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Universities, students and regional economies: a symbiotic relationship?

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ABSTRACT

This paper examines the heterogeneous effect of student spending in UK NUTS-2 regions. Impact analyses of the more than £45 billion students spend each year have so far been agnostic of the regional absorptive capacity to benefit from this expenditure. Building a multi-regional input–output model for the UK and combining it with data on student expenditure, domicile and level of study, the paper finds significant regional heterogeneity in gross value added and employment multipliers as well as in interregional spillovers. The analysis shows how important student expenditure is for regional economies and the symbiotic relationship between student spending and regional industrial structures that produce varying impact outcomes.

KEYWORDS

multi-regional input–output model; student expenditure; impact multipliers; regional industrial structures; higher education institutions; university impacts

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INTRODUCTION

Higher education institutions (HEIs)[1] have been hailed as significant contributors to their national and local economies where they act as catalysts of positive change (Goddard et al., 2014; UPP Foundation, 2019). Universities affect their home regions via several channels such as innovation, human capital, entrepreneurship and spending, which is the focus of this paper. In 2014–15, a fraction of HEI activities (mainly spending, innovation and human capital channels) generated £95 billion of gross output for the UK economy, representing 3% of the country's economic activity and supported 940,000 jobs (Oxford Economics, 2017).

These impacts are not evenly distributed across space but have a rather strong geographical footprint. A total of 75% of Cardiff University's impact is expected to occur in Wales, whilst the University of Birmingham, with its 7200 employees, is one of the major employers in the West Midlands (London Economics, 2015, 2018). Figure A1 in the supplemental data online shows the variation on the regional distribution of HEIs and students in the UK, with some regions having more than 200,000 students in up to 22 HEIs, and others having fewer than 10,000 in one HEI. Universities are important for their local economies, fuelling local labour markets with skilled workers, engaging in knowledge-transfer activities and generating spending to their local area. A testament of this increasing significance is the trajectory of the perceived role of universities from global knowledge institutions with loose connections to their local environment to the enterprising, engaged, mode 2 and the civic university models in more recent years (Goddard et al., 2012; UPP Foundation, 2019; Uyarra, 2010). Further to this, universities have also been seen and used as a tool for regional development in an attempt to assist productivity, demand and growth convergence

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among European Union (EU) regions (Labrianidis, 2010; Pugh, 2017).

The majority of theorizations and impact evaluations assumed that the absorptive capacity of regions to benefit from the presence of universities in their territory is guaranteed and spatially homogeneous. This 'build it and they will come' approach has had mixed results in practice since not all places were ready or able to meaningfully engage with HEIs and benefit from knowledge spillovers and associated effects (Pugh, 2017). Hence, several subsequent propositions have called for contextual considerations and more place-based approaches instead of one-size-fits-all policies that assume positive benefits will flow just by the establishment of a university in an area.

Focusing on the impact of university spending, most studies avoid a geographical focus and instead emphasize the benefits of a university on the national economy. The difficulty in localizing these effects stems from the lack of data on the relationships between industries within, as well as across, regions. Hence, most studies tend to use information on industrial input–output (IO) relationships at the country level and identify effects that cannot be attributed in space. These approaches overlook (1) the absorptive capacity of individual regions to benefit from spending, (2) the regional spillover effects (incoming and outgoing) of spending, and (3) the feedback effects flowing back to the original region. Consequently, whilst the level of spending generated by universities locally is known, the spatial distribution of benefits is not.

This study contributes to the literature on the socioeconomic impact of HEIs by addressing these gaps. To do this the effect of student spending on different UK NUTS-2 regions is examined, accounting for the heterogeneous regional industrial structures, as well as the interregional trade linkages in a stepwise approach. The gross value added (GVA) and employment impact of £1 spent by the average student in each of the 41 UK NUTS-2 regions is first estimated. Interregional trade linkages are then used to estimate the spillover effects in a region by student spending in other regions as well as the feedback effects returning to the region where the original spend has occurred. Finally, these impacts are multiplied by the number of students and their expenditure, accounting for their domicile and type of study and separating fee from non-fee expenditure in order to identify the total GVA and employment effect of student spending by region.

The impacts above depend on the nature and size of industrial relationships within and between different NUTS-2 regions. Hence, we build a multi-regional input–output (MRIO) model for the UK using data from EUREGIO (Thissen et al., 2018) and the Office for National Statistics (ONS) that allows us to represent inter-industry relationships at the intra- and interregional levels. We combine this model with information on the distribution of student spending across different Classification of Individual Consumption by Purpose (COICOP) categories from the Student Income and Expenditure Survey (SEIS) (Maher et al., 2018) and student numbers by the Higher Education Statistical Agency (HESA) (2019).

Our findings highlight a symbiotic relationship between student spending and regional industrial characteristics. Regions benefit to different degrees from the same level of student spending. We find the maximum direct GVA multiplier to be 17% (12% when only the education sector is considered), higher than the minimum one. Jobs multipliers show wider variations with the maximum at 12.5 jobs per £1 million expenditure being more than twice (approaching three times for the education sector only) the minimum. The results on the spillover effects are even greater. From £1 spent in each other region (excluding fees), Inner London – West receives almost a £1 when Cornwall and the Isles of Scilly receive just under £0.02. Measuring the total regional impact of student expenditure highlights places where spending is more important irrespective of the number of students locally.

The observed differences highlight both the differential capacity of places to benefit from student expenditure and the mechanisms driving regional economic imbalances between London and other regions via the generation and receipt of spillover effects. Policy stakeholders should be aware of these differences in order, first, to adjust the expectations of student expenditure benefits and, second, to drive industrial policies that maximize the benefits of this expenditure. The latter could be achieved by both generating higher direct multipliers and receiving more spillover benefits from expenditure in other regions.

The remainder of the paper is structured as follows. The next section presents the background of university economic impacts, touching on different theories and approaches to empirical examinations and focusing on the impact of spending. This is followed in the third section by a discussion of our model construction and data. The fourth section presents our findings, which are discussed in the fifth section, which also provides a conclusion and steps for further research.

LITERATURE REVIEW

HEIs' regional contributions

There are multiple ways and channels in which universities contribute to their host region (Bagchi-Sen & Smith, 2012; Smith, 2007; Trippl et al., 2015). These revolve around the generation and dissemination of innovation, the fostering of entrepreneurship, the provision of a skilled workforce and the increase of expenditure. Theoretically, most of these contributions are centred on the emergence of the endogenous growth theory and models that stress the importance of technological change and knowledge on economic performance (Lucas, 1988; Romer, 1990). The progressive understanding of the importance of universities for regional development led to the evolution of HEIs' identity from space-blind, knowledge-generating institutions to active stakeholders and anchor institutions in their local areas (Bagchi-Sen & Smith, 2012; Breznitz & Feldman, 2012; Goddard et al., 2014).

The most intuitive contribution of universities to their host regions is through the production of human capital.

Several theoretical and empirical contributions examine the mechanisms behind human capital effects on regional development. These range from direct growth (Gennaioli et al., 2013; Valero & Van Reenen, 2019) and productivity impacts (Hermannsson et al., 2014) to indirect effects such as positive externalities from graduate to non-graduate workers (Hermannsson et al., 2017; Moretti, 2004) and wider socio-economic benefits such as reduced criminality and enhanced resilience performance during economic crises (Hermannsson et al., 2014; Kitsos & Bishop, 2018; Moretti, 2004; Walker & Zhu, 2007).

Universities can also influence regional development via innovation activities. Several models (see the 'learning region', Morgan, 1997; regional innovation systems (RIS), Asheim et al., 2011; Benneworth et al., 2017; and the 'triple helix', Etzkowitz & Leydesdorff, 1997; Pugh, 2017) analyse the role of regions in the national innovation landscape and the role of universities within that. Drucker and Goldstein (2007) provide a useful overview of several impact studies on the link between HEIs' knowledge-based activities and regional growth. Uyarra (2008) suggests that HEIs can increase the capacity of regions to receive and productively utilize knowledge, whilst Valero and Van Reenen (2019) find a positive relationship between university innovation and gross domestic product (GDP) per capita in 1500 regions across 78 countries. However, not all regions have the absorptive capacity to benefit by research-intensive institutions (Marozau et al., 2021; Pugh, 2017) and neither are all HEIs equally able to contribute to regional development (Huggins & Johnston, 2009). In a similar vein, our research suggests that not all regions are able to benefit to the same extent from student spending.

Relevant to the generation and diffusion of knowledge, universities may contribute to regional growth via the relationship between knowledge and entrepreneurship. HEIs can affect entrepreneurship in three ways. First, by generating knowledge that is used by local agents in order to provide new innovative products and services (Audretsch, 1995; Audretsch & Lehmann, 2005). Second, by setting up businesses to commercialize research (Goddard et al., 2014; Smith & Bagchi-Sen, 2006). Third, by teaching entrepreneurship and thus influencing a region's entrepreneurial culture (Smith & Bagchi-Sen, 2012; Pugh et al., 2018). As with the previous channels, local contextual factors are expected to mediate a region's capacity to benefit from the link between knowledge creation and entrepreneurship (Qian & Acs, 2013).

The evolution of understanding around the universities' contributions to their local economies was followed by the development of different university models attempting to capture the multiple identities of universities. Even though these models have been developed sequentially, they now present a spectrum along which HEIs find themselves subject to the national and regional policy context. The range starts with the university as a 'knowledge factory' (or mode 1) and ends in the 'civic university' (or modes 2 and 3) (Trippl et al., 2015; UPP Foundation, 2019; Uyarra, 2010).

As a 'knowledge factory', the university is primarily concerned with the generation of new knowledge. It forms relationships with firms that already have absorptive capacity and delivers regional benefits in the sense of knowledge spillovers. In addition to the generation of knowledge, the 'relational university' is focused on the co-production and sharing of knowledge with industry partners (Uyarra, 2010). Realizing the potential monetary value of university knowledge led to the development of the 'entrepreneurial university' (Pugh et al., 2018; Trippl et al., 2015; Uyarra, 2010) where HEIs are expected to formalize knowledge-transfer partnerships and establish technology-transfer offices. Consequently, they may commercialize their knowledge production and secure the pecuniary benefits of their intellectual property.

The RIS and triple-helix approaches to regional growth support a more institutional function for HEIs. Universities are considered active stakeholders that shape regional development through a multitude of channels beyond the commercialization of activities (Trippl et al., 2015). Uyarra (2010) identifies this model as the 'systemic university' to signal the HEIs' involvement in a socio-economic system of actors. One of the most recent university models is that of the 'engaged' or 'civic' university (Goddard et al., 2012; UPP Foundation, 2019; Uyarra, 2010). In this, HEIs are regarded as an anchor institution that is responsive to local needs and responsible for contributing to the socio-economic and cultural development of their local areas (Breznitz & Feldman, 2012; Trippl et al., 2015).

The spending channel

Irrespective of these functional models, universities always impacted their host area by generating student spending on goods and services. This spending translates into increased demand for inputs and other goods and services, creating knock-on effects down supply chains and local economies. These impacts have been largely measured in institutional or sectoral impact assessments whilst, with notable exceptions, they remained underexamined in the academic literature. This academic literature uses mainly demand-driven impact models such as export base, Keynesian multipliers, and IO or social accounting matrix multipliers (Loveridge, 2004; Miller & Blair, 2009). Normally, these analyses estimate the impact of student expenditure as part of the larger effect of the spending of HEI itself and not on its own (e.g., Florax, 1992; Florax and Folmer, 1992).

Hermannsson et al. (2018) offer a recent and comprehensive revision of the different methods used to evaluate the impact of students' consumption expenditure. The majority of studies examining these effects use information on sectoral relationships in a certain economy, and either consider all students (Harris, 1997; Love & McNicoll, 1988) or the ones coming from outside the region (Kelly et al., 2004; Kelly et al., 2009) as additional exogenous spending. Thus, they find multiplier effects of spending on particular products.

The availability of IO information at the national level enabled the examination of the impact of HEI spending at the country level, and the approximation of such impact for specific regions. However, Siegfried et al. (2007) highlight the importance of defining the study area considered since it has important consequences on the results obtained. To the best of our knowledge, no study has examined the impact of student spending on all UK regions in a systematic manner. Rather, there are several studies at either the country or the single institutional/regional level.

Kelly et al. (2009, 2014) examine the impact of universities on the total UK economy for the academic years 2007/08 and 2011/12, respectively. Besides university spending they also include estimates of the impact of international visitors attracted to the UK by the universities, whilst the off-campus expenditure of UK-domiciled students is excluded since it is not regarded as additional to the UK economy. Both studies use a type II national IO model (including induced effects) based on actual UK data derived from the ONS. They find that the total employment generated was equivalent to 2.6% of all full-time equivalent (FTE) employment in 2007 and 2.7% of all UK employment in 2011. They also find that for 2011 the non-UK students' and related visitors' expenditure together generated £3.51 billion of GVA in industries across the UK.

Oxford Economics (2017) analyses the short-term impact from 162 universities in the UK for 2014–15. Using a UK-wide IO model, and information on HEIs' operational spending as well as the expenditure of international students and their visitors, they find a contribution of £52.9 billion in terms of GVA. This supports £940,000 jobs and represents 2.9% of the UK's GDP. London Economics has produced similar assessments both for individual universities such as the University of Birmingham (London Economics, 2018) and Cardiff University (London Economics, 2015), and for groups of universities such as the Russell Group (London Economics, 2017).

Hermannsson et al. (2013) examine the level of heterogeneity on the expenditure impact of Scottish HEIs. They distinguish between HEI and student consumption expenditures and use a purpose-built IO table for Scotland that is disaggregated for each individual university. Assuming student expenditure is representative of household spending, they find that the heterogeneity of the impact of different HEIs on the Scottish economy is driven by the types of expenditure and its scale. However, when they translate this impact into local multipliers, universities appear to uniformly affect their regions.

Pereira López et al. (2016) assess the economic impact of international students and their visitors in Galicia's regional economy in comparison with conventional tourists in the region. With the help of an IO model specific to the region, and a consumption demand vector based on survey data, they find that the direct and indirect impacts of international students are significantly lower than those of conventional tourists. This has significant practical applications in terms of both impact expectations and policy focus in developing regional growth initiatives.

Finally, in Pastor et al. (2013), the impact of the Valencian public universities is calculated from the demand side by designing a methodology based on Monte Carlo simulations to introduce stochastic elements in the IO multipliers. They use a regional IO table for 2000 and type II multipliers to find that the total expenditure made by HEIs in Valencia generated €3 billion of output, €1.4 billion of income and almost 39,000 jobs per year (2.43% of total employment in the Valencian Community). Pastor et al. also review the previous literature analysing the spending channel, suggesting that the limitations of relevant studies are due to a lack of consensus on: (1) defining the counterfactual scenario, (2) identifying the local area in which there is economic impact, (3) measuring the first-round of impacts avoiding double counting and (4) the selection of the multipliers.

This paper contributes to this literature by considering the student expenditure effects for all NUTS-2 regions in the UK simultaneously. Beyond the direct effects, this allows one to consider the knock-on effects in various supply chains and follow an increase in demand across its trajectory through the regional and national economic structure. In addition, the paper uses the Student Income and Expenditure Survey (SIES) (Maher et al., 2018) to account for the different structure of student spending in comparison with the average household. The findings reveal the distribution of benefits from student expenditure in the UK by region and highlight the symbiotic relationship between spending and the regional industrial structures.

METHODS: DATA

The multi-regional input–output (MRIO) framework

We use an MRIO framework to better understand the regional effects of student expenditure. To do this, we focus on the role of local industrial structures and relationships, together with trade spillovers and feedback effects. The IO relationships between industries at the regional level enable us to understand the regional absorptive capacity of student spending. On the one hand, interregional trade spillovers show the transmission of impacts from one region to another, whilst the feedback effects consider the trajectory of the impact back to the region of origin (Figure 1). In this way, we are able to account for both direct and indirect effects.

IO models are the most appropriate tool for the study as they allow us to estimate the gross macroeconomic effects (direct and indirect) of an increase in spending, and to disaggregate these effects by industry (Hermannsson et al., 2013; Pereira López et al., 2016). Their simplicity, transparency, and relative ease of use and interpretation of the results (in contrast to computable general equilibrium (CGE) models) make them the most commonly used tools in impact evaluation studies. Simultaneously, by focusing on a phenomenon that is

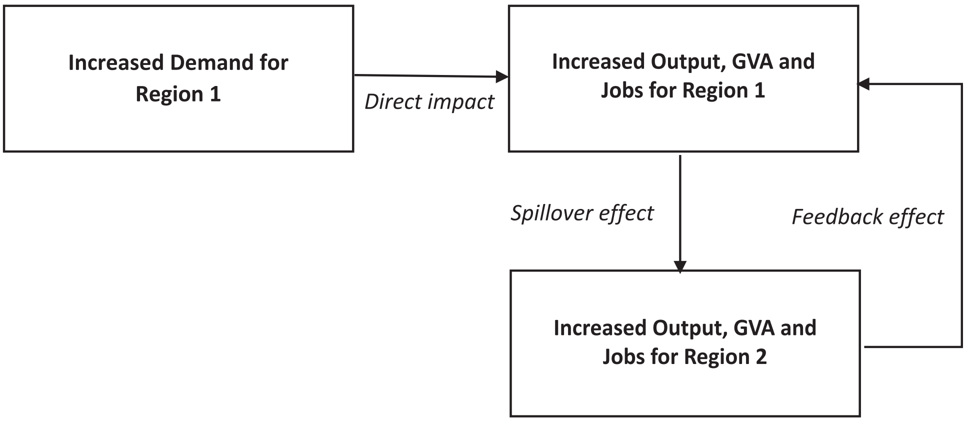

Figure 1. Spillover and feedback effects in multi-regional input–output (MRIO) models.

happening, that is, actual students spending in the way they spend in the present (in contrast with hypothetical impact shocks), we avoid the limitations of the traditional IO model around the lack of supply restrictions (Miller & Blair, 2009).[2]

In a single-region IO model, domestic output can be defined as:[3]

$$\boldsymbol{x}^d = (\boldsymbol{I} - \boldsymbol{A}^d)^{-1}\boldsymbol{f}^d$$

where $\boldsymbol{x}^d$ is the vector of total domestic output by industries; $(\boldsymbol{I} - \boldsymbol{A}^d)^{-1}$ is the domestic Leontief's inverse (excluding intermediate imports);[4] and $\boldsymbol{f}^d$ is the exogenous domestic final demand vector. Knowing the final demand, we can obtain the value of the required output in each industry to satisfy it. Hence, this model can show us how regional production changes in response to changes in final demand (Carrascal Incera et al., 2015), and the total contribution, direct and indirect, of a particular spending pattern.

To identify the impact of an increase in demand, IO approaches use the concept of economic multipliers. These show the effect of an additional unit of consumption on the economy. Beyond the direct impact of the expenditure, multipliers take into consideration the indirect effects. These are knock-on effects, arising from the increase in demand along value and supply chains. For example, having an extra meal at a restaurant (an increase in demand for catering and hospitality services), beyond its direct effect, also represents an increase in the demand for the inputs of the restaurant, generating further demand increases down the supply chain.

The MRIO model has two advantages compared with single-region IO models. First, it can locate where the production will take place in order to satisfy the increased demand. As a result, we can simultaneously identify local effects and the impacts on other regions (spillover effects). This type of model produces estimations of both regional and national effects, consistently dealing with intra- and interregional impacts (Oosterhaven & Hewings, 2021).

Second, the MRIO model allows us to estimate interregional feedback effects. These are defined as the impact on the initial region arising from the indirect effect of production in other regions that were due to an increase in demand in the initial region. The literature on feedback effects has found that, on average, they represent 1–10% of the total intra-regional indirect effect (Carrascal Incera et al., 2015), depending on the size of the subnational economy. Figure 1 explains graphically the direct, spillover and feedback effects.

For a region r, the structural form of the MRIO model is:

$$\boldsymbol{x}^r = (\boldsymbol{I} - \boldsymbol{A}^{rr} - \boldsymbol{A}^{rs}(\boldsymbol{I} - \boldsymbol{A}^{ss})^{-1}\boldsymbol{A}^{sr})^{-1}\boldsymbol{f}^r$$

where $\boldsymbol{x}^r$ is the output of region r; $\boldsymbol{f}^r$ is the vector of exogenous final demand; $\boldsymbol{A}^{rr}$ and $\boldsymbol{A}^{ss}$ are the intra-regional matrix of regions r and s, respectively; and $\boldsymbol{A}^{rs}$ and $\boldsymbol{A}^{sr}$ are the interregional trade matrices between the two regions (from r to s and from s to r). In this way, different regional specializations can be taken into account along with different patterns of intermediate imports and exports.

The two-region MRIO model can also be expressed in a matrix format as:

$$\begin{pmatrix} \boldsymbol{x}_d^r & \boldsymbol{x}^{rs} \\ \boldsymbol{x}^{sr} & \boldsymbol{x}_d^s \end{pmatrix} = \left(\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix} - \begin{pmatrix} \boldsymbol{A}^{rr} & \boldsymbol{A}^{rs} \\ \boldsymbol{A}^{sr} & \boldsymbol{A}^{ss} \end{pmatrix}\right)^{-1} \begin{pmatrix} \boldsymbol{f}^r & 0 \\ 0 & \boldsymbol{f}^s \end{pmatrix}$$

where, by multiplying with the final demand as a diagonal matrix ($\hat{\boldsymbol{f}}$), we obtain the output ($\boldsymbol{x}$) disaggregated between the domestic/own effect ($\boldsymbol{x}_d^r$ and $\boldsymbol{x}_d^s$) and the impact that comes from a different region ($\boldsymbol{x}^{sr}$ is the effect in region s coming from the final demand in r, and vice versa for $\boldsymbol{x}^{rs}$).

Consequently, trade relations between regions within a national economy (in our case, the UK) can affect the impact of student expenditure on regional economies. The indirect effects of this expenditure span beyond the regional economy in which the consumption originates to regions that supply intermediate inputs. The MRIO model incorporates these channels and offers insights into the impact of students on regional economies and the capacity of these economies to benefit from this expenditure.

Once the regional multipliers are calculated, the contribution of student spending to each regional economy[5] can be measured by multiplying the number of students in each region by their average expenditure and their domestic multiplier. These are expected to provide interesting insights in the heterogeneous effects of student spending in UK regions.

Data: model

To perform our analysis we use the Socio-Economic Impact Model of the UK (SEIM-UK), which is an MRIO model that covers 41 UK regions (NUTS-2 classification) and 30 sectors (Tables 1 and 2). This model was built using information from the UK supply and use tables (SUTs) for 2016. Hence, all estimations of the regional variables mentioned above will be consistent with the national total for 2016. The sum of output and demand components by NUTS-2 regions is equal to the total for the UK in the SUTs.

The SUTs and the regional UK information allow us to estimate regional weights for the MRIO margins (i.e., total primary inputs, imports and final demand) based on the most disaggregated information available from the ONS. The constraint in the number of sectors considered in the SEIM-UK comes from the components of the value-added by industry (compensation of employees, gross operating surplus and mixed income) for NUTS-2 regions.

For the interregional IO table, estimations are based on applying the relationships from UK national datasets to the NUTS-2 level at a 68-industry level (from the GVA of the regional accounts; ONS). When data are aggregated to 30 industries, the heterogeneity observed within industries across regions is mainly the result of different production and demand structures of industries within the 30-industry level. In sum, sectoral mix and regional industrial specialization will be the key element that would differentiate regional economic structures.

The Cross-Hauling Adjusted Regionalisation Method (CHARM) (Többen & Kronenberg, 2015) is used to construct the SEIM-UK model. Beyond the SUTs, other databases involved in the model development are: (1) the regional accounts (ONS) for the components of GVA, and for obtaining regional domestic output; (2) the regional household final consumption expenditure, regional gross disposable household income and Living Costs and Food Survey (LCFS) for the regional weights of the final consumption by region; (3) the Public Expenditure Statistical Analysis (PESA) released by HM Treasury for the public consumption by region; (4) the regional gross fixed capital formation from ONS for the investment; and (5) HM Revenues and Customs information and the EUREGIO database for the exports and imports. The final adjustments to achieve global consistency have been made using the well-established RAS method (Bacharach, 1970; Stone, 1961).

Estimating the final demand vector

To identify the final demand vector of HEI students, we use the SIES for 2014–15 (Maher et al., 2018). The survey has a sample of 4697 students and, in addition, has collected 2627 seven-day expenditure diaries from English-domiciled students to estimate the size and distribution of student expenditure by broad product category. SIES is preferred over the LCFS due to its specialization on individual student spending (as opposed to student household-level information from the LCFS) and its significantly larger sample size (the LCFS contains approximately 70 student households per year). The SIES contains information on expenditure in detailed product categories that are grouped into living costs, housing costs and participation costs.

The share of student expenditure by COICOP category is needed to derive the student expenditure multipliers (Table 1). To calculate these shares, the spending categories of SIES are matched to the COICOP classes (see Table A1 in the supplemental data online). The only exception is expenditure on fees (COICOP class 10) where instead of the average in SIES the total fee income is used and divided by the total number of students as both are registered in HESA data. This is in order to account for the different fee-bands offered by HEIs in the UK for students of different domiciles and the fact that SIES provides expenditure information only for English-domiciled students. For example, Scottish-domiciled students pay a fraction of the fees that English-domiciled students do in Scottish HEIs. Similar differences exist for overseas students, whilst under- and postgraduate course fees may differ as well. Thus, whilst it can be assumed, in accordance with Conlon et al. (2011), that all students have similar spending profiles to English-domiciled students, it is considered preferable to separate fee-related spending from the rest of the expenditure in order to account for fee level differences.

Consequently, the multipliers are calculated separately for education and the rest of student expenditure. In 2014/15 (the latest year of available data), more than 40% of student expenditure is on education, followed by 18% on accommodation. These products account to two-thirds of the total consumption by university students. Alternatively, for every £1 a student spends, almost £0.60 go to education and real estate activities.

The total consumption vector (Table 1) is formed of 30 products/sectors. The vector is estimated following two transformations. First, the consumption bridge matrix from the SUTs is used to obtain consumption by 30 industries (e.g., from COICOP products to Standard Industrial Classification (SIC) industries). Second, student spending is translated from purchasing prices to producers prices (IO figures are at basic prices) by deducting indirect taxes and reallocating the distributors' trading margins.[6] This vector is used as the exogenous part of the MRIO model to derive the type I, direct and indirect multipliers of student spending to regional economies for GVA and jobs (per £1 million spent).[7]

Student profiles

Having two of the three components (multipliers and spillovers) that are needed to calculate the total contribution of students to regional economies, what remains is to understand regional student populations by domicile and

Table 1. Final demand vector for higher education institution (HEI) students and comparison with the UK average household (30 sectors).

Code	Sector	HEI student consumption pattern (%)	UK average household consumption pattern (%)
A	Agriculture, forestry and fishing	1.47%	1.51%
B	Mining and quarrying	0.02%	0.04%
CA	Manufacture of food, beverages and tobacco	5.47%	6.39%
CB	Manufacture of textiles, wearing apparel and leather	2.16%	3.15%
CC	Manufacture of wood and paper products and printing	0.30%	0.50%
CD–CF	Manufacture of petroleum, chemicals and pharmaceuticals	0.67%	2.67%
CG	Manufacture of rubber, plastic and non-metallic minerals	0.24%	0.45%
CH	Manufacture of basic and fabricated metal products	0.18%	0.36%
CI	Manufacture of computer, electronic and optical products	1.27%	1.11%
CJ	Manufacture of electrical equipment	0.33%	0.76%
CK	Manufacture of machinery and equipment	0.06%	0.18%
CL	Manufacture of transport equipment	0.03%	4.23%
CM	Other manufacturing, repair and installation	0.59%	1.93%
D	Electricity, gas, steam and air-conditioning supply	1.37%	2.47%
E	Water supply; sewerage and waste management	0.46%	0.88%
F	Construction	0.09%	0.16%
G	Wholesale and retail trade; repair of motor vehicles	6.39%	13.11%
H	Transportation and storage	8.25%	4.53%
I	Accommodation and food service activities	2.56%	9.21%
J	Information and communication	4.15%	3.57%
K	Financial and insurance activities	0.76%	6.36%
L	Real estate activities	17.78%	24.95%
M	Professional, scientific and technical activities	0.32%	1.44%
N	Administrative and support service activities	0.01%	0.05%
O	Public administration and defence; compulsory social security	0.10%	0.29%
P	Education	42.64%	1.57%
Q	Human health and social work activities	0.20%	2.75%
R	Arts, entertainment and recreation	1.57%	2.59%
S	Other service activities	0.34%	2.16%
T	Activities of households	0.23%	0.62%
	Total	100.00%	100.00%

Source: Authors' calculations from the Student Income and Expenditure Survey (SEIS) (Maher et al., 2018) and the supply and use tables of the Office for National Statistics (ONS).

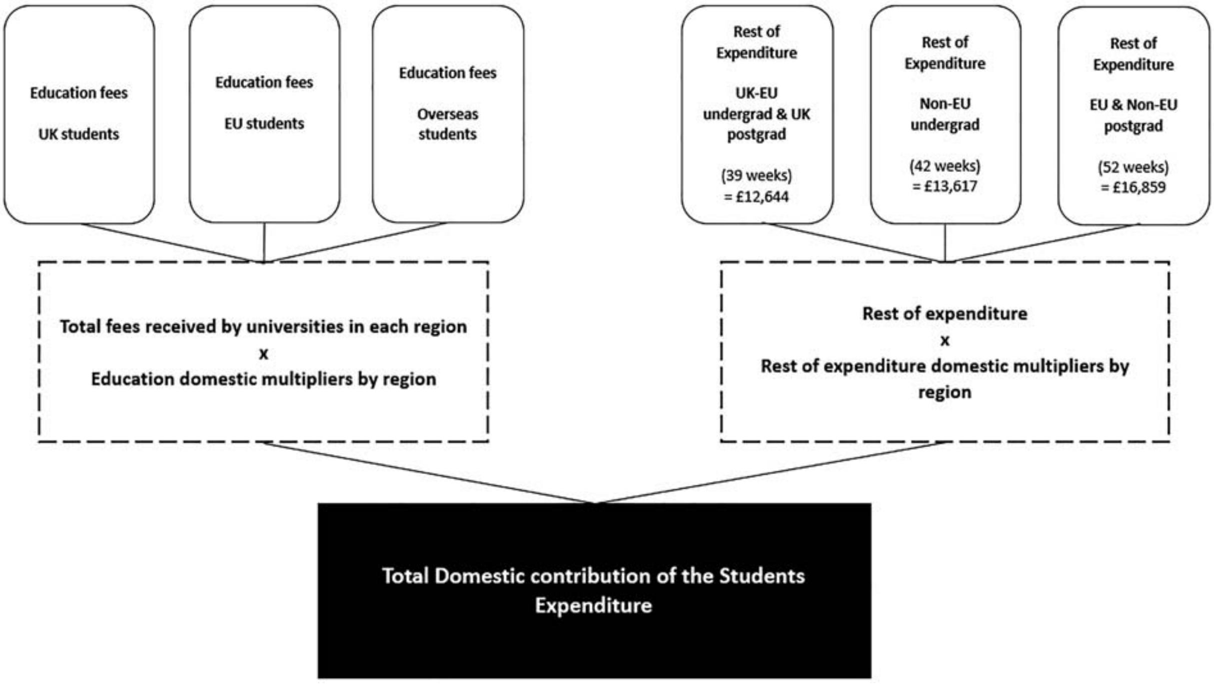

Figure 2. Overview of the calculation of total contribution of student expenditure.

tenure characteristics. Following the relevant literature (Conlon et al., 2011) the paper distinguishes between domicile (UK, EU, overseas) as well as under- and postgraduate students.

Non-fee student expenditure is provided by SIES (Maher et al., 2018) based on a 39-week period for which an average English-domiciled full-time student is expected to stay in the region of the university they attend. The figure refers to 2014–15 data and, excluding fees, amounts to £11,729. This figure is updated using the relevant consumer price index (CPI) deflators for 2018–19 (£12,644) and following the assumptions of Conlon et al. (2011) it is expected that:

- UK under- and postgraduate students and EU undergraduate students stay for 39 weeks (total, non-fee related expenditure £12,644).
- Overseas undergraduates stay for 42 weeks (total, non-fee expenditure related £13,617).
- EU and overseas postgraduate students stay for 52 weeks (total, non-fee related expenditure £16,859).

This estimation strategy is summarized in Figure 2, which highlights the differential student spending profiles considered (UK, EU and overseas students separated by level of study). To identify student domicile and level of study, the paper uses HESA detailed statistics on FTE students aggregated at the regional level for UK and EU and overseas student totals. Distinguishing between different types of students and consumption levels provides a varied landscape of direct and spillover student expenditure impacts by UK region. Their sum will provide the total contribution of students to their respective regional economies.

RESULTS

Multipliers results: the impact of £1 spent

Heterogeneous impacts are found by a HEI student spend of £1 in each region (Table 2 and Figures 3 and 4). Overall, fee-related multipliers (*education fees multipliers*) are higher than the rest of the student expenditure (non-fee related) ones, whilst larger differences among regions are observed in jobs rather than GVA multipliers. Mapping the four sets of multipliers provides interesting insights into their spatial variation, which in turn reflects the UK's regional industrial structures.

The average student generates almost £0.80 of GVA in Eastern Scotland (UKM7), but only £0.68 in East Yorkshire and Northern Lincolnshire (UKE1) by spending £1 on non-fee-related products. In terms of jobs, non-fee-related student expenditure generates more than 12 jobs per £1 million spent in West Central Scotland (UKM8), whilst in Inner London – West (UKI3) the respective multiplier is halved. Overall, places with a diversified local industrial bases which combine services and manufacturing production such as Greater Manchester have been better able to benefit from non-fee-related student expenditure compared with regions with more specialized business bases such as the services-based economies of regions in and around London.

Fee-related expenditure shows higher domestic multipliers due to the nature of the activity. The interrelationship between the education sector and services means that the spatial distribution of GVA multipliers reflects a core–periphery geography. More urbanized regions such as Inner London – West, West Midlands and Greater Manchester have some of the highest GVA multipliers, whilst more rural and peripheral regions such as Cornwall

Table 2. Domestic regional gross value added (GVA) and employment multipliers from student expenditure divided into education fees and non-fees spending.

Region code	Region	Rest of student expenditure multipliers		Education fees multipliers	
		GVA	Jobs (per £1 million spent)	GVA	Jobs (per £1 million spent)
UKM7	Eastern Scotland	0.797	10.637	0.933	18.732
UKM8	West Central Scotland	0.777	12.498	0.940	25.009
UKH1	East Anglia	0.76	10.983	0.924	22.268
UKD3	Greater Manchester	0.759	11.988	0.941	25.279
UKF1	Derbyshire and Nottinghamshire	0.751	11.647	0.915	24.688
UKL2	East Wales	0.748	11.471	0.904	22.466
UKF2	Leicester, Rutland and Northampton	0.742	10.975	0.917	23.316
UKE4	West Yorkshire	0.737	11.229	0.924	23.689
UKI7	Outer London – West and North West	0.737	7.619	0.920	18.678
UKK2	Dorset and Somerset	0.737	11.824	0.907	25.519
UKG3	West Midlands	0.736	11.097	0.936	23.933
UKJ4	Kent	0.734	10.355	0.933	24.273
UKK1	Gloucestershire, Wiltshire and Bristol/ Bath	0.734	9.941	0.942	23.611
UKD4	Lancashire	0.733	10.772	0.903	25.271
UKE2	North Yorkshire	0.732	10.974	0.904	26.261
UKJ1	Berkshire, Buckingham and Oxford	0.729	8.248	0.927	23.052
UKJ2	Surrey, East and West Sussex	0.727	9.242	0.926	21.073
UKG2	Shropshire and Staffordshire	0.726	11.177	0.892	26.033
UKH3	Essex	0.725	10.293	0.900	28.913
UKE3	South Yorkshire	0.722	12.025	0.911	19.365
UKD6	Cheshire	0.72	11.017	0.919	29.448
UKC2	Northumberland and Tyne and Wear	0.719	10.663	0.913	24.185
UKG1	Hereford, Worcester and Warwick	0.716	10.925	0.909	27.201
UKJ3	Hampshire and Isle of Wight	0.713	8.811	0.917	26.225
UKL1	West Wales and The Valleys	0.713	11.954	0.870	27.392
UKN0	Northern Ireland	0.711	9.251	0.862	24.526
UKH2	Bedfordshire and Hertfordshire	0.71	9.165	0.925	24.530
UKK4	Devon	0.709	11.410	0.905	23.753
UKM6	Highlands and Islands	0.709	11.331	0.849	32.668
UKD1	Cumbria	0.708	10.469	0.880	31.360
UKI5	Outer London – East and North East	0.707	8.102	0.875	24.278
UKC1	Tees Valley and Durham	0.706	11.135	0.903	26.417
UKK3	Cornwall and Isles of Scilly	0.705	11.374	0.845	28.198
UKF3	Lincolnshire	0.701	11.434	0.855	26.758
UKD7	Merseyside	0.699	10.302	0.919	24.004
UKI4	Inner London – East	0.698	6.893	0.935	17.226
UKI6	Outer London – South	0.698	8.441	0.915	21.635
UKM9	Southern Scotland	0.693	10.955	0.853	30.578
UKI3	Inner London – West	0.689	5.896	0.945	13.194
UKM5	North Eastern Scotland	0.689	7.665	0.863	18.614
UKE1	East Yorkshire and Northern Lincolnshire	0.682	10.985	0.882	29.245
Average		0.723	10.321	0.906	24.460

Note: Regions are sorted by the largest to the smallest GVA rest of student expenditure multiplier.
Source: Authors' calculations.

and the Isles of Scilly, Highlands and Islands, and Northern Ireland benefit the least in terms of GVA from fee-related spending. Potentially reflecting labour intensity or productivity in the sector, employment multipliers are higher in some of the areas with the lowest GVA multipliers, and vice versa. Highlands and Islands and Southern Scotland generate more than 30 jobs for each £1 million spent on student fees, whilst Inner London – West generates approximately 13. This is in line with studies reflecting on the large disparities in labour productivity among UK regions (Carrascal-Incera et al., 2020; Gardiner et al., 2020).

Not all the impact generated locally remains in that region. The way products arrive in regions (produced locally as opposed to be imported from outside the region) affects the size of the multipliers and the benefits that spill over to other regions (see Table A2 in the supplemental data online for the results and discussion on spillover effects). The total impact of student spending will depend on the size of the domestic multipliers and associated spillovers as well as the number and characteristics of each region's students. This highlights the symbiotic relationship between regional economies and student expenditure, which is fully explored below.

Students' total contribution

Table 3 ranks regions on the basis of their student populations (FTE student numbers) and shows the symbiotic relationship behind the impact of student spending on regional economies. The IO relationships of local industrial structures determine the size of direct and indirect multipliers, whilst the characteristics of regional student populations influence the size of spending by region. The interaction between industrial structures and student spending are behind the variability of the impact by region, whilst the size of the local economy (GVA, employment) co-determines the importance of this spend, locally.

Consequently, the 62,266 FTE students of Berkshire, Buckinghamshire and Oxfordshire (UKJ1) generate the same direct GVA impact as the 81,279 FTE students of Gloucestershire, Wiltshire and Bath/Bristol area (UKK1). In terms of jobs, student expenditure in West Midlands (UKG3) generates more direct jobs than in Inner London – West (UKI3) even though it has 20% fewer FTE students. Similar results are found by comparing Eastern Scotland (UKM7) with Derbyshire and Nottinghamshire (UKF1). Table 3 also highlights the importance of spillovers with one in four to five jobs created by student spending in areas such as Cheshire (UKD6) and Herefordshire, Worcestershire and Warwickshire (UKG1) being associated with spillover effects from spending in other regions.

Comparing these direct and indirect impacts with each region's GVA and employment figures shows the importance of student spending in each regional economy. The significance of these contributions depends both on their magnitude and also the size of the local economies. Student spending accounts for 4.2% of GVA and up to 4.7% of employment in regions such as the West Midlands (UKG3). These figures suggest that places such as North Yorkshire (UKE2) are almost twice as dependent as Inner London – East (UKI4) despite having fewer than half the students.

Figures 5 and 6 show an overview of the capacity of student spending to benefit each region's GVA in terms of fee-related (education sector multipliers) and the rest of student expenditure. They distinguish between those regions that benefit more than the average (dashed lines) directly from this expenditure (vertical axis) and those that benefit indirectly from spillovers (horizontal axis).

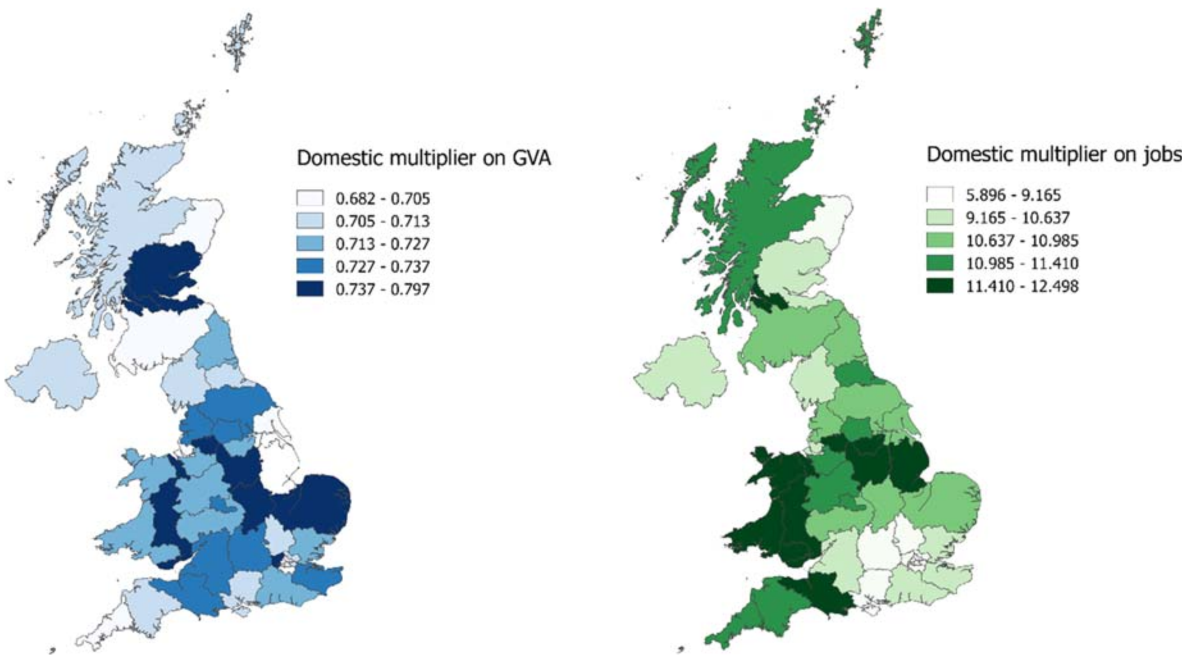

Figure 3. Domestic regional multipliers on gross value added (GVA) and jobs (per £1 million spent) from student expenditure excluding fees.

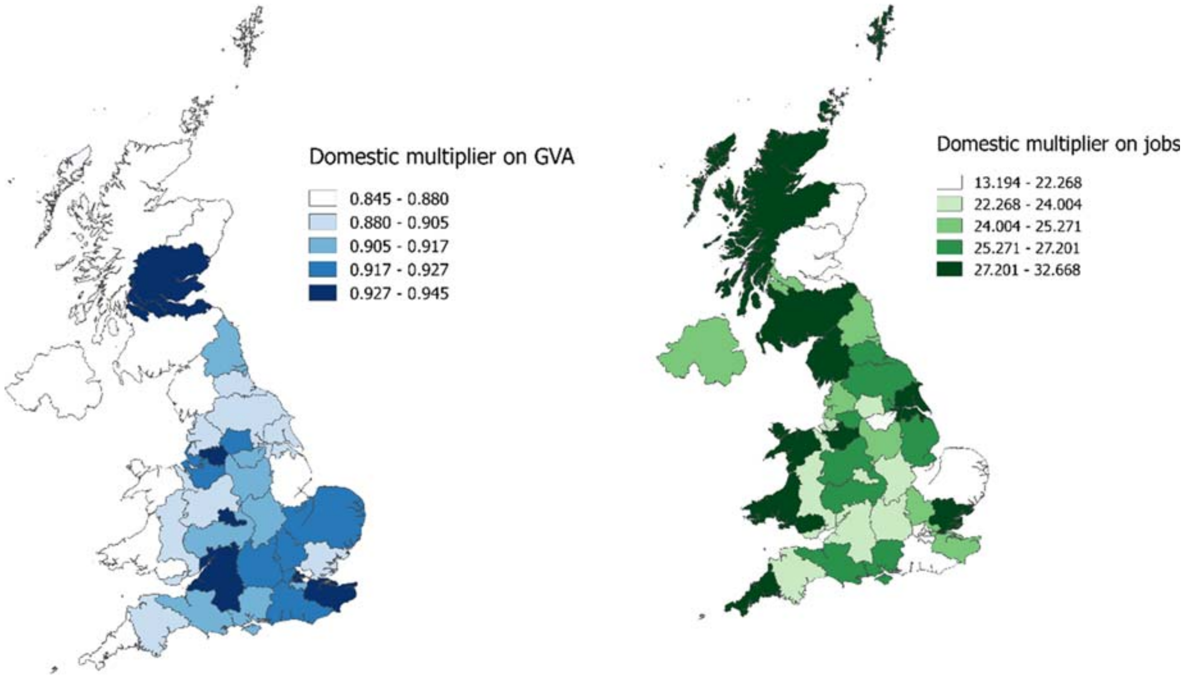

Figure 4. Domestic regional multipliers on gross value added (GVA) and jobs (per £1 million spent) from student expenditure on fees.

By examining Figures 5 and 6, four types of regions arise:

- In the bottom-left quadrant there are regions that benefit below the average from the presence of students both directly and indirectly. These regions would gain from improving their direct absorptive capacity, that is, strengthening their HEI's regional embeddedness or diversifying their industrial structures, but also from establishing further trade relationships with other regions to capture more spillover effects. This is the situation of regions such as North Eastern Scotland (UKM5) and Cornwall and Isles of Scilly (UKK3).
- The top-left quadrant includes regions with high absorptive capacity (domestic effect above average), but limited spillover inflow such as West Yorkshire (UKE4) or Kent (UKJ4). These regions would benefit from increasing trade flows with other regions in order to benefit from higher spillover effects.
- Regions in the bottom-right quadrant are capturing higher than average spillover effects but less than average direct effects from student expenditure locally. Regions with these characteristics are only found when considering the rest of the expenditure multipliers and include regions engaged in long supply chains such as Inner London – East (UKI4) and West (UKI3).
- Finally, regions in the top-right quadrant enjoy the strongest direct and indirect benefits from student expenditure. This group includes the most wholesome regional economies such as Greater Manchester (UKD3) and West Midlands (UKG3) as well as regions in and around London.

DISCUSSION AND CONCLUSIONS

Universities can be a catalyst for the socio-economic fortunes of their host areas in a multitude of ways ranging from the creation of knowledge and the supply of skilled labour to increasing local demand via institutional and student expenditure. Whilst absorptive capacity has been considered a key for the innovation and labour supply channels, expenditure has until now been expected to benefit places homogenously.

This paper challenges this idea by proposing a symbiotic relationship between student spending and the capacity of regions to benefit. An MRIO model for the UK is built to simultaneously consider the contribution of student spending in different regions. The model allows the identification of both the direct and indirect effects of an average student £1 spent.

Significant heterogeneity is found in the direct and spillover effects across NUTS-2 regions in the UK. Regions differ across their own effects, the spillovers they generate and receive, as well as the number of students they host. These produce a variable spatial footprint of student expenditure contributions. The largest direct GVA and employment effects are 17% and 100% higher than the smallest ones (rest of expenditure), whilst the majority of spillover effects are directed to London. Considering the actual size of the impacts, it is evident that student expenditure is more important in some places than others. These results point to the imbalance that is endemic in the economic geography of the UK (Carrascal-Incera et al., 2020; McCann, 2016) and shed light to the mechanisms that fuel it.

Table 3. Total contribution of student expenditure: absolute figures and shares of local gross value added (GVA) and employment.

			Direct impact		Spillovers (incoming)		Share of regional GVA and jobs	
Region code	Region	FTE students	GVA (£ millions)	Jobs	GVA (£ millions)	Jobs	GVA (%)	Employment (%)
UKI3	Inner London – West	180,122	4242	50,107	749	7700	2.49%	2.84%
UKG3	West Midlands	143,679	2796	56,886	111	2153	4.17%	4.66%
UKM7	Eastern Scotland	92,878	1681	27,119	90	1269	3.06%	2.98%
UKD3	Greater Manchester	90,236	1814	38,782	97	2124	2.69%	3.00%
UKE4	West Yorkshire	82,671	1560	31,717	73	1428	2.95%	3.03%
UKK1	Gloucestershire, Wiltshire and Bath/Bristol area	81,279	1547	29,820	110	1922	2.26%	2.54%
UKF1	Derbyshire and Nottinghamshire	75,196	1430	30,153	67	1411	3.10%	3.28%
UKJ2	Surrey, East and West Sussex	65,154	1227	21,681	143	2251	1.64%	1.82%
UKH1	East Anglia	64,093	1309	25,347	102	2021	2.19%	2.30%
UKM8	West Central Scotland	63,543	1027	20,417	36	771	2.81%	2.78%
UKF2	Leicestershire, Rutland and Northamptonshire	63,283	1206	24,105	99	2026	2.86%	2.97%
UKJ1	Berkshire, Buckinghamshire and Oxfordshire	62,266	1547	30,310	237	3486	1.89%	2.53%
UKI4	Inner London – East	61,255	1171	16,779	309	3730	1.37%	1.55%
UKJ3	Hampshire and Isle of Wight	60,151	1118	22,867	99	1560	2.15%	2.71%
UKL1	West Wales	59,807	989	23,060	38	714	2.88%	3.06%
UKC2	Northumberland and Tyne and Wear	59,621	1086	22,239	33	594	3.49%	3.54%
UKE3	South Yorkshire	54,065	1031	19,533	37	812	3.91%	3.51%
UKD7	Merseyside	52,860	985	20,271	35	646	3.04%	3.22%
UKK4	Devon	44,320	797	16,805	17	389	3.24%	3.31%
UKD4	Lancashire	43,306	781	16,412	29	546	2.38%	2.56%
UKI7	Outer London – West and North West	43,145	782	11,760	207	2746	1.37%	1.63%
UKN0	Northern Ireland	40,990	552	9901	51	927	1.43%	1.43%
UKL2	East Wales	39,908	741	14,691	34	608	2.63%	2.62%
UKH2	Bedfordshire and Hertfordshire	33,027	629	12,470	120	2166	1.30%	1.55%
UKC1	Tees Valley and Durham	31,717	583	13,096	19	309	2.67%	3.03%
UKJ4	Kent	29,783	531	10,450	74	1295	1.43%	1.61%
UKE2	North Yorkshire	23,612	446	9783	29	580	2.29%	2.55%
UKG2	Shropshire and Staffordshire	22,951	387	8354	44	920	1.24%	1.30%
UKM5	North Eastern Scotland	22,563	285	4022	59	844	1.89%	1.69%
UKK2	Dorset and Somerset	19,189	334	7183	20	419	1.18%	1.28%
UKI5	Outer London – East and North East	18,025	310	5922	56	752	0.98%	1.18%
UKF3	Lincolnshire	15,985	264	6104	26	612	1.94%	2.19%

(*Continued*)

Table 3. Continued.

Region code	Region	FTE students	Direct impact GVA (£ millions)	Direct impact Jobs	Spillovers (incoming) GVA (£ millions)	Spillovers (incoming) Jobs	Share of regional GVA and jobs GVA (%)	Share of regional GVA and jobs Employment (%)
UKI6	Outer London – South	15,076	267	4716	74	1317	1.06%	1.28%
UKH3	Essex	14,938	271	6153	61	1076	0.78%	0.97%
UKM9	Southern Scotland	14,048	152	2925	21	354	1.07%	0.90%
UKE1	East Yorkshire and Northern Lincolnshire	13,657	231	5631	45	805	1.36%	1.58%
UKD6	Cheshire	11,161	190	4371	77	1237	0.82%	1.10%
UKG1	Herefordshire, Worcestershire and Warwickshire	8650	149	3294	66	1254	0.58%	0.68%
UKM6	Highlands and Islands	7073	74	1403	20	420	0.77%	0.76%
UKK3	Cornwall and Isles of Scilly	5957	98	2359	16	359	1.04%	1.16%
UKD1	Cumbria	5566	91	2195	24	475	0.96%	1.05%
Total	UK	1,936,808	36,710	691,191	3655	57,030	2.06%	2.31%

Note: FTE, full-time equivalent.
Source: Authors' calculations using data from the Student Income and Expenditure Survey (SIES) (Maher et al., 2018) and Higher Education Statistical Agency (HESA).

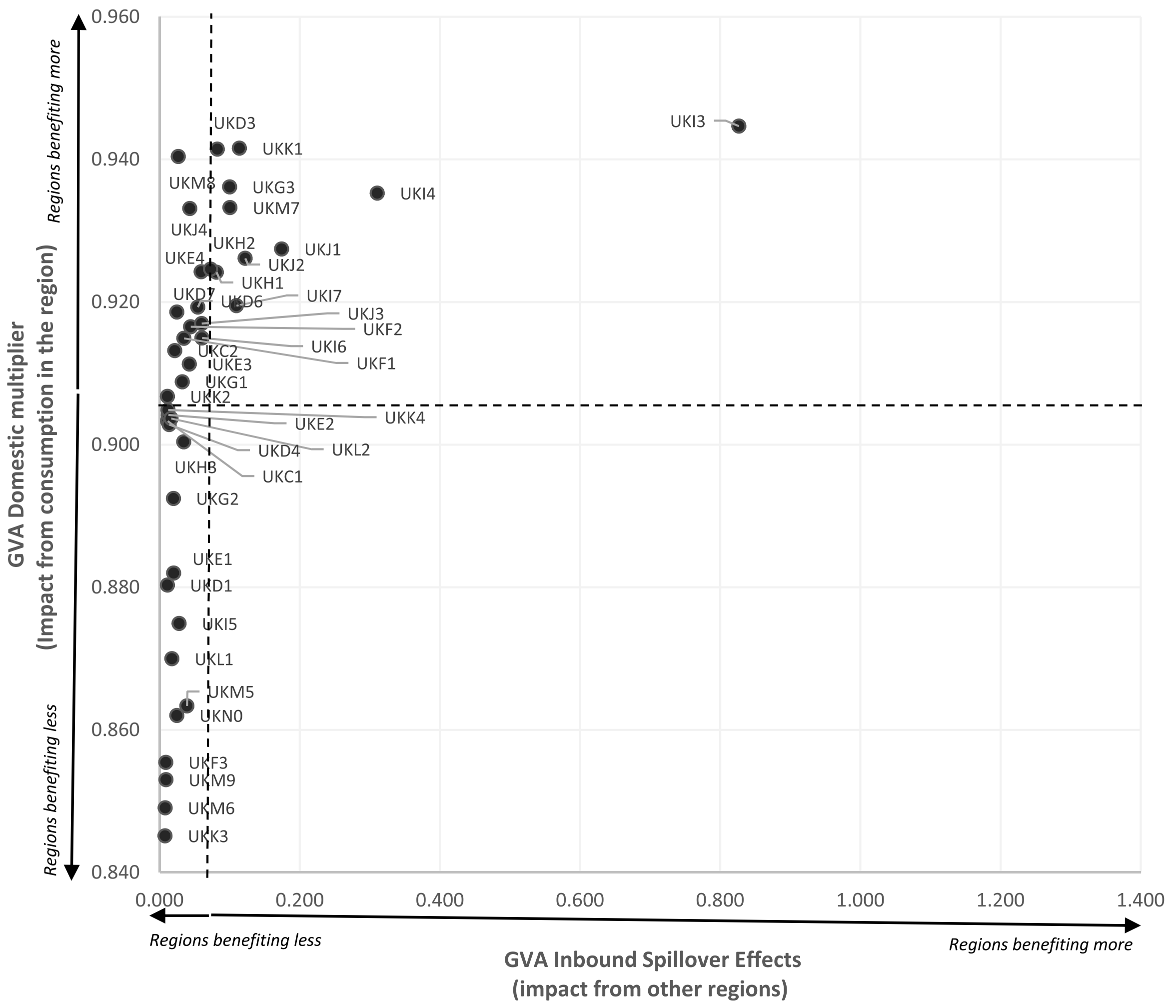

Figure 5. Quadrant of relative own effect and relative spillovers from other regions for the education multipliers.

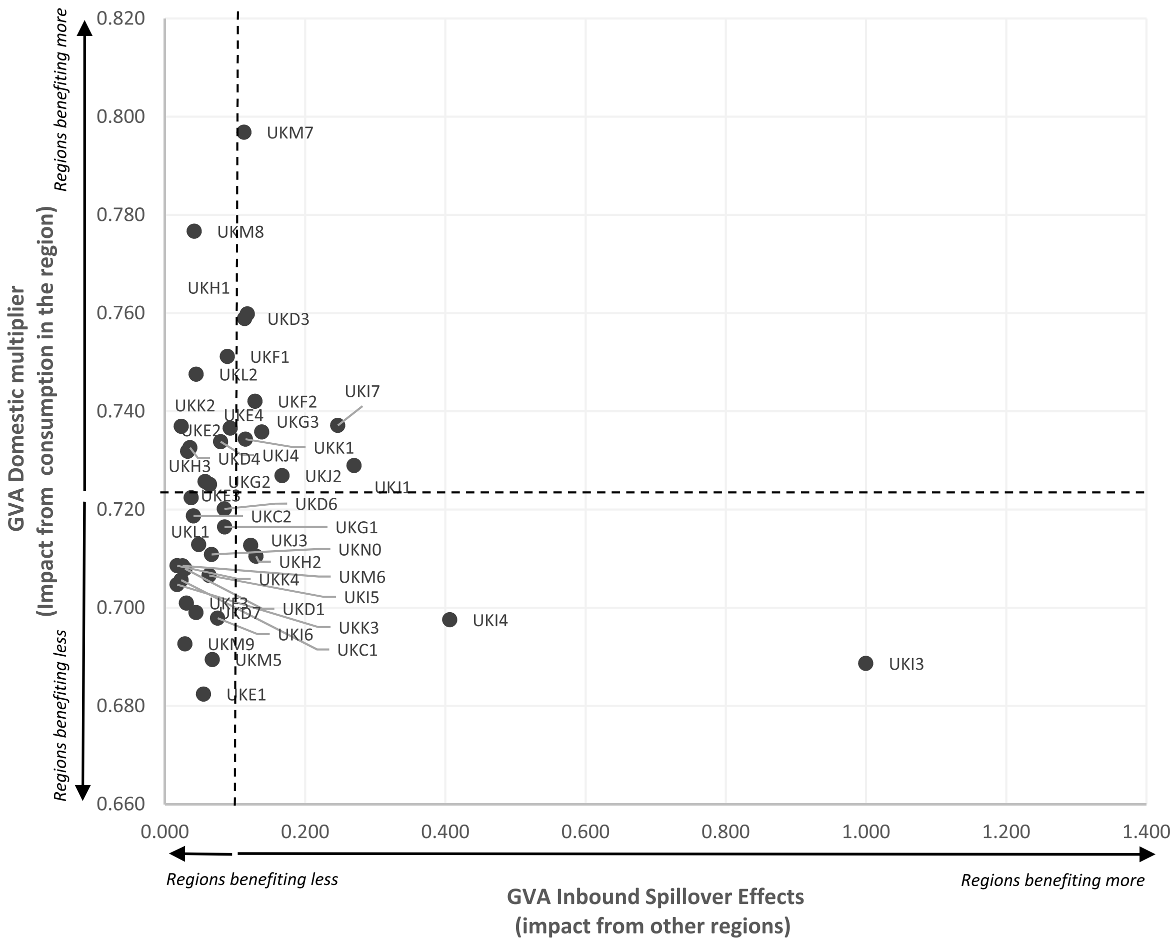

Figure 6. Quadrant of relative own effect and relative spillovers from other regions for the rest of the expenditure multipliers.

The level of regional economic diversification and specialization significantly determine the observed differences both in the direct and spillover effects. The former are higher in regions with more diversified economic bases that offer a wider range of industries that can match student demand at the local level. This results in higher direct multiplier effects. However, specialization still has a role to play. The dominance of London in finance and real estate allows it to be the centre through which a lot of the student expenditure flows which makes the regions of the capital the largest recipients of spillover effects.

In policy terms, the paper highlights the need to consider a region's capacity to benefit when measuring the impact of student expenditure. To maximize the benefits from student spending, local industrial strategies should provide for a wide, diversified economic base coupled with specializations around the main student expenditure items. In addition, the paper highlights that increasing student numbers will have varying effects in different places and that some places would benefit more from achieving higher multipliers rather than plainly increasing their number of students.

Finally, the paper's approach has specific limitations that open up avenues for further research. An interesting extension of this analysis would look into intra-household transfers and their effect on the total student impact. Evidence suggests that student expenditure is partly financed from intra-household transfers (Hermannsson et al., 2018). To the extent that this represents a consumption displacement effect, it means that the total impact of student expenditure needs to be revised downwards. Adding to this the interregional mobility of students, intra-household transfers further displace consumption from one region to another. Estimating the extent of this displacement will add an interesting nuance in impact studies of this kind. A further step is to calculate the different contribution to local labour markets, in terms of the type of skills that are demanded by the sectors (directly and indirectly) in order to satisfy student demand. Additionally, it would be interesting to estimate the induced effects of the income generated to those households employed to meet this demand, since they will have an additional spending effect in the local economy as well. Lastly, from a life-cycle and dynamic perspective, students become graduates and regions can see their labour supply increased with qualified new workforce if these students stay local. Considering the retention and mobility of these graduates (Faggian et al., 2007a, 2007b) can provide further insights into the characterization of regions in those that benefit from student spending in the short-run but they export qualified graduates and others who benefit from both student expenditure and graduate migration in the medium and long-run. This could reveal regional brain drain phenomena within a country and have significant consequences in the potential growth of certain areas.

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NOTES

1. The terms 'university' and 'higher education institution' are used throughout interchangeably.
2. Due to these restrictions, input–output models are often regarded as a short-run impact model (as a quantity model where prices cannot be changed in the short run) and computable general equilibrium (CGE) models as a preferred option in dealing with medium and long-run effects.
3. Domestic flows do not take into account imported flows. The model expressed in domestic terms is used in impact analyses in order to exclude the possible leakages to other regions and the overestimation of the effects calculated.
4. It is composed by the subtraction of the identity matrix ($\boldsymbol{I}$) and the coefficients matrix ($\boldsymbol{A}$). The inverse of those elements reflects a power series of the $\boldsymbol{A}$ matrix where $\boldsymbol{I} + \boldsymbol{A}$ are the direct effects and the subsequent $\boldsymbol{A}^2 + \boldsymbol{A}^3 + \ldots + \boldsymbol{A}^\infty$ are the indirect effects. By just taking domestic inputs and outputs into account, this $\boldsymbol{A}$ matrix does not reflect technologies of production but domestic coefficients of production.
5. This is a type I IO model and as such the income generated by the expenditure of students is not creating further rounds of effects (induced effects).
6. As the students' final demand is provided at purchasing prices, we need to transform it into basic prices. For this last transformation, the only information available comes from the Supply Table of the ONS that provides the 'Total domestic output of products at basic prices' and the 'Total supply of products at purchasers' prices'. The Supply Table also contains information on how much of that difference is due to distributors' trading margins and how much is due to taxes less subsidies on products. Hence, by using this information it is possible to discount indirect taxes and reallocate the distributors' trading margins to the wholesale and retail trade sectors.
7. GVA at the NUTS-2 level comes from ONS's regional accounts, and the number of jobs by region and sector is from the Business Register and Employment Survey.

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