

International Students and Regional Economic Growth: Panel Evidence from the United Kingdom and Australia

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Abstract. Higher education has become a substantial export sector in several advanced economies, yet the regional economic footprint of international student inflows remains unevenly documented. This paper examines whether international student enrolments are associated with higher output per capita at the subnational level in the United Kingdom and Australia. Two balanced panels are assembled, covering the four countries of the United Kingdom from 2013 to 2022 and the six states and two mainland territories of Australia from 2005 to 2022. A double-log specification relating output per capita to enrolments and resident population is estimated by pooled ordinary least squares, by fixed effects and by random effects, with the Hausman test used to select between the latter two. The fixed effects estimates indicate that a one per cent increase in enrolments is associated with an increase of approximately 0.0494 per cent in gross domestic product per capita in the United Kingdom and approximately 0.101 per cent in gross state product per capita in Australia, both statistically significant. The Australian point estimate is the larger of the two, although the difference between them is not statistically significant. The estimates describe the level of nominal output per capita rather than a growth rate, and they are associations rather than causal effects, since enrolments and regional output are jointly determined and no instrument is available.

Keywords: international students, regional output, panel data, fixed effects, higher education export

1. Introduction

The internationalisation of higher education has turned overseas recruitment into a significant revenue stream for universities in the English-speaking world, and several governments now treat that population as an export market.

Evidence that higher education capacity matters for regional prosperity is established. Valero and Van Reenen [1] report that a ten per cent increase in the number of universities per capita in a region is associated with an increase of approximately 0.4 per cent in subsequent gross domestic product per capita. University counts, however, move slowly, which makes them an unsuitable margin for studying short-run regional dynamics. Enrolment of international students responds to fees, visa rules and exchange rates within a single admissions cycle, and therefore offers a margin on which the economic contribution of higher education can be observed over shorter windows.

Therefore, a subnational panel of the UK and Australia is used in this paper. Analysis is carried out at the sub-national level, and changes in the concentration of students in certain areas are masked by national averages; therefore, both panels are estimated using a common double-log model for direct comparison of magnitudes.

Section 2 presents the evidence for the fiscal, labour market and social effects of international student mobility. Section 3 shows the data and the estimating equations. Section 4 presents the results, Section 5 discusses the difference in magnitude, and Section 6 concludes.

2. Literature review

The three links for international student inflow to regional output are institutional finance, the labour market and the policy environment, along with associated social costs.

International students generally pay much higher fees than those paid by domestic students; thus, they constitute a small part of the income for institutions with limited public funds. Bound, Braga, Khanna and Turner [2] estimated that in the United States, a ten per cent decline in state appropriations between 1996 and 2012 led to a sixteen per cent increase in international undergraduate enrolment at public research universities, thus fee income substituted for withdrawn public funds. Beine, Delogu and Ragot [3] have shown in Italy that the tuition fee elasticity is approximately -0.8 and, positively correlated with educational quality, thus fiscal contributions will only occur if fees are competitive.

Retained graduates expand the host skill foundation. Beine, Peri and Raux [4] believe that one additional international master's student added about 0.23 employees to the United States' skilled labour force in the year of graduation, and about 0.08 for bachelor's students; this effect was positive and statistically significant only in science, technology, engineering and mathematics. Graham and Pottie-Sherman [5] added an entrepreneurial margin and documented international student start-ups in a non-core Atlantic Canadian city.

Benefits are dependent on policy, and the costs are distributed unevenly. Császár, Tarrosy, Dobos, Varjas and Alpek [6] found that for Hungary, student expenditure has provided the highest net sectoral benefits in education and housing, followed by retail. Mocanu and Tremacoldi-Rossi [7] have found that the rise of overseas students after 2005 supported the US housing market during the Great Recession and increased rents and home prices. Lomer [8] thinks that UK policy talk now often presents overseas students as economic assets and exposes recruitment to the fluctuations in immigration policy.

The literature thus establishes plausible transmission mechanisms but reports magnitudes mostly for single countries and often at national scale. Subnational and two-country estimations are used.

3. Data and methodology

3.1. Data

The United Kingdom panel covers England, Wales, Scotland and Northern Ireland annually from 2013 to 2022, giving forty observations. Gross domestic product per capita at current market prices is taken from the Office for National Statistics [9], resident population from Statista [10], and international student enrolments in higher education by permanent address from the Higher Education Statistics Agency [11].

The Australian panel covers New South Wales, Victoria, Queensland, South Australia, Western Australia, Tasmania, the Australian Capital Territory and the Northern Territory annually from 2005

to 2022, giving one hundred and forty-four observations. Gross state product per capita at current prices and estimated resident population are taken from the Australian Bureau of Statistics [12, 13], and enrolments from the Department of Education [14]. Gross state product measures output within a state or territory and sums to national gross domestic product. New Zealand citizens hold entitlements comparable to those of domestic students in Australia and are excluded from the enrolment counts.

The cited pages are rolling releases; the panels use the vintages published as of September 2024, which are no longer current. The component series also rest on different time bases, since enrolments are reported by academic year, Australian state accounts by financial year and the rest by calendar or mid-year reference, with no explicit alignment rule applied.

In the United Kingdom, output per capita rose steadily from 2013 to 2019, declined in 2020 under the pandemic and increased year on year thereafter, while population and enrolments rose in every year of the window. In Australia, gross state product per capita fell markedly in 2009, 2014 and 2020 but trended upward over the sample, and population rose year on year in all eight units. All three series therefore trend upward across both windows, a pattern the specification cannot separate from a common time trend. Table 1 reports descriptive statistics. Dispersion is pronounced in both panels because the units differ by an order of magnitude in size, with England dominating the United Kingdom distribution and New South Wales and Victoria the Australian one.

From 1 August 2021 students domiciled in the European Union became liable for the same fees as other international students at United Kingdom institutions [15], and enrolments from those countries fell in the following cycle, so the 2021 figure should be read with that policy change in mind. In Australia, enrolments rose in every year from 2005 to 2019 before falling from 2020, when border closures curtailed student visa issuance.

Table 1. Descriptive statistics

Variable	Mean	SD	Min	Median	Max
<i>Panel A. United Kingdom, four countries, 2013 to 2022 (N = 40)</i>					
GDP per capita (GBP)	27,466.1	4,265.584	20,724.000	27,543.5	37,852
Enrolments	104,921.38	158,793.96	2,585.000	28,660	630,005
Population	16,499,724	22,912,638	1,831,677.00	4,230,188	57,112,542
<i>Panel B. Australia, six states and two territories, 2005 to 2022 (N = 144)</i>					
GSP per capita (AUD)	69,854.806	20,080.985	34,857.000	64,918.5	146,493
Enrolments	371,421.31	425,035.69	1,602.000	193,909	1,646,303
Population	2,925,733.3	2,630,473.6	207,385.00	1,933,016	8,249,295

Sources. Panel A, [9-11]. Panel B, [12-14].

3.2. Empirical specification

A double-log specification is adopted so that estimated coefficients are elasticities. Let i index the region, that is a country of the United Kingdom or an Australian state or territory, and let t index the year. The pooled specification is

$$\ln(y_{i,t}) = \alpha_0 + \alpha_1 \ln(S_{i,t}) + \alpha_2 \ln(N_{i,t}) + \varepsilon_{i,t} \quad (1)$$

where y denotes output per capita, S denotes international student enrolments, N denotes resident population, α_0 is a constant and ε is an idiosyncratic error. Adding a region-specific intercept η_i to absorb time-invariant heterogeneity gives the fixed effects specification

$$\ln(y_{i,t}) = \alpha_0 + \alpha_1 \ln(S_{i,t}) + \alpha_2 \ln(N_{i,t}) + \eta_i + \varepsilon_{i,t} \quad (2)$$

Modelling the region effect instead as a random draw μ_i uncorrelated with the regressors gives

$$\ln(y_{i,t}) = \alpha_0 + \alpha_1 \ln(S_{i,t}) + \alpha_2 \ln(N_{i,t}) + \mu_i + \varepsilon_{i,t} \quad (3)$$

The random effects estimator is more efficient when its orthogonality assumption holds and inconsistent when it fails, so the choice between equations (2) and (3) is made by the Hausman specification test rather than by any comparison of goodness-of-fit statistics, which are not comparable across estimators applying different transformations to the data. Estimation is carried out in Stata. The specification contains no year effects and no common time trend, and the dependent variable is a level rather than a growth rate.

4. Results

Table 2 reports estimates of equations (1) to (3) for both panels.

Table 2. Regression results

Variable	(1) OLS	(2) Fixed effects	(3) Random effects
<i>Panel A. United Kingdom, dependent variable $\ln$ GDP per capita ($N = 40$)</i>			
$\ln S$	0.0816*** (0.0277)	0.0494** (0.0240)	0.137*** (0.0224)
$\ln N$	-0.00868 (0.0343)	4.171*** (0.799)	-0.0554 (0.0739)
Constant	9.498*** (0.285)	-55.72*** (12.35)	9.650*** (1.087)
R-squared	0.628	0.740	0.526
<i>Panel B. Australia, dependent variable $\ln$ GSP per capita ($N = 144$)</i>			
$\ln S$	0.112*** (0.0386)	0.101*** (0.0208)	0.310*** (0.0332)
$\ln N$	-0.161*** (0.0485)	1.783*** (0.106)	0.0119 (0.0974)
Constant	12.07*** (0.312)	-15.56*** (1.346)	7.005*** (1.218)
R-squared	0.074	0.878	0.616

Notes. Standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Hausman test, Panel A, chi-square 28.248, $p < 0.001$. Panel B, chi-square 1135.175, $p < 0.001$. Both reject random effects in favour of fixed effects. The source study does not record whether the reported standard errors are conventional, robust or clustered.

For the United Kingdom, pooled estimation returns an enrolment elasticity of 0.0816, so that a one per cent increase in enrolments is associated with an increase of approximately 0.0816 per cent in output per capita. Fixed-effects estimation reduces the elasticity to 0.0494, significant at the five per cent level. The attenuation is expected, since pooled estimation attributes to enrolments part of the persistent income gap between England and the smaller countries, which the within-region estimator removes. Population becomes significant once regional heterogeneity is absorbed, at 4.171, a magnitude implausible as a structural elasticity and better read as reflecting limited within-

region population variation over a ten-year window. The random-effects estimator returns 0.137, but the Hausman statistic of 28.248 rejects its orthogonality assumption, so the preferred estimate is 0.0494.

For Australia, the pooled specification returns 0.112 with an R-squared of 0.074, indicating that the two regressors account for little of the raw variation once regional identity is ignored. Under fixed effects the elasticity is 0.101, significant at the one per cent level, with population entering at 1.783. The random-effects estimator returns 0.310, and the Hausman statistic of 1135.175 rejects it decisively, so the preferred estimate is 0.101.

In both panels the sign and significance of the enrolment coefficient are stable across all three estimators, indicating that the positive association is not an artefact of a single modelling choice. The magnitude, by contrast, is sensitive to the treatment of regional heterogeneity, and only the within-region estimates are reported as preferred.

5. Discussion

The preferred estimates place the enrolment elasticity at approximately 0.0494 in the United Kingdom and approximately 0.101 in Australia. The Australian point estimate is roughly twice the British one, but the two are not statistically distinguishable. Treating the panels as independent, the difference of 0.0516 has a standard error of 0.0318, a z-statistic of 1.62 and a two-sided p-value of 0.10, and the 95 per cent confidence intervals, 0.002 to 0.096 for the United Kingdom and 0.060 to 0.142 for Australia, overlap. The magnitudes are moderate and lie in the neighbourhood of the university-count elasticity of approximately 0.04 implied by [1], with the United Kingdom estimate close to that benchmark and the Australian estimate about two and a half times it, so the enrolment margin, which moves within a single admissions cycle, is associated with output at magnitudes comparable to the far slower institutional margin.

Several mechanisms are consistent with a positive association. Fee income sustains teaching and research capacity where public funding recedes [2] and responds to the fee and quality conditions documented for Italy [3]. Expenditure on accommodation, food and services circulates through the local economy, with education, housing and retail capturing the largest net sectoral benefits [6]. Retained graduates augment the supply of skilled labour, an effect concentrated in science, technology, engineering and mathematics [4], and a minority establish businesses in regions with thin entrepreneurial bases [5].

Taken as point estimates, the gap between the two coefficients is consistent with differences in exposure and in sample composition. Australian enrolments concentrate heavily in New South Wales and Victoria, so a proportional change in enrolments moves a larger share of measured state output, and the Australian window averages over both the long expansion to 2019 and the pandemic contraction from 2020. The United Kingdom window is shorter, ends amid the move of European Union students to international fee status in 2021 [15], and sits within a policy environment subject to repeated revision, a volatility that has been argued to weaken the position of the United Kingdom in international recruitment [8].

Four qualifications constrain interpretation. First, the dependent variable is the level of nominal output per capita, not a growth rate, and the specification carries no year effects and no deflator, so the coefficients may load on inflation and on trends common to all regions. Second, the estimates are associations rather than causal effects, since enrolment decisions respond to regional economic conditions as well as influencing them and no instrument breaks that simultaneity. Third, the specification includes only enrolments and population, so omitted determinants of regional output

that co-move with enrolments are absorbed into the error term. Fourth, the 2021 fee-status change in the United Kingdom disturbs the enrolment series at the end of the panel.

6. Conclusion

Fixed-effects estimation, selected by the Hausman test in both panels, indicates that a one per cent increase in international student enrolments is associated with an increase of approximately 0.0494 per cent in gross domestic product per capita in the United Kingdom and approximately 0.101 per cent in gross state product per capita in Australia. The association is positive and significant in both settings. The Australian point estimate is the larger of the two, although the difference between the two estimates is not statistically significant.

Two policy implications follow from the above qualifications. Areas whose output is directly linked to enrolment flows are subject to the same fee and visa policies. At the same time, concentrated inflows generate costs, most visibly in the housing market [7], and these fall on incumbent residents and are not reflected in output per capita. To determine the net contribution, both sides of that ledger are required.

The study has some defects. The dependent variable is a nominal level rather than real growth, and the specification does not include year effects or control for industrial structure, investment and macroeconomic cycles. The basis for the reported standard errors in the source study is not provided, and thus the level of significance cannot be determined independently. The UK panel is small, thus reducing precision and making the within-region population coefficient weakly identified. The Design does not find a causal effect. Future work should deflate the output to constant prices, add year effects, address simultaneity with instrumental variables or policy discontinuities, align the series on a common time base, extend the panel to include more host countries, and distinguish enrolments by level of study and field, as the fiscal and labour market channels are unlikely to operate equally strongly for all of them.

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