GPA, while the influence may be visible on "soft" aspects like classroom climate and engagement. As suggested by Inspectie van het Onderwijs (2019), international students might also be insufficiently integrated in the

international classroom. Finally, it is worth stressing that this part of the analysis was applied to data from a single university and this may affect the generalisability of findings.

Within the frame of the growing debate about the costs and benefits of internationalisation in higher education, some policy implications are derived from this study. First, the process of internationalisation of higher education brings net benefits especially in combination with students' retention after graduation. Hence, policies aimed at stimulating international students' stay rates should be designed to maximise net benefits, in line with previous findings on the topic (Bergerhoff et al., 2013). Based on our results, net benefits outweigh the costs after more than four years from graduation. After ten years from graduation, the net benefits double the costs. From this perspective, policy-makers should promote reforms aimed at student retention, for instance offering tax reduction to companies hiring international students. In addition, as pointed out by Han et al. (2015) and by MAC (2018), the debate about the ability to retain international students is closely linked to the availability of visas and permits to stay in the country, especially for extra-EU students. Second, competition in the job market could arise in hosting economies as well, between international and native graduates. As shown by Kahanec and Králiková, (2011) "Skilled immigration benefits the low-skilled native labour force and may, but does not need to hurt high-skilled native workers" (p. 3). Indeed, high-skilled immigration is found to have redistributive effect (Kahanec & Zimmermann, 2008) beneficial for inequality reduction, but it may also put pressure on the competition for high skilled job positions resulting in ambiguous effects. Additional considerations concern the presence of cost economies that would make internationalisation economically advantageous both marginally and on average (Zhang et al., 2017; Zhang and Worthington, 2018), but also, in a wider context, the relevance of cultural-related effects in positively affecting internationalisation, despite these factors are generally difficult to measure (Kahanec & Králiková, 2011; OECD, 2018a). Policy makers should inform the wider public on the relevance, importance and added value of internationalisation in higher education.

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Supplementary Appendixes

Appendix A – Detailed calculations of costs and benefits.

The following Appendix renders a detailed description of the methodology employed in deriving conclusions on the overall costs and benefits of incoming international students on the national economy of the hosting country. Each of the following paragraphs comprises of precise description of the sources of data and method of calculation, divided by the dimensions of costs and benefits.

1. *Costs*

    a. *Public spending for education*

Data containing national spending on education are provided by OECD (2018b) within the '*Country Statistical Profile: Belgium 2018'*. The variable is defined as "Spending includes instruction and ancillary services for students and families provided through educational institutions." (OECD, 2019a). Data between 2010 and 2016 is available pertaining to expenditure per student in tertiary education in 2010 prices. As a primary step, the future value (FV) has been computed as $FV = PV(1 + i)^n$ wherein PV is the present value of the expenditure (i.e. the datum in 2010 prices), i is the inflation rate per year and n are the number of years considered (i.e. years between 2010 and 2016).

After obtaining the expenditure per student in 2016, the subsequent step is to multiply the value per capita by the number of international students in Flanders, which correspond to 21,898 students (data Flemish Ministry of Education). Subsequently, multiplying the expenditure per student by the number of international students, we get the overall expenditure for the educational offer to international students per year. The expenditure per student is differentiated between students enrolled at bachelor and master levels, and the doctoral students.

The final step consists in considering the average duration of studies, namely the number of years spent in the country by international students while attending university. For this purpose, we use the regular duration of study for bachelor and PhD students (i.e., 3 and 4 years, respectively), while for master students we use micro data from the KU Leuven, the largest university in Flanders. Given the possible variability in the duration of master courses, which can last for 1 or 2 years, it is important to consider the effective time spent in education by international students, and not the formal duration of studies. We consider the distribution observed in KU Leuven to be representative for Flanders, given that this university counts half of the total number of international students, while the rest is distributed among all the other universities in Flanders[10]. Thus, our assumption is based on

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[10] https://www.mo.be/nieuws/buitenlandse-studenten-vlaanderen-wie-zijn-ze-en-wat-doen-ze

the direct observation for half of the population and it is extended to the other half. From this analysis, we get the distribution that is presented in Table A1. The obtained proportion will be then applied throughout the paper as the primary reference for the actual duration of studies for master students. Finally, by multiplying the cost per year by the number of years of education, and by adjusting the values for the inflation rate in order to get the result in 2016 prices, we get the value presented in Table A2.

Table A1. International master students' distribution by duration of studies.

Time between first enrolment and degree	Percentage of students
1 year	33.11%
2 years	47.30%
3 years	13.59%
4 years or more	5.99%

Source: Authors' elaboration on data from the KU Leuven, cohorts 2007/2017.

Table A2. Calculation of the educational expenditure for international students.

Dimension	Metric	Value
Expenditure per student: tertiary education (OECD, 2018)	€	€ 17,683
Expenditure per student: PhD (Flemish Ministry, 2018)	€	€ 45,000
Number of international students in Flanders (2016/17)	N	15,001
Number of international PhD candidates in Flanders (2016/17)		6,897
Total amount	€	**€ 1,902,195,573**

Source: authors' elaboration on data from Flemish Ministry of Education and OECD (2018a; 2018b).

b. Scholarship subsidies

A second dimension of the costs may be represented by scholarship subsidies incurred in relation to the international students. In Flanders, though, the legislation poses specific requests for granting scholarships which comprises of living in the country for at least five years, having worked or having parents working in Belgium for at least one year[11]. For the international students, specific scholarships are available, whose amount is considered negligible in the analysis pertaining to all the sources of costs that are instead included.

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[11] http://www.studyinflanders.be/en/scholarship-programmes/other-funding-opportunities/ (Accessed July 2019)

c. International student support

Costs borne by HE institutions for international students support include budget dedicated to activities and staff specifically related to internationalisation. These costs are not included in the analysis due to a lack of reliable data. Still, it is worth to mention them given the contribution in terms of theoretical model. Costs related to international marketing; international office staff and functioning; admission administration; duplication of courses provided in both Dutch and English; activities related to on-boarding of international faculty; contributions for international education networks.

d. Public social costs

Additional costs are induced by the presence of international students in the country, with respect to public spending for social security services and healthcare. We aim at attributing costs proportionally to the actual use of services made by students, to avoid under or over allocation. The first source of spending is made by healthcare services. With respect to this, the fact that access to these services is strongly stratified by age is considered, with elderly people and children making the most of the total costs. Given the similar population demographics with respect to the Netherlands[12], we analyse the distribution of the costs for healthcare services in the neighbouring country[13], and apply this stratification to data from Belgium. Indeed, OECD (2018b) reports government spending for healthcare as making up 7.9% of the annual Belgian GDP in 2016, corresponding to € 3,344 per capita. Though, citizens in tertiary education age are found to deviate from the average by -140% for men and -65% for women (overall deviation for citizens in tertiary education age by -102%). Assuming an overall population of students who are gender balanced, a cost for healthcare services attributable to international students equals to € 1,395 (for men) and € 2,030 (for women) is computed. The second source of spending regards social security, for which we only consider the proportion of spending related to "Income support to the working age population" which makes up 7.5% of the Belgian GDP per capita (OECD, 2019b), resulting in € 3,175 per person as the GDP per capita equals to € 42,333 in 2016. However, we assume that students may have limited access to this category of social security services and for this reason we reduce the cost per person by the same percentage of the healthcare services (i.e., a deviation by -102%), assuming a similar stratification by age. This way, the amount of spending for social security is € 1,570 per student. The value reported in Table A3 is obtained by multiplying the sum of healthcare and social security costs by the total

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[12] https://www.indexmundi.com/factbook/compare/belgium.netherlands/demographics (Accessed July 2019)

[13] https://www.zorgprismapubliek.nl/producten/zorgverzekeringen/zorgkosten-basisverzekering/row-1/gemiddelde-kosten-voor-de-zorg-in-de-zorgverzekeringswet/ (Accessed July 2019)

number of international students in Flanders and by the duration of studies as described in Section A.1.a.

Table A3. Calculation of the expenditure for public social and healthcare services for international students.

Dimension	Metric	Value	
Healthcare government expenditure per capita	€		€ 3,344
Healthcare government expenditure age 20-24	€		€ 1,395 (Men) € 2,030 (Women)
Social security: Income support to the working age population	% of GDP		7.50%
GDP per capita (2016)	€		€ 42,333
Social security expenditure per capita	€		€ 3,175
Social security expenditure per student	€		€ 1,570
Number of international students in Flanders (2015/16)	N		21,898
Total amount	**€**	**€**	**213,345,385**

2. *Benefits*

    a. *Private social contributions*

In addition to the government spending for the provision of social services, private contributions play a significant role in the national balance and can be interpreted as a net benefit for the hosting economy. According to OECD (2018b), in Belgium the private social expenditure is 1.80% of the GDP per capita. The latest data available refer to 2013, so the amount has been expressed in 2016 prices by computing the equivalent Future Value as given in Section A.1a, making up € 737 per capita. Further, by multiplying this value by the number of international students and by the duration of studies, the final value given in Table A4 is obtained.

Table A4. Calculation of the private social expenditure by international students.

Dimension	Metric	Value	
Private social expenditure (in 2013)	% of GDP		1.80%
GDP per capita (2013)	€		€ 39,769
Private social expenditure per capita (in 2016 prices)	€		€ 737
Number of international students in Flanders (2015/16)	N		21,898
Total amount	**€**	**€**	**47,873,210**

b. Tuition fee income

The amount of tuition fees in Flanders is differentiated by level of tertiary education and, in some cases, by student nationality. Additionally, for students coming from the European Economic Area (EEA), the level of tuition fees is set by the government and in the a.y. 2015/16 it is equal to € 890 for every course at bachelor or master level. Non-EEA students may have to pay increased tuition fees, whose amount is independently set by HE institutions. Information about the amount of tuition fees required to non-EEA students has been retrieved by the Institutional websites, pertaining to the academic year 2015/16. A number of master programmes at KU Leuven and Antwerp University require increased tuition fees, making up an average of nearly € 2,700 a year per student at KU Leuven and € 2,900 a year at Antwerp University. VUB increases the tuition fee for all non-EEA students, requiring around € 2,950 per student. However, no evidence of additional tuition fees emerged for Ghent University, wherein an amount of € 890 is required to all students, independently from their nationality. Finally, no information was retrieved for Hasselt University, for which a weighted average of the previous fees has been used. Despite this lack of information, it is worth mentioning that only 3% of the total amount of international students enrolled at this latter institution, so that a variation in this sense cannot outweigh results. Subsequently, the amount of tuition fee per institution has been multiplied by the number of master students coming from non-EEA countries, as rendered by OECD (2018b). To make the computation as precise as possible, the overall proportion of non-EEA master students has been divided according to the composition of international students per institution, as reported in Section A.1a (hence, 49% enrolled at KU Leuven, 22% at Ghent University, 13% at Antwerp University, 13% at VUB, 3% at Hasselt University).

Moreover, for PhD students a different computation is required, for whom the tuition fee is required in the first and last year of attendance and amounts to € 450 per student per year. In consideration of the PhD students enrolled in 2015/16 as evenly distributed over cohorts (i.e. one fourth per year, being an average PhD programme 4-years long), we multiply the yearly tuition fee by half of the number of international PhD students (i.e. assuming that half of them will be enrolled in the first or in the last years).

Furthermore, by summing the 'regular' tuition fee by the number of non-EEA bachelor or master students to the tuition fees for non-EEA master students by the weighted additional tuition fee plus the tuition fees for PhD students by the number of PhD students enrolled in the first or last years, the total value given in Table A5 is obtained.

Table A5. Calculation of overall tuition fees paid by international students.

Dimension	Metric	Value
Tuition fee per student (2015/16)	€	€ 890
Tuition fee per PhD student (2015/16) (first and last year)	€	€ 450
Tuition fee per non EEA master student (weighted average)	€	€ 2,283
Number of international PhD students in Flanders (evenly distributed)	N	6897
Number of non EEA master students in Flanders	N	3045
Other international students in Flanders	N	11956
Total amount	**€**	**€ 57,445,418**

Source: authors' elaboration on data retrieved from HE institutions' websites.

c. *Good consumptions (non-tuition fee expenditure)*

Expenditure for good consumption is obtained by the Household Budget Survey 2014, a survey administered by the Flemish Statistical Office collecting detailed information about household expenditures for: food and non-alcoholic beverages, alcoholic beverages and tobacco, maintenance and repair of personal transport, transport services, clothes and shoes, real rent, communication devices, water and waste collection, culture and leisure, electricity, gas and fuels, education, furniture, household and maintenance, restaurant and catering, healthcare and personal care. There is no identification for international students in the survey. Still it is possible to identify families with kids in tertiary education age (between 19 and 30 years old), whose status was identified as "student" in the survey. Hence, 800 families were considered, whose monthly expenditure for goods and services is € 788.4 per person (i.e. the household spending has been divided by the number of household components). In 2016 prices, this makes up € 808 per capita per month, and this value has been multiplied by the overall number of international students and by the average duration of studies in order to estimate the overall spending for consumption of goods, as given in Table A6.

Table A6. Calculation of the monthly good expenditure by international students.

Dimension	Metric	Value
Monthly consumption (in 2016 prices)	€	€ 808
Number of international students in Flanders (2015/16)	N	21,898
Total amount (yearly)	**€**	**€ 630,560,695**

Source: authors' elaboration on HBS survey.

d. *Income from visitors*

An additional source of economic benefit derives from the impact of people visiting relatives and friends whilst they are studying in the hosting country. As per the report by the Flemish Tourism

Office (Toerisme Vlaanderen, 2017) a total amount of 14.76 million people visited Flanders in 2016. Of them, 49% visited art cities, where university campuses are located. The following report by the Flemish Tourism Office (Toerisme Vlaanderen, 2018) focuses on art cities, presenting results from a survey taken among people visiting Flanders. From the analysis it is discerned that 8% of people visiting art cities cited "visiting relatives of friends" as the primary purpose for coming. It can be noted that the overall number of people coming to Flanders to visit the region in 2016 was around 579,000 people, as given in Table A7. The following step is to trace back the presence of tourists to that of international students. Moreover, to make a detailed analysis, we consider the foreign population in Belgium by nationality[14], computing a ratio to indicate the proportion of international students by nationality over the overall number of foreign people. To get the detail about the number of students by nationality, we use the data provided by OECD (2018a) about the number of international students in Belgium. Results are provided in Table A8. For instance, the ratio computed for France asserts that international students make up around 10% of the total French population living in Belgium. By multiplying the number of visitors by the average length of stay in Flanders and expenditure per day, the final value of around € 47 million is obtained that can be imputed to the presence of tourists visiting international students in 2016. Then, by multiplying this value by the proportion of international students enrolled in the educational system each year, we get the final value of € 125 million.

Table A7. Numbers of tourists visiting international students in 2016.

Dimension	Metric	Value
Visitors coming to Flanders (2016)	N	14,760,000
Percentage of visitors going to art cities	%	49%
Percentage of people visiting relatives and friends	%	8%
Total number of people coming to the main cities to visit relatives and friends	N	578,592

Source: authors' elaboration on Toerisme Vlaanderen (2017; 2018).

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[14] https://www.statista.com/statistics/517235/foreign-population-of-belgium-by-origin/ (Accessed November 2019)

Table A8. Calculation of the yearly expenditure by tourists coming to Flanders to visit international students.

	Foreign population in 2018	Student population in 2016	Ratio	Number of visitors per country related to international students	Length of stay	Expenditure per day	Total
France	165,486	16856	10.19%	58934	2.12	135	€ 50,062,137
Italy	156,063	1166	0.75%	4323	2.3	141	€ 4,160,946
Netherlands	155,239	4438	2.86%	16541	1.84	129	€ 11,653,074
Romania	87,616	432	0.49%	2853	2.05	150	€ 2,603,706
Morocco	81,215	785	0.97%	5592	2.05	150	€ 5,104,169
Poland	71,537	275	0.38%	2224	2.05	150	€ 2,029,989
Spain	64,049	629	0.98%	5682	2.64	132	€ 5,877,094
Portugal	46,611	278	0.60%	3451	2.05	150	€ 3,149,546
Germany	39,469	770	1.95%	11288	2.26	140	€ 10,600,286
Turkey	36,233	218	0.60%	3481	2.05	150	€ 3,177,195
Others	454,038	35255	7.76%	44926	2.05	150	€ 41,003,424
Total amount							**€ 139,421,564**

Source: authors' elaboration on Toerisme Vlaanderen (2017; 2018) and OECD (2018a).

3. *Long term labour market outcomes and net contribution to GDP*

For estimating the long term effect driven by the presence of international students, we first of all estimate the probability of staying and looking for a job in Belgium after graduation. Therefore, we use Flemish Government Social Security Data in order to match information about tertiary education attainment of Flemish students graduated in 2010/11 to the following labour market outcomes over a time frame of 10 quarters (until 2013). As mentioned in the Section 5 'Data Sources', an identification label for international students is not provided, however, we use the citizenship and the status of scholarship granted student for this purpose. In detail, having no way to specifically identify international students, we consider only foreign students that did not get a scholarship. The reason is twofold. First, as discussed in Appendix A.1.b, there are not many scholarships available for international students in Flanders, so that foreign students getting a scholarship are likely to live in Flanders since many years before enrolling at university and they cannot be labelled as international students. Second, we assume that the socio-economic status of international students is higher than that of students whose families are moving for economic reasons. Hence, international students are less likely to be eligible for a scholarship. Matching the data about educational attainment with labour market outcomes, a stay rate by 52.8% is obtained, with high heterogeneity by macro-area as given in Table A9. Students from neighbouring countries have a higher stay rate (64.9%) compared to those having extra-European nationalities (38.4%).

Table A9. Stay rates of international students after graduation.

International students stay rate	52.8%
Neighbouring countries (France, Netherlands, Germany)	64.9%
Other EU countries	60.4%
Europe Extra-EU	51.7%
Extra-Europe	38.4%

Source: authors' elaboration on Flemish Government Social Security Data.

Majority of the arguments coming from this analysis cannot hold without considering that the decision to stay and work in a foreign country is a dynamic phenomenon, that must be analysed as such. To date, no data have been collected about the length of stay of international students working in Flanders. Though, a proxy is represented by the attitude to stay in the country shown by highly educated immigrants in the past. Hence, the DIOC (Database on Immigrants in OECD Countries) database well serves the purpose, providing information about the number of years spent in a country by foreign citizens, together with the highest educational attainment (ISCED level) and the sector they work in (ISCO level). Besides this, the file B of the database contains details about Census data 2011 and specifically refers to immigrants' educational level and length of stay in the country. Selecting immigrants resident in Belgium who got a bachelor degree or higher and were born in a foreign country, we get a distribution with respect to the length of stay that is given in Table A10. Based on the assumption that international students in the future will show a probability to stay similar to highly educated immigrants in the past, distribution to estimate the length of stay of international students in the future is used. Table A10 shows the average years in Belgium spent by highly educated immigrants.

Table A10. Average years in Belgium spent by highly educated immigrants.

Years in Belgium	One year or less	One to five years	Five to ten years	Ten to twenty years	More than twenty years
Average Years in Belgium	1	3	7	15	30
Distribution of the population	13%	19%	21%	24%	23%

Source: authors' elaboration on DIOC database (OECD, 2013a).

This is the primary basis for the computation of the benefits and costs generated by international students, conditional on their decision to stay after graduation. Consequently, benefits are related to contributions to the economy represented by wage taxation, good consumption and private social contributions; instead, costs are represented by social costs with particular reference to healthcare

services (stratified by age), income support to the working age population, family services (since 5 years from graduation, being the age for the first child in Belgium around 29) and pensions (from the age of 65 to 81, which is the average life expectancy in Belgium, OECD, 2017). With respect to the benefits for the hosting economy, majority of the contribution depends on the sector in which graduate students are employed and, hence, on the amount of taxes paid. This is again provided within the DIOC database in its file D, which contains data from the European Labour Force Survey and reports the sector in which foreign people work. Immigrants who completed tertiary education and work in Belgium are so distributed across ISCO sectors: 7% of them have an occupation that requires elementary activities (ISCO 1); 35% of them are workers with occupations related to sales, production, services (ISCO 2); 58% of them are professionals and managers (ISCO 3/4). This specification is then used for estimating the average salary over time depending on the occupation typology. Data have been retrieved from the website Vacature.com elaborating wage data for Flanders in collaboration with the KU Leuven[15]. An average taxation rate of 52.80% on gross salaries has been computed (OECD, 2018a), plus an employer contribution by 32.80% (OECD, 2019b). Expenditures for food consumption and private social security are perceived as constant over time, as presented in Section A.2c and A.2a, respectively. Social security costs have been discerned as income support for the working age population (as presented in Section 1.d), plus family services (when graduate students are 30 or older), plus pensions (when graduate students are 65 or older). In Belgium, data about pensions report that retired people receive around 81% of their previous wages as social contributions (OECD, 2013b).

Based on this, the present value of net benefits and costs has been computed, with an upper and a lower bound of estimation. Indeed, the precise number of students who will enter the local job market depends on the students drop-out rate. This has been found to be equal to 24% as national average (OECD, 2010). As a double check, we compute the student drop-out rate on the population of international students enrolled at KU Leuven, observing a drop-out rate by 21-22%, which is lower than the national value that may be used as lower bound. Hence, the lower bound is asserted to the case in which 24% of the students drop-out from higher education before graduating; the upper bound to the case in which all students gained their degree. As a discount rate for future economic flows, the average inflation rate between 2010 and 2017 is used, which is equal to 1.8% (OECD, 2018b). As time horizon, we use T=56 years, being the average life expectancy for Belgian population equal to 81 years (OECD, 2017). Subsequently, we multiply the average costs and benefits per capita by the number of international students over time, depending on the estimation of their stay rate right

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[15] https://www.vacature.com/nl-be (Accessed July 2019)

after graduation and over the following years (OECD, 2013b) and average unemployment (7.9% one year after graduation, as retrieved from the Social Security data). As a result, a lower bound of € 4,230 million as net benefits, and an upper bound of € 5,566 million is obtained.

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Appendix B – Estimation of the indirect effects.

1. Methodology and data

As a source of indirect effects of internationalisation, the present paper also estimates the peer effects induced by the presence of international students in the classroom, as further detailed in Section 4.3 of the paper.

The micro-data for the empirical estimation have been provided by KU Leuven for the academic years 2007-2017 for master and advanced master students. In the data, the international status of students, the origin, degree, credits taken in the program, successfully acquired credits and the Grade Point Average (GPA) is observed. In addition, to estimate the influence of international students on the native students, the program fixed effects regression is run to account for all observed and unobserved heterogeneity at the program level. The cohort variation is exploited regarding the composition of international students, so that we link the percentage of international students to various outcome variables such as GPA and acquired credits. The individual characteristics as age, gender and nationality are also controlled. The indication of the peer-effects, that are commonly referred to as 'Internationalisation at home' is provided by the estimates. A panel at the programme level is available from 2007 to 2017, making up a total number of 170,000 observations at master level and 27,000 at the advanced master level.

2. Results from the estimation of indirect effects

We investigate the peer effect of attending an international class, as measured by the proportion of international students attending a programme. Descriptive statistics are given in Table B1, while Table B2 and B3 present results for master and advanced master students, respectively. The percentage of international students per programme seems not to affect students' attainment, except for a small negative effect on study success (measured as a number of courses succeeded over the courses booked during the last year before graduation). In particular, an additional 1% of international students are related to an average 0.7% decrease in the ratio between courses passed and booked at master level. Among individual level variables, international students need more time to get a degree and with lower grades, hence registering lower study success. This may be coherent with the idea that international students take time to get used to the hosting educational system, resulting in more time needed to graduate and lower GPAs. This is particularly true for extra-EU students (i.e. students from outside the EU), who receive an average GPA that is 2.50% and 2.98% lower than their peers at master and advanced master level, respectively. Other individuals and programme characteristics affect consistently the educational outputs, such as gender, which suggests positive educational attainments for female students, particularly at the master level. Indeed, female

students are nearly 3.6% and 2.3% less likely to drop-out at master and advanced master levels respectively, completing their master programs with an average additional 1 GPA point (up to 100). On the contrary, age shows a negative correlation with measures of students' results, possibly because of part-time or working students. At the programme level, results are mixed, with the provision of the programme in English that is related with longer time to degree, lower grades and lower study success for advanced master students, but that is also related with smaller drop-out probability, in the measure of 37% and 19%, on average, for master and advanced master students. Hence, students in these programmes struggle more but are more likely to finally succeed. To take the study time into account, we control for programs which last for 2 years relatively to one year programs. It is found that students attending longer programmes are more likely to graduate on time and with an average of 10 additional GPA points, probably indicating more motivation to succeed due to self-selection of students in challenging programmes, or suggesting that students need time to adapt to the hosting educational system.

Finally, Table B4 reports an analysis of the heterogeneity of the variable under investigation, the proportion of international students per program, by the field of study. Accordingly, the programs have been classified into humanities, STEM and biomedical disciplines. Results show that the proportion of international students do not affect significantly any of the output variables, confirming the baseline results.

Table B1. Descriptive statistics for master and advanced master students.

	Master level				Advanced master level			
	Graduate		Graduate and drop-out		Graduate		Graduate and drop-out	
	Mean	No.	Mean	No.	Mean	No.	Mean	No.
Output variables								
Time to graduation (years)	1.95	67246	-	-	1.81	8129	-	-
Final grade (up to 100)	70.10	67236	-	-	72.09	8126	-	-
Study success (proportion of courses succeeded over courses booked in an academic year)	0.99	66865	-	-	0.99	8088	-	-
Drop-out student (=1)	-	-	0.18	81324	-	-	0.22	10376
Individual-level variables								
Gender (female =1)	0.54	67246	0.53	81324	0.54	8129	0.53	10376
International student (=1)	0.11	67246	0.12	81324	0.31	8129	0.31	10376
Extra-EU student (=1)	0.06	67246	0.07	81324	0.20	8129	0.19	10376
Scholarship granted student (=1)	0.13	67246	0.14	81324	0.01	8129	0.01	10376
Age	22.45	67246	22.67	81324	26.05	8129	26.50	10376
Programme-level variables								
English programme (=1)	0.14	67246	0.14	81324	0.47	8129	0.47	10376
Two years programme (=1)	0.23	67246	0.26	81324	-	-	-	-
Proportion of international students	0.12	67246	0.12	81324	0.32	8129	0.31	10354

Source: Authors' elaboration on data from the KU Leuven, cohorts 2007/2017.
Note. The "graduate" sample refers to students graduated between 2007 and 2017. The "graduate and drop-out" sample considers also dropped-out students defined as students enrolled before 2014 that did not get a degree by 2017. Students switching to a different programme are also defined as dropped-out. Mean value and number of observations given for each of the variables used in the subsequent peer effect models. Output variables are the dependent variables. Individual and programme-level variables are the regressors.

Table B2. Peer effect estimation, master students.

Variable	Time to graduation	GPA	Study success	Drop-out
Proportion of international students	**-0.106**	**-0.450**	**-0.007****	**0.007**
	(0.192)	**(0.712)**	**(0.003)**	**(0.913)**
Gender (female =1)	-0.083***	1.014***	0.001***	-0.036***
	(0.010)	(0.128)	(0.000)	(0.004)
International student (=1)	0.047**	-1.297***	-0.001**	0.013*
	(0.021)	(0.229)	(0.000)	(0.009)
Extra-EU student (=1)	-0.011	-2.504***	-0.000***	0.005
	(0.023)	(0.209)	(0.001)	(0.009)
Scholarship granted student (=1)	0.017	-0.527***	-0.001***	0.082***
	(0.009)	(0.073)	(0.000)	(0.006)
Age	0.025***	-0.048**	-0.000	0.013***
	(0.003)	(0.023)	(0.000)	(0.001)
English programme (=1)	1.090	2.370***	-0.010	-0.377***
	(0.232)	(0.844)	(0.010)	(0.079)
Two years programme (=1)	-0.532***	10.726***	0.001	-0.380***
	(0.043)	(0.284)	(0.001)	(0.018)
Program FE	Yes	Yes	Yes	Yes
Cohort FE	Yes	Yes	Yes	Yes
No.	67246	67236	66865	81324
R squared	0.553	0.213	0.050	0.326

Source: Authors' elaboration on data from the KU Leuven, cohorts 2007/2017.
Note. The measure of the peer effect is given by the proportion of international students at programme level. Time to graduation indicates the years between enrolment and graduation; GPA indicates the graduation grade; study success is obtained by dividing the number of courses passed in the last academic year by the number of courses booked in the study plan; drop-out identifies drop-out students by means of a dummy variable (equal to one if the student dropped out and zero otherwise). Models for time to graduation, GPA and study success are run on the "graduate" students sample. Model for student drop-out is run on the "graduate and drop-out" students sample. ***<.01; **<.05; *<.1. Standard errors in parenthesis.

Table B3. Peer effect estimation, advanced master students.

Variable	Time to graduation	GPA	Study success	Drop-out
Gender (female =1)	**0.002**	**0.355**	**0.001**	**-0.027****
	(0.024)	**(0.290)**	**(0.001)**	**(0.010)**
International student (=1)	0.075***	-1.966***	-0.003	0.034
	(0.024)	(0.332)	(0.003)	(0.027)
Extra-EU student (=1)	-0.048	-2.981***	0.002	-0.032
	(0.034)	(0.371)	(0.002)	(0.024)
Scholarship granted student (=1)	-0.170***	-1.199	0.000	0.284***
	(0.055)	(0.787)	(0.002)	(0.099)
Age	0.013**	-0.087***	0.000	0.011***
	(0.003)	(0.031)	(0.000)	(0.002)
English programme (=1)	0.474***	-2.479***	-0.028**	-0.219***
	(0.107)	(0.437)	(0.011)	(0.039)
Proportion of international students	-0.149	-0.813	0.006	0.207*
	(0.147)	(1.506)	(0.011)	(0.107)
Programme FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes

Source: Authors' elaboration on data from the KU Leuven, cohorts 2007/2017.
Note. The measure of the peer effect is given by the proportion of international students at programme level. Time to graduation indicates the years between enrolment and graduation; final grade indicates the graduation grade; study success is obtained by dividing the number of courses passed in an academic year by the number of courses booked; drop-out identifies drop-out students by means of a dummy variable (equal to one if the student dropped out and zero otherwise). Models for time to graduation, GPA and study success are run on the "graduate" students sample. Model for student drop-out is run on the "graduate and drop-out" students sample. ***<.01; **<.05; *<.1. Standard errors in parenthesis.

Table B4. Heterogeneity analysis of the peer effect estimation by field of study, master and advanced master students.

	Time to graduation	Final grade	Study success	Drop-out
Master				
Humanities	-0.293	-0.275	-0.009**	0.004
	(0.201)	(0.65)	(0.003)	(0.087)
STEM	-0.116	0.437	-0.003	-0.019
	(0.152)	(1.713)	(0.003)	(0.092)
Biomedical	1.593	-5.824	-0.012	0.188
	(1.187)	(3.604)	(0.011)	(0.304)
Student controls	Yes	Yes	Yes	Yes
Program controls	Yes	Yes	Yes	Yes
Program FE	Yes	Yes	Yes	Yes
Cohort FE	Yes	Yes	Yes	Yes
N	66851	66841	66471	80908
r2	0.555	0.212	0.050	0.326
Master after master				
Humanities	-0.259	-0.426	0.013	0.119
	(0.188)	(1.841)	(0.014)	(0.084)
STEM	0.133	-2.256	-0.016	0.251
	(0.240)	(2.639)	(0.014)	(0.192)
Biomedical	-0.405	2.884	0.038	0.092
	(0.308)	(1.858)	(0.030)	(0.143)
Student controls	Yes	Yes	Yes	Yes
Program controls	Yes	Yes	Yes	Yes
Program FE	Yes	Yes	Yes	Yes
Cohort FE	Yes	Yes	Yes	Yes
N	8081	8078	8040	10282
r2	0.792	0.375	0.103	0.271

Source: Authors' elaboration on data from the KU Leuven, cohorts 2007/2017.
Note. The measure of the peer effect is given by the proportion of international students at programme level. Time to graduation indicates the years between enrolment and graduation; final grade indicates the graduation grade; study success is obtained by dividing the number of courses passed in an academic year by the number of courses booked; drop-out identifies drop-out students by means of a dummy variable (equal to one if the student dropped out and zero otherwise). Models for time to graduation, GPA and study success are run on the "graduate" students sample. Model for student drop-out is run on the "graduate and drop-out" students sample. ***<.01; **<.05; *<.1. Standard errors in parenthesis.

Appendix C – Robustness checks.

As a robustness check for our analyses, we simulate the benefit-cost ratios in alternative scenarios as presented in Table C1. In particular, we simulate how the benefit-cost ratio modifies when there is a change in the stay rate (Panel A) or in the timeframe under investigation (Panel B). Hence, starting from the estimated stay rate of 52.80%, we test our results by simulating stay rates of 60%, 40%, 30% and 19% (as in the report by the CPB, 2012). In the three cases below the actual value, the benefit-cost ratio is still positive, meaning that the benefits are larger than the costs.

By adopting a similar approach, we test our results when a different timeframe is considered. In our baseline analysis, we consider the costs and the benefits related to international students over their entire lifetime. As a robustness check, we simulate how the benefit-cost ratio changes if we suppose that all the international students leave Flanders after 20, 10 or 5 years. Also in these alternative scenarios the benefits overcome the costs, as the benefit-cost ratios range between 2.61 and 1.00 (worst case scenario). Indeed, supposing that all the international students leave after 5 years, the lower bound shows a parity between costs and benefits, as the benefit-cost ratio is equal to 1.00.

Table C1. Robustness checks – simulations by using alternative stay rates and timeframes.

	BC ratio (Lower bound)	BC ratio (Upper bound)
By stay rate		
Stay rate: 60%	2.80	3.56
Stay rate (actual): 52.8%	2.51	3.18
Stay rate: 40%	2.00	2.51
Stay rate: 30%	1.60	1.98
Stay rate: 19%	1.16	1.40
By time span		
All international students leaving after 20 years	2.08	2.61
All international students leaving after 10 years	1.42	1.74
All international students leaving after 5 years	1.00	1.19

Source: Authors' elaboration on OECD (2013a; 2013b; 2017; 2018a; 2018b; 2019b); Flemish Government Social Security Data; HBS survey; Toerisme Vlaanderen (2017; 2018).
Note: The benefit-cost ratio reports an upper and a lower bound, depending on the fact that the computation is made net or gross the students drop-out rate.