The impact of international students in the UK on the cultural goods trade

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Abstract

This study examines the economic impact of international students' influx on UK's cultural goods trade after the abolition of Post Study Work (PSW) visa, which effectively allow graduates from non-EU countries to stay in the UK for at least two years after completing a UK degree. Using administrative enrolment data covering the universe of UK higher education sector spanning from 2008 to 2016, this study provides evidence demonstrating that the PSW visa abolition corresponded with a 34.62% average reduction in the value of UK's cultural goods export trade to non-EU countries (relative to that to EU countries). On the contrary, the PSW visa abolition has no impact on cultural goods import trade. Furthermore, the PSW visa abolition only impacts on cultural goods export to countries with low GDP, population, and high stock of immigrants. Given the substantial negative impact of a decreased influx of international students, government should be well-warranted when formulating relevant policy.

Keywords: International students, cultural goods trade, PSW visa abolition, United Kingdom

JEL Codes: F16, I23

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1 Introduction

In September 2019, under the leadership of Prime Minister Boris Johnson, the United Kingdom (UK) reintroduced the Post-Study Work (PSW) visa[1]. This represents a substantial policy shift from the decision to abolish the visa scheme, a move made by Theresa May in her capacity as Home Secretary. The abolition of PSW visa in 2012 was perceived by universities as a deterrent to international student recruitment due to the presence of comparable visa schemes in competing countries like the US, Canada, and Australia. It was believed to be a major contributor to the significant decline (over 50% between 2010 and 2012) in the enrollment of Indian students in the UK (House, 2020).

The number of international students in the UK reached a total of 496,110 in the 2018/19 academic year[2]. Moreover, the 2018/2019 cohort of first year international students brought an estimated net economic contribution of £25.9 billion (Halterbeck and Conlon, 2021). A reduction in the influx of international students may have detrimental effects not only on the UK's economy but also on the UK's soft power[3], as it can lead to a reduction in diversity, a weakened reputation, limited economic impact, and constrained international networks.

In addition, the cultural industry is a knowledge-intensive industry whose level of development is highly dependent on the level of talent absorbed, and it produces the goods that are traded in the global marketplace. The influx of international students and the cultural goods trade are the main components of building soft power.

The cultural industry, sometimes called "mass culture", "popular culture", "media culture", "content industries", or "copyright industries", has different meanings in different countries, historical and cultural contexts. In the UK, it is referred to as the "creative industries." Most studies follow the definition of cultural industries from the United Nations Educational, Scientific and Cultural Organization (UNESCO), which refers to the use of essentially intangible cultural content in combination with creation, production, and commercialization.

Given this diverse understanding of the cultural industry, the UK's specific economic

[1]Information on the reintroduced policy refers to: https://www.gov.uk/government/news/graduate-route-to-open-to-international-students-on-1-july-2021; News about visa reintroduction refers to: https://www.timeshighereducation.com/news/uk-reintroduce-two-year-post-study-work-visas.

[2]Data Source for international students' number: https://www.hesa.ac.uk/data-and-analysis/students/where-from#non-uk.

[3]Soft power, distinct from hard power, is a country's ability to influence others through attraction rather than coercion. In the UK, soft power is manifested through cultural influence, media, education, and diplomacy, contrasting with hard power's focus on economic and military might. This approach, important for the UK's global presence, aligns with Joseph Nye's concept of blending hard and soft power into 'smart power' for effective foreign policy (Nye, 2017).

contribution in this sector, as reported by the Department for Digital, Culture, Media, and Sport (DCMS) for the year 2019, is particularly insightful. In 2019, data from the UK's DCMS highlighted the substantial economic impact of the cultural industry excluding tourism, this industry contributed £212.0 billion to the UK economy[4]. Additionally, it accounted for 5.3 million jobs, corresponding to 15.7% of all employment in the UK[5]. In terms of international trade, the cultural industry accounted for £29.9 billion in goods exports (8.3% of the UK's total goods exports) and £53.6 billion in goods imports (9.8% of the UK's total goods imports)[6].

However, only a few studies have examined the economic impact of international students, while most of the literature focuses on the determinants of their influx. In addition, it remains unclear how the abolition of the international talent introduction policy impacts international trade, especially since prior studies have pointed out the positive impact of the international student influx on international trade. To address this gap, we aim to test the hypothesis that international students have an impact on the cultural goods trade in the UK, a major player in both the international higher education market and international trade.

This study contributes to the existing literature (Murat, 2014; Wei and Chen, 2015; Wei and Yuan, 2017) in several ways. First, using administrative enrolment data covering the universe of the UK higher education sector, we adopt a plausible identification strategy to find the negative impact of PSW visa abolition on cultural goods export. Second, we provide the first robust evidence on the negative economic outcome of the UK abolishing international talent introduction policy. This study distinguishes itself from previous literature by targeting trade in a specific sector and encompassing the characteristics of students.

The remainder of the paper organized as follows. Section 2 reviews similar literature. Section 3 presents the institutional background while Section 4 introduces the data and method for empirical analysis. Section 5 presents the empirical analysis divided into four distinct segments. We begin with estimating the effects of PSW visa abolition. Then, the heterogeneity of the effects is estimated in relation to the economic and cultural characteristics of different country groups. Finally, we discuss the mechanisms of the PSW visa abolition. Section 6 concludes the study.

[4]Data Source for DCMS economic contribution: https://www.gov.uk/government/statistics/dcms-sectors-economic-estimates-2019-regional-gva/dcms-sectors-economic-estimates-2019-regional-gva-headline-release

[5]Data Source for DCMS employment: https://www.gov.uk/government/statistics/dcms-sectors-economic-estimates-2019-employment/dcms-sectors-economic-estimates-2019-employment

[6]Data Source for DCMS traded goods: https://www.gov.uk/government/statistics/dcms-economic-estimates-2019-trade-report/dcms-sectors-economic-estimates-2019-trade

2 Literature Review

Most of the existing research in the economics of migration have explored the economic effects of population movements from the perspective of international migration flows. Gould (1994) initially posited that international migration engenders a trade creation effect, elucidating that migration influences trade via two principal channels. First, an increase in migrant numbers correlates with increased import trade; second, migrant networks significantly contribute to diminishing the costs associated with trade between their nations of origin and destination. Subsequently, the facilitation of trade by immigrants, also known as the pro-trade effect of immigration, is corroborated by extensive literature. This body of work includes single-country analyses with studies from Canada (Head and Ries, 1998), the US (Dunlevy and Hutchinson, 1999), the UK (Girma and Yu, 2002), Spain (Blanes, 2005) and Switzerland (Tai, 2009). Furthermore, there are multi-country analyses (Felbermayr and Jung, 2009; Egger et al., 2012; Felbermayr and Toubal, 2012; Aleksynska and Peri, 2014). Lastly, studies examining bilateral trade from a micro-perspective, focusing on interactions between domestic regions (states or provinces) and foreign countries, has been conducted. The countries under investigation include Canada (Wagner et al., 2002), the USA (Herander and Saavedra, 2005), Spain (Peri and Requena-Silvente, 2010), Italy (Bratti et al., 2014), and France (Combes et al., 2005; Briant et al., 2014).

The methodological approach in earlier studies predominantly employed Ordinary Least Squares (OLS), as exemplified by the foundational works of Gould (1994) and Rauch and Trindade (2002). In contrast, more recent research has shifted towards the use of Instrumental Variables (IV) to address endogeneity, investigating trade with EU countries (Campaniello, 2014), Japan (Cohen et al., 2017), and Vietnam (Parsons and Vézina, 2018).

Beyond this body of literature, researchers aim to determine which specific immigrant groups are pivotal to the trade-migration nexus. Highly skilled migrants, especially those engaged in business-oriented occupations, are likely to possess more extensive foreign market information, thereby being more effectively positioned to disseminate and utilize this knowledge. Felbermayr and Jung (2009) discovered that the pro-trade elasticity of high-skilled immigrants is almost four times greater than that of their low-skilled counterparts. In a similar vein, Herander and Saavedra (2005) and Felbermayr and Toubal (2012) demonstrate more pronounced pro-trade effects within high-skilled ethnic networks compared to the corresponding impact of the aggregate immigrant population. Additionally, Giovannetti and Lanati (2017) find that the pro-trade effect of high-skilled immigrants is more significant for high-quality goods, attributable to their lower liquidity constraints and superior human capital advantages.

International students, as potential high-skilled immigrants, have garnered significant interest from researchers concerning their economic effects. Bound et al. (2021) discusses the significant economic effects brought by international students on the US educational institutions and subsequently the US economy. International students represent a significant source of revenue; without a steady influx of these students, universities would have faced the necessity to either navigate reductions in instructional resources per student or substantially increase tuition for domestic students (Bound et al., 2020). This cross-subsidization is not only evident in the US (Shih, 2017) but also in the UK Machin and Murphy (2017). The intensification of political concerns subsequent to the escalation of US-China trade relations in 2018 may potentially impede the influx of international students. Khanna et al. (2023) estimate that the US-China trade war could cost US universities 27,948 Chinese students or 1.1 billion dollars in tuition revenue per year. Notwithstanding, the estimated loss is likely an underestimation of the overall economic losses for the US economy, as it does not encompass the broader effects on local economies surrounding universities.

Murat (2014) is the first study investigating the impact of international students from 167 countries on UK's trade during 1999-2009. This study clearly reveals the positive nexus that exists between international student and the UK's bilateral trade and contributes to the understanding of the overall effects of students' international movements on the economic exchanges between the involved countries. However, this research suffers from certain limitations: the sample of international students lacked further details on the students' characteristics (e.g., gender, the level and subject of study, and the HE provider); the international trade value was all in commodities. Some specific sectors of commodities, such as cultural goods that have a closer connection with international student, were ignored. Nevertheless, the identification strategy in Murat (2014) is 2SLS, which adopts the outbound students from the origin countries to all destination countries except the UK and the distance between the origin countries and the US as IV to address potential endogeneity problems. In contrast, the Difference-in-Differences (DID) approach based on a natural experiment method we propose is a clearer and more plausible identification strategy.

There is empirical evidence suggesting that policies such as the PSW visa, which permit international students to seek employment in their host countries post-graduation, significantly influence the decisions of international students. The Optional Training Programme (OPT) is a 12-month work visa available to international students who seek employment in the US in their fields of study and implemented a further extension to 17-month for STEM

students. Some studies employed the OPT extension[7] to construct natural experiments, revealing its positive impact on the engagement and success of international students in the U.S., particularly in STEM fields [8].

3 Institutional Background

The Points-Based System (PBS) launched in 2008 brought a major change to the UK's immigration system. The main objective of its introduction was to simplify the immigration system into 5 tiers of visas and allow the selection of immigrants with needed skills in the UK's labour market. As part of the introduction of PBS, the UK (Labour) government decided to introduce the Post-Study Work (PSW) scheme under the Tier 1 visa to benefit all foreign graduates in the UK[9].

Under the PSW scheme, international students who graduated from British Higher Education Institutions (HEIs) were allowed to stay in the UK for up to 2 years after finishing their studies without a work permit or job offer. This was perceived as being "too generous" by the subsequent Conservative-Liberal Democrat Coalition government because applicants could be hired for any type of job and were not required to have sponsorship. As a result, on March 21, 2011, Theresa May, as Home Secretary, announced that the current PSW visa route would be closed beginning in April 2012[10]. According to the statement of Theresa May, the abolition of the PSW visa was mainly due to two reasons: firstly, the abuse of the

[7]There have been two OPT extensions: the first in April 2008, which increased the visa duration to 17 months for STEM students, and the second in May 2012, which expanded the list of STEM majors eligible for the OPT extension.

[8]The OPT extension positively affects the quantity and quality of international students (Amuedo-Dorantes et al., 2020); the international students who first came to the US on student visas are 18% more likely to major in STEM (Amuedo-Dorantes et al., 2019); international students majoring in STEM have an increased initial stay rate in the US (Demirci, 2019); and the number of Master's degrees in STEM business majors awarded to international students increased by 62.2% (Kim, 2022)

[9]The PSW visa is categorised under Work (Visa type group) → High Value (Visa type) → Tier 1 – Post Study (Visa type subgroup). Although the PSW visa closed in 2012, and there was a significant drop in main applicants following that date, some applications could still be found in the datasets. Most of the applications in the post-abolition period come from the type of "Dependants" that did not drop until 2014 because they can apply at any time during the visa, and there may still be a rare route to still apply for this visa as a dependent, which is contributing to very small numbers of applications. Furthermore, there were not supposed to be any applications with the type of "Main Applicant", but we could still find a very small number of them. The explanation from Home Office is that there are some factors outside their control, such as caseworkers accidentally misclassifying visas, and small errors can continue beyond the time, even though the data will be refreshed a year after they publish it.

[10]Home Secretary's oral statement: https://www.gov.uk/government/speeches/foreign-student-visas-home-secretarys-statement; News statement: https://www.gov.uk/government/news/major-changes-to-student-visa-system

immigration system, which allows people to stay in the UK even if they are unemployed; and secondly, the scheme's objectives were violated because graduates granted the PSW visa were not employed at the same skill level as the scheme expected. In the post-abolition period (i.e., after 2012), if the international students still want to work in the UK, they will need to apply for a Tier 2 (General) visa. The eligible applicant for a Tier 2 visa must have acquired their degree from a recognized UK HEI and obtained a job offer with a certain amount of salary[11] from a licensed employer who can provide the sponsorship.

The abolition slowed the influx of international students into the UK, which not only sparked opposition from some HEIs but also weakened the UK's competitiveness in the global higher education market (Paulina, 2019). Compared to the other 3 main destination countries for international students in Figure 1, in the post-abolition period, obvious upward trends could be found in the US, Australia, and Canada, while the UK had a flattening upward trend.

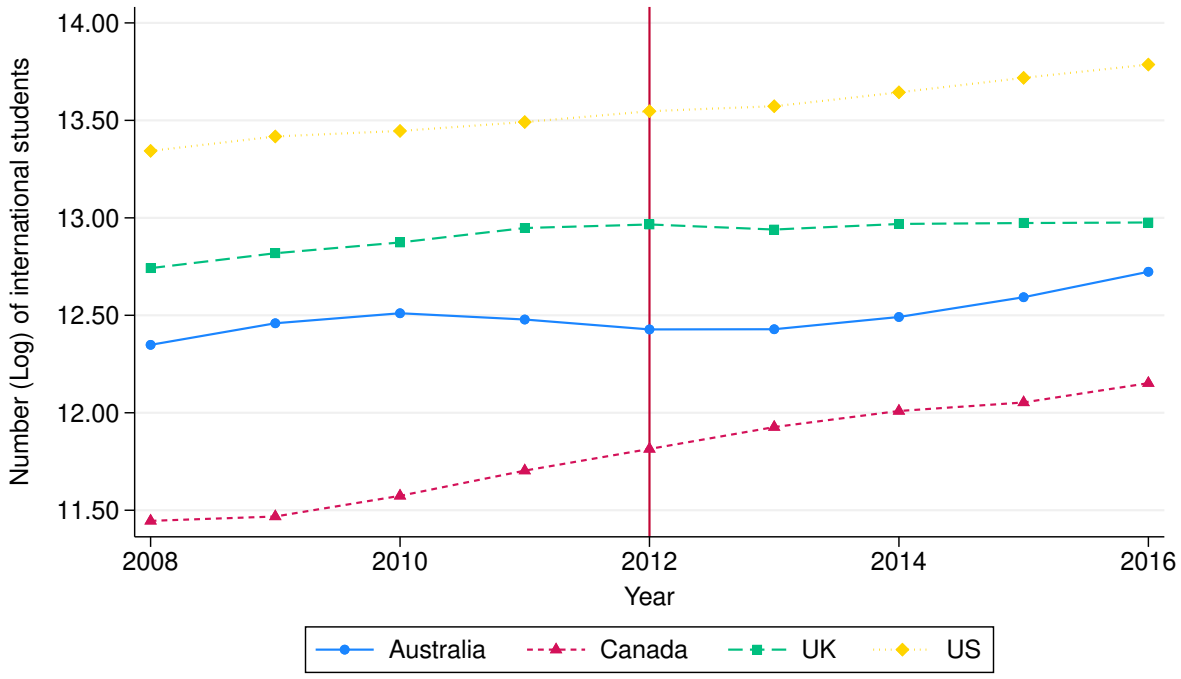


Figure 1: Trends of international students in the UK and competing countries

Notes: The figure presents the log number of total international students in the UK and 3 competing countries. The data source of this figure is UNESCO Institute for Statistics (UIS) database.

[11]The salary requirement varies across different occupations.

As the timeline of relevant events shown in Figure 2, the pre-treatment period for this study is from 2008 (i.e., the first year for applying the PSW visa) to 2012 (i.e., the final year for applying the PSW visa), while the post-treatment period is from 2013 and stops at 2016[12].

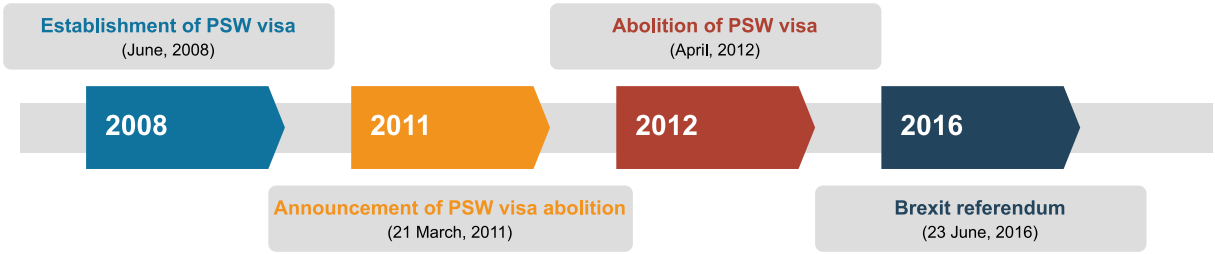


Figure 2: Timeline of relevant events

The PSW visa primarily provides benefits for international students from non-EU countries who want to work in the UK after graduation. According to the Home Office's visa granted dataset[13], applications from EU countries were extremely low, with their application rates to the total number of applications being even lower than 0.5%. The application records in Table 1 are the full records for EU countries during the pre-treatment period, which are in single digits and mostly come from Croatia[14].

Table 1: PSW visa applications from EU countries

Year	Nationality	Application number	Application rate
2008	Croatia	5	0.31%
2009	Croatia	9	0.16%
2010	Croatia	6	0.09%
	Bulgaria	2	0.03%
2011	Croatia	9	0.13%
	Romania	2	0.03%
2012	Croatia	7	0.13%
	Romania	1	0.02%

Notes: The application number is for i country in t year; the application rate is i country's applications versus the total applications of t year.

[12]The post-treatment period ends in 2016 is due to the possibility that the effects might be contaminated by the Brexit referendum.

[13]Visa application data from Home Office: https://www.gov.uk/government/statistical-data-sets/managed-migration-datasets#entry-clearance-visas-granted-outside-the-uk

[14]Croatia's EU accession on July 1, 2013, is not a methodological concern for this study, as the country is excluded from the sample.

4 Data and Method

4.1 Data

(1) *Trade in culture goods*

Cultural goods include the characteristic of being irreproducible, which forges their system of valuation and distinguishes it from other products (Throsby, 2001). As defined in UNESCO (2009), cultural goods are the consumer goods that convey ideas, symbols, and ways of life, and most of them are subject to copyrights.

The cultural goods definition in this study will follow the UNESCO framework[15], which includes 85 types of cultural commodities in total, classified into 6 general categories (domains) and 13 sub-categories, as shown in Figure 3. The trade data in this study only involves the core cultural goods and is collected in 6-digit Harmonized System (HS) codes or 5-digit Standard International Trade Classification (SITC) codes from the UN Comtrade database. The specific cultural commodities and their detailed descriptions can be found in table 3 (p.65-p.69) of the report[16]. The investigation of trade flow is conducted independently. The export trade entails the UK's exportation of cultural goods to various countries. Conversely, the import trade comprises the UK's importation of cultural goods from other nations.

(2) *International Students*

International students, as defined by the UNESCO Institute for Statistics, are the individuals who cross the territorial border for educational purposes and matriculate outside their country of origin. This study mainly focusses on the international students who come to the UK for tertiary level study. Therefore, the administrative data from the Higher Education Statistics Agency (HESA) is employed for including students' personal characteristics like gender, level and subject of study, and their HEI providers[17].

(3) *Control variables*

Several control variables as trade determinants commonly used in the literature are included in the analysis. The economic scale of the partner countries is measured by the GDP and population. We use the *stock of immigrants*[18] from partner countries to the UK to mea-

[15]The definition of cultural goods from UNESCO, see link: http://uis.unesco.org/en/glossary-term/cultural-goods?wbdisable=true

[16]The report can be accessed through UNESCO website: https://uis.unesco.org/en/files/unesco-framework-cultural-statistics-2009-en-pdf

[17]A comprehensive explanation of the variables associated with international students can be found in Appendix B HESA Data.

[18]For some countries have completely no records (maybe for confidential reasons) would interpolate 0 instead.

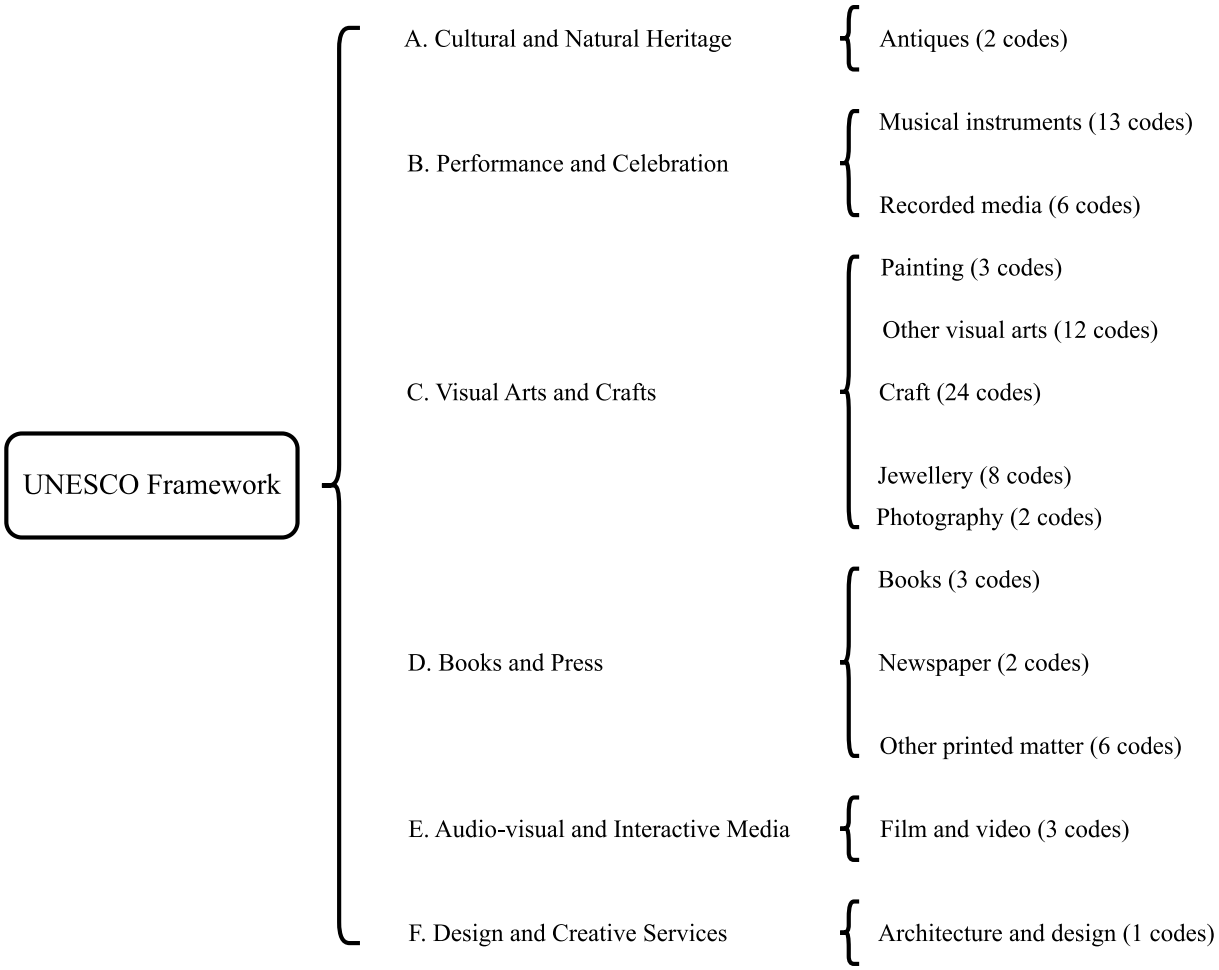


Figure 3: Involved cultural commodities under UNESCO framework

Notes: The number of codes in the parentheses presents the exact number of involved cultural commodities.

sure the scale of social network. Immigrants stimulate the trade through the preference on home countries' goods and the elimination of information gap (Egger et al., 2012; Law et al., 2013). We also take into account factors like *language*, *colonial link*, *distance* and *exchange rates* (Genc et al., 2012), which respectively represent whether common official language and UK-dominated histories exist and the geographical distance between the capitals of partner countries and London.

Due to the different data sources, the choice of countries was adjusted by looking at the control groups[19]. The treatment group is the non-EU countries, while EU countries are the control group; 70 and 22 countries are included, respectively. The period between 2013 and the present is considered the post-treatment phase, while the years from 2008 to 2012 represent the pre-treatment phase. This distinction is based on the availability of the PSW

[19]The definitions and sources of variables are listed in Table A.1.

(Post-Study Work) visa for application during these respective times.

The descriptive statistics in Table 2 show the changes in variables in EU and non-EU country groups before and after the abolition of PSW visas. The UK's export trade in cultural goods to both EU and non-EU countries declined in the post-treatment period. Conversely, while import trade from EU countries showed a slight increase, imports from non-EU countries decreased. Furthermore, the growth rates of various characteristic variables associated with international students exhibited a general downward trend in comparison to the pre-treatment period[20].

[20]The descriptive statistics with log number and proportion is in Table A.2.

Table 2: Sample mean characteristics

	Pre-treatment period (2008 – 2012)		Post-treatment period (2013 – 2016)	
	EU	Non-EU	EU	Non-EU
Outcome				
Export cultural goods trade (ln)	17.942	16.488	17.898	16.381
	(1.518)	(2.125)	(1.473)	(2.247)
Import cultural goods trade (ln)	16.906	14.469	17.125	14.327
	(2.567)	(3.831)	(2.471)	(3.967)
Student characteristics				
Total students (%)	6.187	3.295	-1.283	-0.743
	(10.497)	(12.913)	(7.743)	(12.965)
Male students (%)	6.129	2.972	-1.865	-1.686
	(11.374)	(13.423)	(7.867)	(13.833)
Female students (%)	6.256	3.729	-0.869	0.531
	(10.236)	(14.198)	(8.454)	(13.447)
Undergraduate students (%)	5.854	2.400	-0.560	0.199
	(12.173)	(14.733)	(9.839)	(17.280)
Taught postgraduate students (%)	5.682	3.453	-6.339	-3.245
	(11.491)	(16.810)	(10.704)	(16.929)
Research postgraduate students (%)	4.401	1.507	0.934	-0.499
	(9.212)	(19.190)	(8.046)	(23.536)
Students in RG university (%)	8.262	3.808	2.141	1.518
	(9.930)	(14.358)	(7.406)	(13.000)
Students in Old university (%)	8.786	4.113	-1.454	-2.632
	(12.747)	(16.037)	(10.891)	(18.455)
Students in New university (%)	3.639	-2.329	-4.794	-1.808
	(13.586)	(18.967)	(10.342)	(18.577)
Students in Other university(%)	4.271	6.057	-4.147	-4.939
	(12.508)	(19.829)	(10.633)	(21.606)
Students major in STEM (%)	7.613	2.051	1.984	-0.020
	(11.879)	(15.214)	(8.207)	(15.649)
Students major in Social science (%)	6.132	5.369	-3.292	-1.009
	(11.501)	(13.424)	(9.686)	(13.981)
Students major in Liberal arts (%)	5.041	-0.071	-3.257	-3.373
	(11.641)	(20.825)	(8.773)	(18.376)
Students major in Other subjects (%)	-17.249	-38.768	-31.265	-11.499
	(67.914)	(127.202)	(87.400)	(75.329)
Controls				
Common official language	0.091	0.314	0.091	0.314
	(0.289)	(0.465)	(0.289)	(0.465)
Colonial linkage	0.136	0.486	0.136	0.486
	(0.345)	(0.501)	(0.345)	(0.501)
Distance between capitals (ln)	7.155	8.647	7.155	8.647
	(0.559)	(0.613)	(0.560)	(0.613)
GDP (ln)	26.127	25.633	26.104	25.783
	(1.617)	(1.797)	(1.582)	(1.814)
Population (ln)	15.923	16.800	15.927	16.873
	(1.365)	(1.743)	(1.366)	(1.734)
Exchange rate (ln)	0.521	2.991	0.529	3.168
	(1.463)	(2.900)	(1.431)	(2.772)
Stock of immigrants (ln)	10.935	10.153	11.205	10.285
	(1.069)	(1.378)	(1.078)	(1.299)

Notes: Standard deviations in parentheses. All variables related to international students are growth rates. Detailed definitions of student related variables found in Appendix B HESA Data.

4.2 Methodology

Our basic empirical specification estimates the effects of the influx of international students in the UK on the UK's cultural goods trade. The trends of the UK's cultural goods trade with EU and non-EU countries in Figure 4 shows that the two groups have a parallel trend in the pre-treatment period and even the pre-introduction period of the PSW visa. This feature serves as a pre-test to construct a natural experiment under the PSW visa abolition context, allowing us to rely on the Difference-in-Differences (DID) approach as follows[21]:

$$\begin{aligned} Trade_{it} = \beta_0 + \beta_1 StuGroup_i * Post_t + \beta_2 StuGroup_i + \beta_3 Post_t \\ + \gamma Controls_{it} + \delta_i + \eta_t + \varepsilon_{it} \end{aligned} \tag{1}$$

where $Trade_{it}$ is the value of the UK's cultural goods trade; $Post_t$ is a binary variable that equals to 0 for the period before the PSW visa abolition and 1 otherwise (from 2013 onwards); Similarly, the $StuGroup_i$ variable is a dummy that equals 1 if an international student is from non-EU countries and 0 when comes from EU countries; $Controls_{it}$ is a vector of control variables that influence trade between the UK and i country at time t.

The parameter of interest is β_1, which captures the impact of cultural goods trade with non-EU countries changed, relative to EU countries, from the period before to the period after the abolition of the PSW visa. The term δ_i represents country fixed effects to capture the unobservable time-invariant characteristics and also control for preexisting differences between countries. Finally, η_t represent the year fixed effects which absorb the time variation in our outcome. Another remark concerns inference, in order to allow for within group correlation in standard errors, we cluster standard errors at the country level (Bertrand et al., 2004; Cameron and Miller, 2015; MacKinnon et al., 2023).

Furthermore, we expect to explore the dynamic effects of the PSW abolition on cultural goods trade and test the validity of the parallel trend assumption. To this end, we generalized the DID model to an event study model for exploring the trends in cultural goods trade 4 years prior (i.e., 2008-2011) and 4 years after (i.e., 2013-2016) the PSW visa abolition, as follows:

$$Trade_{it} = \beta_0 + \sum_{t=2008}^{2016} \beta_{1,t}(StuGroup_i \times Year_t) + \gamma Controls_{it} + \delta_i + \eta_t + \varepsilon_{it} \tag{2}$$

[21] The dummy variables $StuGroup_i$ and $Post_t$ only included in the comparison models without controlling year and country fixed effects, given that they are redundant and naturally collinear with the fixed effects.

The estimates of coefficient $\beta_{1,t}$ are interpreted with respect to 2012, where $Year_{2012}$ was the year when the PSW visa abolition took place, which should equal 0 and be omitted from the regression models.

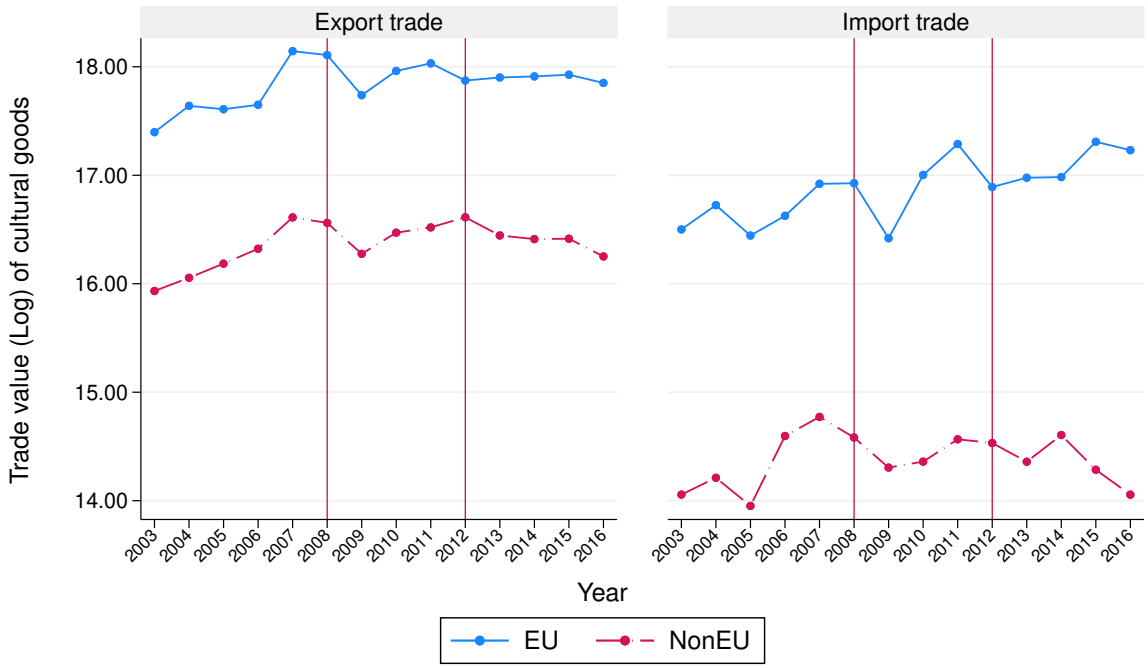


Figure 4: Trend of UK's cultural goods trade (log) value

5 Empirical Analysis

Based on the dataset and identification strategy described above, we empirically examine the hypothesis positing that the influx of international students influences cultural goods trade in the UK. In this section, we initially estimate the treatment effect of the PSW visa abolition and undertake a series of tests to verify the robustness of our findings. Subsequently, we identify the heterogeneity in treatment effect, with an emphasis on variations across country groups from diverse economic backgrounds. Lastly, we investigate the mechanism of the treatment effect.

5.1 Main findings

Column 1 of Table 3 shows the estimated impact from the baseline DID model (Equation 1) without including the variables related to international students, indicating that the

PSW visa abolition has a negative impact on cultural goods export value and results in a reduction of 32.63%. In column 2 of Table 3, when the growth rate of the total international student population is included, the estimated effect of PSW abolition is larger compared to the estimation from the baseline model. Finally, columns 3 to 6 of Table 3 includes the individual characteristics of international students separately, where the estimation results remain consistent with only considering the total number of international students. Among all the individual characteristics, the negative impact on export trade significantly increases when considering international students' level of study.

All the DID estimators ($StuGroup_i \times Post_t$) are significant, underscoring a clear causal link between the diminished influx of international students and a reduction in the export trade value of the UK's cultural goods. Further detailed analysis of the categories of international student characteristic variables (gender, level of study, HEI types and subject of study), only the growth rate of the taught postgraduate student, those enrolled in Russell Group universities, and student majoring in social science have a positively significant impact on the export trade of cultural goods. The results align with our intuition and highlight a significant influence from the majority group of international students: firstly, the taught postgraduate student represents the highest proportion, surpassing both undergraduate and research postgraduate student, among all international students; secondly, international students have a strong preference for entering selective universities, which results in a higher international student number in Russell Group universities; thirdly, students who major in social science, such as business and management, not only have a higher probability of entering trade-related careers, but also represent a larger proportion of the student body compared to other majors, indicating a significant potential impact on trade sectors. Worth noting that the estimated effects become much larger if we do not control the country and year fixed effects, indicating that the unobserved factors may cause the effects been overestimated[22].

The transmission channel of negative effects on cultural goods export after PSW visa abolition could be explained by existing literature in two ways. Since the abolition of PSW visa in this study is regarded as a decrease in the influx of international students, the business information to exporter in destination countries provided by the influx of international students will be decreased (Rauch, 1999; Rauch and Trindade, 2002; Portes and Rey, 2005). Additionally, the influx of international students contributes to the formation of a global

[22]We check without controlling the fixed effects as a comparison with the traditional DID model, which uses group dummies ($Stugroup_i$ and $Post_t$ in equation (1) as similar components of fixed effects in the model. Controlling fixed effects allows us to further control at the level of each country and year for the unobservable time-invariant factors (country FE) and absorb time variation in the outcome (year FE). The results can be found in Table A3 even number columns.

social network within academic and local communities. These students, coming from diverse backgrounds, naturally foster cross-cultural connections and networks through their interactions in educational settings and social activities. This network can lead to the sharing of valuable market insights and contacts, thereby overcomes the informal barriers to trade (e.g., cultural misunderstandings and mistrust) and lowers trade transaction costs (Rauch, 2001; Combes et al., 2005; Iranzo and Peri, 2009; Docquier and Rapoport, 2012). The social network enhances the fulfilment of contracts, which strengthens the maintenance of trade relations (Greif, 1993; Rauch, 2001; Rauch and Trindade, 2002).

In sum, the PSW visa abolition results in a reduction in the UK's cultural goods export trade to non-EU countries when compared to trade with EU countries. Focusing on the models with student characteristic variables, the PSW visa abolition brought a larger impact on cultural goods export trade, at average -34.62%. On the contrary, import trade is not affected by the PSW visa abolition[23]. Our findings suggest that the influx of international students significantly contributes to the spread of UK culture but not to the introduction of the cultures from the students' home countries into the UK. Because the UK is more open to embracing cultural diversity, the information gap for trading cultural goods with international students' origin countries is small. Thus, the fluctuation in international students' influx would not impact the cultural goods import trade too much.

[23]The results of PSW abolition impact on UK's cultural goods import trade found in Table A4. The results obtain from estimating the Equation 1, only the dependent variable switching to the import trade, which is the cultural goods trade value of UK import from the home countries of international students.

Table 3: Effects of the PSW visa abolition on cultural goods export trade

	(1) Baseline	(2) Total Number	(3) Gender	(4) Level of Study	(5) HEI types	(6) Subject of Study
StuGroup x Post	-0.395***	-0.431***	-0.430***	-0.437***	-0.421***	-0.435***
	(0.143)	(0.146)	(0.148)	(0.147)	(0.146)	(0.145)
Total students		0.585*				
		(0.318)				
Male students			0.359			
			(0.308)			
Female students			0.230			
			(0.238)			
Undergraduate students				-0.112		
				(0.169)		
Taught postgraduate students				0.485**		
				(0.230)		
Research postgraduate students				0.097		
				(0.093)		
Students in RG university					0.398**	
					(0.185)	
Students in Old university					0.089	
					(0.189)	
Students in New university					0.026	
					(0.117)	
Students in Other university					0.102	
					(0.092)	
Students major in STEM						0.064
						(0.208)
Students major in Social science						0.422*
						(0.248)
Students major in Liberal arts						0.182
						(0.112)
Students major in Other subjects						-0.004
						(0.015)
Constant	-24.605*	-20.668	-20.292	-21.563	-19.088	-20.675
	(14.157)	(13.248)	(13.449)	(13.498)	(13.156)	(12.841)
Controls	✓	✓	✓	✓	✓	✓
Year FE	✓	✓	✓	✓	✓	✓
Country FE	✓	✓	✓	✓	✓	✓
Observations	828	828	828	828	828	828
Clusters	92	92	92	92	92	92
R^2	0.941	0.942	0.942	0.942	0.942	0.942

Notes: The reported results are estimating from equation (1) wherein the dependent variable is cultural goods export trade. Standard errors in parentheses are clustered at country level. * p <0.10, ** p <0.05, *** p <0.01. New universities refer to those with polytechnic or central institution roots which obtained university status since 1992. Old universities refer to those founded before 1992 but not one of the 24 Russell Group (RG) universities.

5.2 Robustness checks

5.2.1 Validity of parallel trend assumption

The parallel trend assumption ensures the validity of DID models. This requires that the difference between the treatment and control groups be constant during the pre-treatment period. The violation of the parallel trend assumption would lead to biased estimation of causal effects. Therefore, we conduct an event-study model as in Equation 2 to test the parallel trend assumption and observe the dynamic effects of the PSW visa abolition.

The trend of cultural goods trade in Figure 4 serves as a rough pre-test on the parallel trend assumption, while the coefficient plot shows the statistical evidence. Figure 5 illustrates the results from estimating the Equation 2 with the 95% confident interval, based on clustered standard errors at the country level. Most of the models' coefficients vary around 0 on the x-axis in the pre-treatment period, indicating that there is no significant impact, and the parallel trend assumption is supported. The impact of PSW visa abolition is long-lasting, given that a negative impact can still be found in the fourth year 2016, implying that the UK's cultural goods exports to non-EU countries are significantly decreasing because of PSW visa abolition.

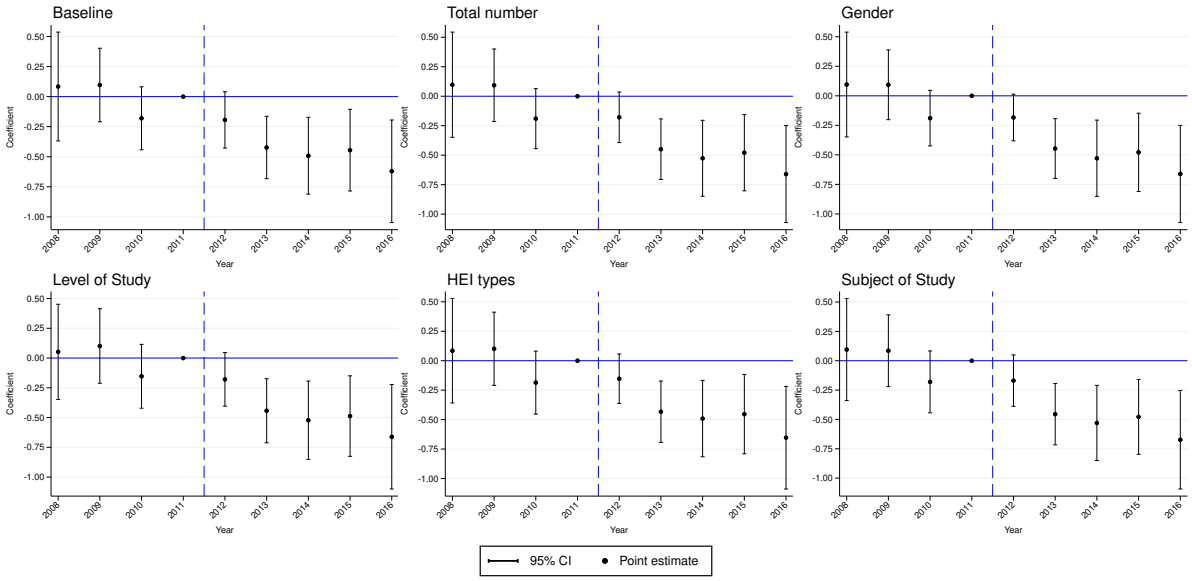


Figure 5: Effect of the PSW abolition on cultural goods export trade

Notes: The left y-axis represents the coefficients estimated from Equation 1, which captures the effect of PSW visa abolition on UK's cultural goods export trade varies across different student characteristics model. The confidence interval is computed based on robust standard errors clustered at the country level.

5.2.2 Placebo test

To further ensure that our results are not affected by unobserved factors, we conduct the placebo test which first introduced by La Ferrara et al. (2012), applied in DID model by Li et al. (2016). The logic behind the placebo test involves randomly assigning the treatment group and checking whether the distribution of estimates remains significant.

In ideal situation, we have an exogenous policy shock which is not affected by unobserved factors, the $\widehat{\beta_1}$ is consistent for the DID estimator β_1 in Equation 1. While we strive to account for both observed and unobserved factors influencing the policy shock, it's important to acknowledge the inherent limitation that not all relevant variables can be exhaustively identified and controlled in reality. The estimator normally shows like the Equation (3):

$$\widehat{\beta_1} = \beta_1 + \varphi \frac{cov(StuGroup_i \times Post_t, \varepsilon_{it}|Control)}{var(StuGroup_i \times Post_t|Control)} \tag{3}$$

where the β_1 is the DID estimator; Control is the observable control variables; φ is unobserved factors' impact on the dependent variable that equals to 0 when β_1 is unbiased.

We neither know if φ equals 0 nor directly test the estimate if the unobserved factors have effect on it. Therefore, we use the randomly generated variable $StuGroup_{fake}$, which is a fake treatment variable and would not affect the outcome variable $Trade_{it}$, to replace the true treatment variable $StuGroup_i$, as Equation 4 shows:

$$Trade_{it} = \beta_0 + \beta_{1f} StuGroup_{fake} * Post_t + \gamma Controls_{it} + \delta_i + \eta_t + \varepsilon_{it} \tag{4}$$

where the β_{1f} should equals to 0, indicates the false treatment variable produce no significant effect; otherwise, it would lead to a biased estimation. Furthermore, we can know $\varphi = 0$ if $\widehat{\beta_1} = 0$ is estimated.

To set up the placebo test, we first draw 70 random samples from the whole sample as a placebo group to replace the treatment group; then we repeat the randomization and estimation for 500 times to increase the identification power of the placebo test. Our expectation is that the distribution of placebo estimates centered around 0 and the actual estimate falls in the far tails of it. As confirmed by Figure 6, the placebo estimates of each model are distributed around 0, and the true point estimates are located outside the whole distribution, suggesting there is no effect with the randomly constructed PSW visa abolition. Meanwhile, all the actual point estimates obtained from Table 3 are located outside the distributions of placebo estimates, suggesting that the estimations are not driven by spurious correlations with unobserved factors.

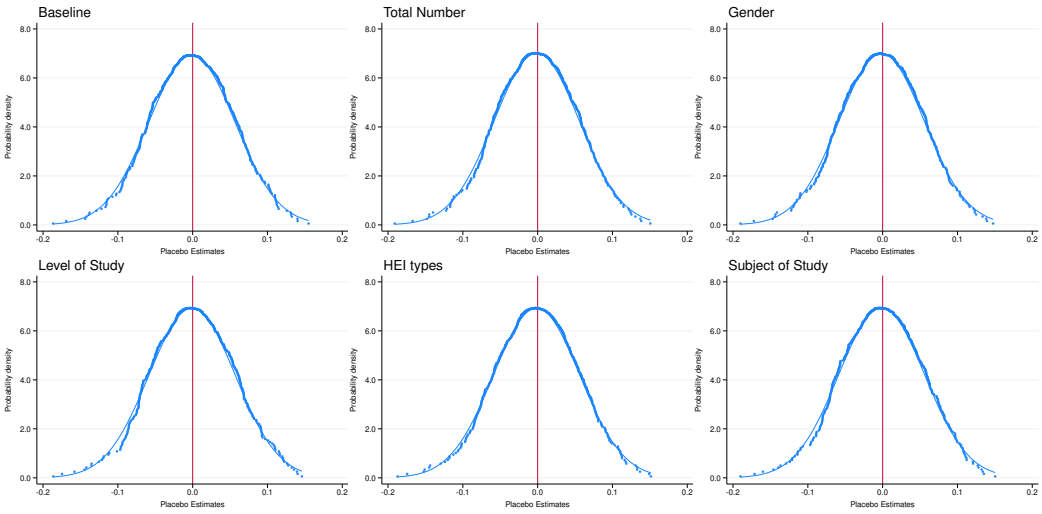


Figure 6: Placebo estimates

Notes: The figure displays the distributions of placebo estimates across six different models, derived from 500 placebo regressions derived from 500 placebo regressions in which 70 countries are arbitrarily designated to constitute the treatment group. The actual point estimates that correspond to each model can be found in Table 3.

5.2.3 Checks with altering data

In order to further assess the reliability of our findings, we conduct a series of robustness checks. First, the treatment effects might be dominated by Chinese and Indian students, due to the large proportion of international students come from China and India. In columns (a) of Table 4, we exclude China and India from the whole sample and the results remain consistent suggesting that the estimated effects are robust and not dominated by the countries with most international students.

Second, for the classification of trade in goods normally allocated in the HS or SITC code, we choose the 6-digit HS classification code in our empirical analysis for categorizing cultural goods in detailed contrast to the 5-digit SITC code. As a result, the estimation should be similar when switching to the alternative SITC code. After changing to the SITC code, columns (b) of Table 4 shows similar results to our main findings from Table 3.

Third, we change the source for trade data from UN Comtrade to Her Majesty's Revenue & Customs (HMRC)[24], which remains consistent with our main results. The coefficients in columns (c) of Table 4 are a bit lower than those in the main results, due to the fact that trade values are recorded in British pounds in HMRC while UN Comtrade reports them in U.S. dollars.

[24]HMRC is the UK's customs authority. It collects the UK's international trade in goods data. The HMRC trade data in Table 4 still adopts the HS classification code. The alternative results that adopt SITC classification code are shown in Table A5, which aligns with the results using the HS code.

Table 4: Robustness checks with excluding China and India from full sample and changing trade classification, trade data source

	(a)	(b)	(c)	(a)	(b)	(c)	(a)	(b)	(c)	(a)	(b)	(c)	(a)	(b)	(c)	(a)	(b)	(c)
		Baseline			Total Number			Gender			Level of Study			HEI types			Subject of Study		
StuGroup x Post	-0.395***	-0.369**	-0.268*	-0.431***	-0.410**	-0.305**	-0.430***	-0.402**	-0.300**	-0.437***	-0.420**	-0.307**	-0.421***	-0.403**	-0.296**	-0.435***	-0.420**	-0.314**
	(0.143)	(0.176)	(0.145)	(0.146)	(0.175)	(0.148)	(0.148)	(0.176)	(0.149)	(0.147)	(0.173)	(0.150)	(0.146)	(0.176)	(0.148)	(0.145)	(0.171)	(0.147)
Total students				0.585*	0.677**	0.613*												
				(0.319)	(0.326)	(0.317)												
Male students							0.359	0.536*	0.444									
							(0.308)	(0.312)	(0.311)									
Female students							0.231	0.132	0.173									
							(0.238)	(0.180)	(0.251)									
Undergraduate students										-0.112	-0.103	-0.020						
										(0.169)	(0.181)	(0.190)						
Taught postgraduate students										0.485**	0.560***	0.411						
										(0.230)	(0.188)	(0.254)						
Research postgraduate students										0.097	0.066	0.110						
										(0.093)	(0.091)	(0.090)						
Students in RG university													0.398**	0.404**	0.327			
													(0.185)	(0.193)	(0.201)			
Students in Old university													0.089	0.144	0.156			
													(0.189)	(0.168)	(0.183)			
Students in New university													0.026	0.055	0.046			
													(0.117)	(0.122)	(0.117)			
Students in Other university													0.102	0.131	0.093			
													(0.092)	(0.099)	(0.095)			
Students major in STEM																0.064	0.033	0.040
																(0.208)	(0.186)	(0.206)
Students major in Social science																0.422*	0.500*	0.487*
																(0.248)	(0.267)	(0.251)
Students major in Liberal arts																0.182	0.247**	0.190
																(0.112)	(0.115)	(0.129)
Students major in Other subjects																-0.004	0.004	0.003
																(0.015)	(0.019)	(0.016)
Constant	-24.604*	-23.468	-30.643**	-20.663	-18.907	-26.514*	-20.287	-17.945	-25.792*	-21.560	-20.515	-27.189*	-19.087	-17.396	-25.509*	-20.669	-18.646	-26.292*
	(14.159)	(18.682)	(15.100)	(13.251)	(18.037)	(14.276)	(13.452)	(18.210)	(14.229)	(13.501)	(18.440)	(14.478)	(13.159)	(18.036)	(14.272)	(12.844)	(17.393)	(13.762)
Controls	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Year FE	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Country FE	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Observations	810	828	828	810	828	828	810	828	828	810	828	828	810	828	828	810	828	828
Clusters	90	92	92	90	92	92	90	92	92	90	92	92	90	92	92	90	92	92
R^2	0.941	0.937	0.937	0.942	0.938	0.939	0.942	0.938	0.939	0.942	0.939	0.939	0.942	0.939	0.939	0.942	0.939	0.939

Notes: The reported results are estimating from equation (1) wherein the dependent variable is cultural goods export trade. Standard errors in parentheses are clustered at country level. * p <0.10, ** p <0.05, *** p <0.01. New universities refer to those with polytechnic or central institution roots which obtained university status since 1992. Old universities refer to those founded before 1992 but not one of the 24 Russell Group (RG) universities.

5.2.4 Sensitivity analysis on unobservable characteristics

We further evaluate the robustness of our results by accounting for the omitted variable bias. The method proposed by Oster (2019) allows us to explore to what extent the selection on observables is informative about the selection on unobservables.

Altonji et al. (2005) suggest an estimator (δ) as the measurement for selection ratio between selection on unobservables and selection on observables, which would lead to a zero-treatment effect (i.e., $\beta = 0$). The suggested result is with ratio above 1, which indicates the unobservable is more important in explaining the treatment than the observables, can be viewed as robust. However, this approach ignores the fact that the coefficient movements must be scaled by R-squared movements. It is crucial to observe the impact of both adding observables on estimators and model's fitness level. Oster (2019) extend the approach with consideration of two sensitivity parameters, the selection ratio (δ) and the explanatory effect of unobservables on outcome (R-squared). Specifically, she proposes the following equation to calculate an approximation of the bias-adjusted treatment effect:

$$\beta^* \approx \tilde{\beta} - \delta[\dot{\beta} - \tilde{\beta}]\frac{R_{max} - \tilde{R}}{\tilde{R} - \dot{R}} \tag{5}$$

where β^* is the bias-adjusted effect of PSW visa abolition, while $\dot{\beta}$ and $\dot{R}$ ($\widetilde{\beta}$ and $\widetilde{R}$) denote the DID estimator and R-squared with the fewest (most) controls.

In Table 3, we obtain the $\widetilde{\beta}$ and $\widetilde{R}$ for each DID model[25]. As we include control variables and fixed effects, the DID estimator decreases while R-squared increases. In the Equation 5, the δ measures the importance of unobservables relative to observables, and R_{max} is the R-squared for the regression controls the unobservables and observables. Following Oster (2019) we take 1 as the upper bound of δ and assume that $R_{max} = 1$[26]. Based on the given conditions, we obtain the bias-adjusted effects of PSW visa abolition (β^*) and the relative selection when treatment effects equal zero (δ), show in Table 5 below.

[25]The $\dot{\beta}$ and $\widetilde{R}$ for each model can be found in the Table A.3.

[26]For $R_{max} = \Pi\widetilde{R}$, it is recommended to set Π as 1.3 as inferred from simulations in Oster (2019). However, the R_{max} exceeds 1 when $\widetilde{R}$ is higher than 0.77. Consequently, the product $\Pi\widetilde{R}$ should not surpass 0.77. Given that most values of $\widetilde{R}$ in our models exceed 0.77 even before multiplying by 1.3, we set R_{max} as 1 in the implementation of the approximation equation.

Table 5: Results of the Oster test

	(1) Baseline effect $\dot{\beta}$ (Std. error) $[\dot{R}]$	(2) Controlled effect $\widetilde{\beta}$ (Std. error) $[\widetilde{R}]$	(3) Bias-adjusted β^* (Bootstrapped Std. error)	(4) Identified set $[\widetilde{\beta}, \beta^* \vert \delta = 1, R_{max} = 1]$	(5) δ for $\beta = 0$ given $R_{max} = 1$
Baseline	-0.577**(0.175) [0.108]	-0.395*** (0.143) [0.941]	-0.381** (0.152)	[-0.395, -0.381]	20.901
Total Number	-0.792**(0.251) [0.153]	-0.431*** (0.146) [0.942]	-0.400*** (0.152)	[-0.431, -0.400]	12.184
Gender	-0.757**(0.241) [0.156]	-0.430*** (0.148) [0.942]	-0.402*** (0.152)	[-0.430, -0.402]	13.192
Level of Study	-0.842**(0.251) [0.159]	-0.437*** (0.147) [0.942]	-0.403*** (0.149)	[-0.437, -0.403]	11.160
HEI types	-0.726**(0.227) [0.157]	-0.421*** (0.146) [0.942]	-0.395** (0.154)	[-0.421, -0.395]	13.809
Subject of Study	-0.813**(0.258) [0.162]	-0.435*** (0.145) [0.942]	-0.403*** (0.153)	[-0.435, -0.403]	11.865

Notes: Standard errors for $\dot{\beta}$ and $\widetilde{\beta}$ are in parentheses clustered at country level, and their R^2 are in square brackets. Bootstrapped standard errors for β^* are in parentheses (1,000 reps). * p <0.10, ** p <0.05, *** p <0.01.

In the column 3 of Table 5 reports the bias-adjusted effect of PSW visa abolition. The robustness of β^* approximation can be evaluated with two standards (Oster, 2019): First, the bounds of the identified set $[\widetilde{\beta}, \beta^*]$ should not include zero; Second, the β^* falls within ± 2.8 standard errors[27] of the controlled estimates. Our results clearly satisfied above two standards. Oster (2019) suggests the value of δ greater than one indicates the results is robust to omitted variable bias. Column 5 of Table 5 shows that the value of δ for each model exceeds one; the effect of unobservables would have to be at least 11.16 times stronger than the effect of observables to obtain a zero-treatment effect in our results. As a result, we conclude that the estimated effect of PSW visa abolition is unlikely to be confounded by unobservables and omitted variable bias.

[27] ± 2.8 standard errors are the bounds of the 99.5% confidence interval.

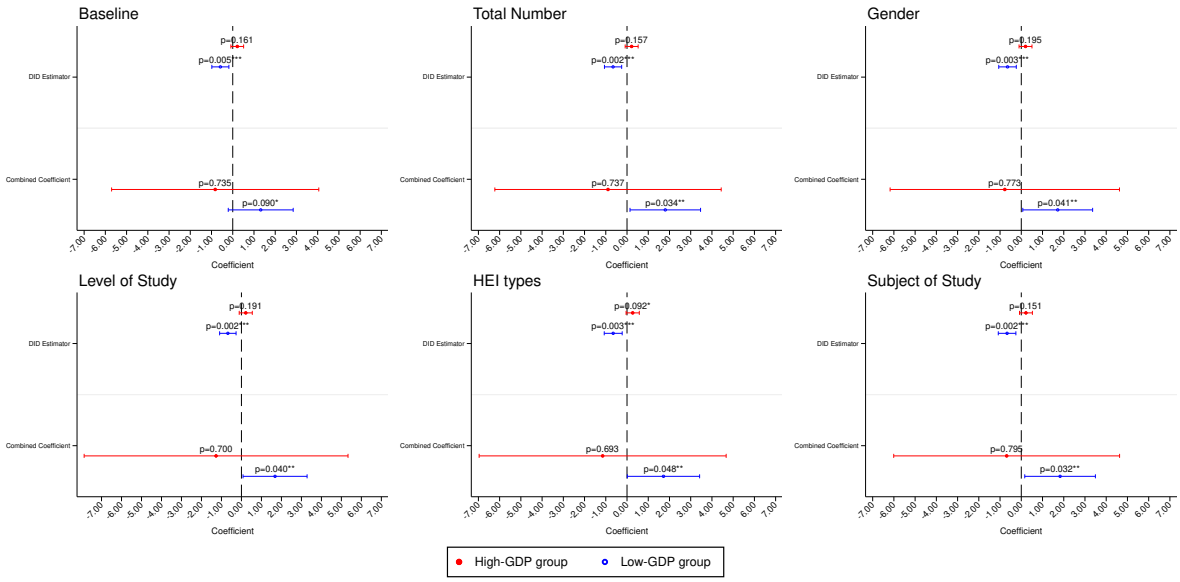
5.3 Heterogeneity in effects

Thus far, the empirical results point out that the abolition of PSW visa significantly decline the cultural goods export trade. However, the significant heterogeneity of the impacts might be masked by the average treatment effects on the treated. The PSW visa abolition might have a differential or heterogeneous effects across countries. Therefore, we consider three variables (i.e., GDP, population, and stock of immigrants) from control variable set to find the heterogeneity across countries. The EU and non-EU countries are split by the median of the three indicators, giving us the high and low country groups, respectively[28].

Economic factors play important roles in international trade. We examine whether cultural goods exported to countries with a better economic background suffer a larger impact from the PSW visa abolition. The GDP is adopted as a proxy for economic development level, while population is regarded as market size. As can be seen in Figure 7, the upper part shows the DID estimators of each model, only the lower groups in blue color are statistically significant. The abolition of the PSW visa has a significant negative impact on countries with a lower GDP or population. This suggests that when the UK export cultural goods to these countries, which have weaker economic foundations, the changes of trade value depend on informal trade barrier, like local custom, business information, and cultural differences. This trade barrier is often mitigated by the influx of international students, who play a crucial role in this dynamic due to their diverse backgrounds and experiences. International students provide valuable insights and understanding of their home cultures, which is crucial for the UK to export its cultural goods for these markets more effectively. The trade relationship with those countries is more vulnerable, given that the cultural goods trade value will decline when losing the mitigation of informal trade barriers provided by international student. By contrast, countries with a stronger economic background might have more channels to mitigate the disadvantage caused by the decreasing influx of international students, meaning they are able to mitigate the informal trade barriers through other means.

[28]We present the results of heterogeneity effects in coefficient plots with their DID estimators and liner combination coefficients for the whole model. The full regression results for GDP, Population and Stock of immigrants groups are in Table A.6, Table A.7, and Table A.8, respectively.

Panel (a). High/Low GDP groups



Panel (b). High/Low Population groups

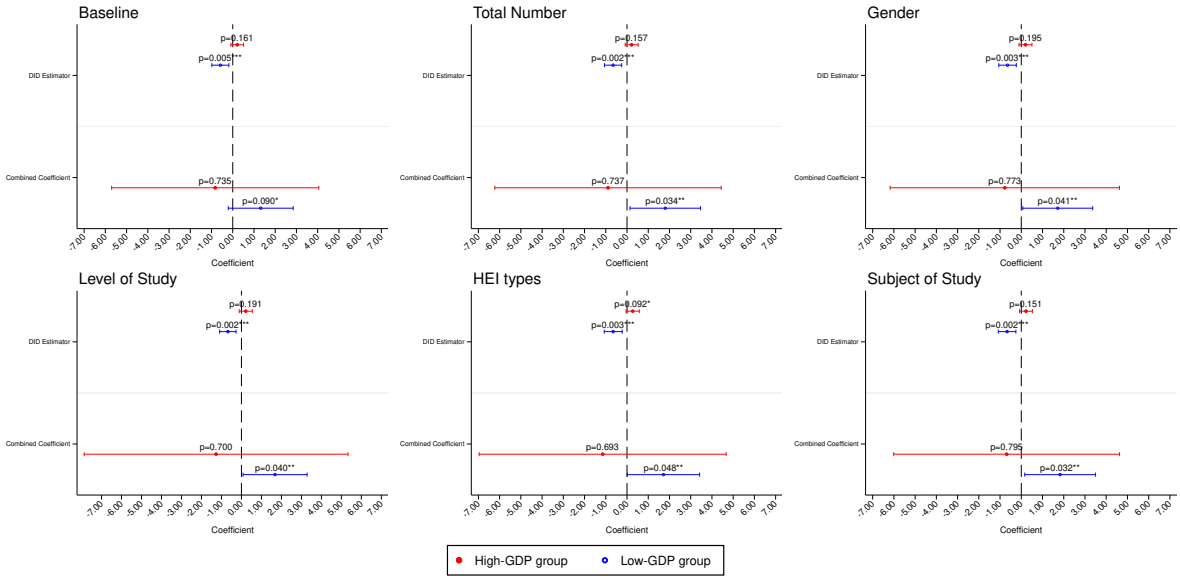


Figure 7: Heterogeneity in GDP and Population groups

Notes: The figure includes two panels that display the heterogeneity in GDP and Population groups, respectively. For each panel, in the upper part are the DID estimators that capture the effects of PSW visa abolition on UK's cultural goods export trade to both the high countries group (in red) and the low countries group (in blue); in the lower part are linear combined coefficients that show the overall effects on cultural goods export trade when taking into account all factors in the model. Capped solid lines are associated with 95 percent confidence intervals, and the p-value of each coefficient is shown with a significance level denoted by * p <0.10, ** p <0.05, and *** p <0.01, respectively.

Subsequently, we consider countries with different scale of social network might be impacted by the abolition of PSW visa. Figure 8 provides evidence that the UK's cultural goods export trade suffers a significant reduction in countries with a higher stock of immi-

grants in the UK in the post PSW visa abolition period. As we regard stock of immigrants as the scale of home countries' social network in the UK, which means countries have larger scale of social network in the UK and have a deeper bond or stronger trade partnership with the UK. Therefore, the decreasing influx of international students only have negative impact on exporting cultural goods to countries with higher stock of immigrants compare to those with lower stocks.

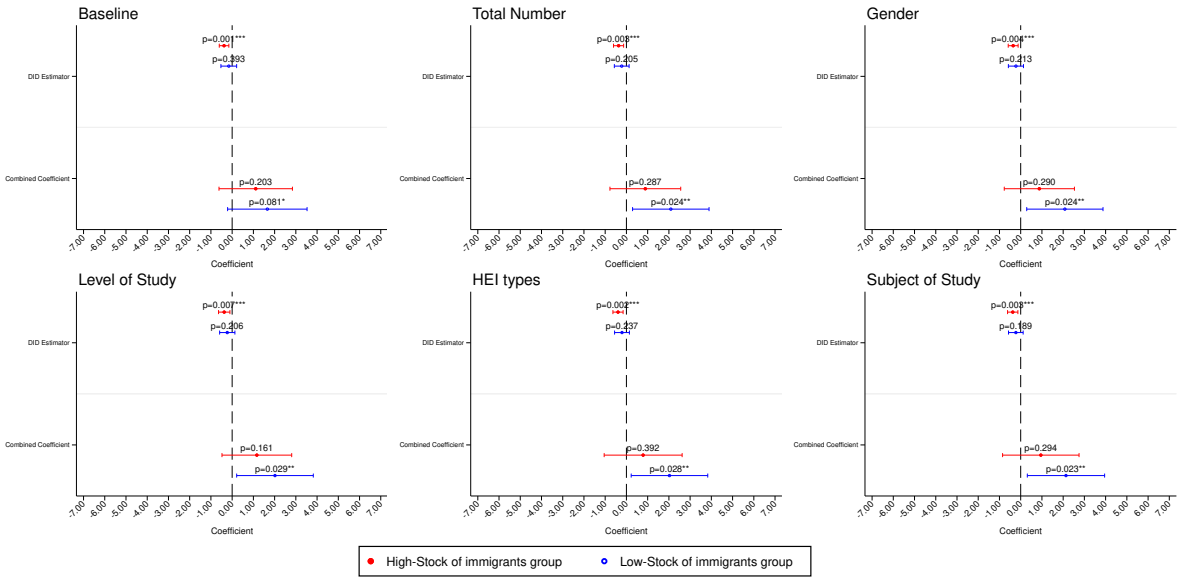


Figure 8: Heterogeneity in Stock of immigrants groups

Notes: The figure shows the heterogenous effect of PSW visa abolition on UK's cultural goods export trade (upper part) and overall effect when considering all factors in the model (lower part). Capped solid lines are associated with 95 percent confidence intervals, and the p-value of each coefficient is shown with a significance level denoted by * p <0.10, ** p <0.05, and *** p <0.01, respectively.

As to the combined coefficients in coefficient plots across three different heterogeneity groups, they have an inverse sign compared to the DID estimator. A negative DID estimator suggests the treatment leads to a decrease in the cultural goods export, while a positive combined coefficient indicates when accounting for other factors, the overall effect to cultural goods export could be positive.

5.4 Mechanisms

5.4.1 Announcement of PSW visa abolition

According to the timeline presented in Figure 2, the PSW visa abolition was announced on 21 March 2011, and officially abolished in April 2012. Therefore, we consider the announcement effect of PSW visa abolition by advancing the treatment one year ahead. As

Figure 9 shows, there are *indeed announcement effects*. The overall pattern in the coefficient plot still aligns with our baseline models, the coefficients decrease significantly after the PSW visa abolition, even when the abolition was announced. The export of cultural goods has experienced a decline following the announcement of the abolition, indicating a profound connection between the influx of international students and the exportation in cultural goods. The trade values exhibit a rapid response to the fluctuating influx of international students.

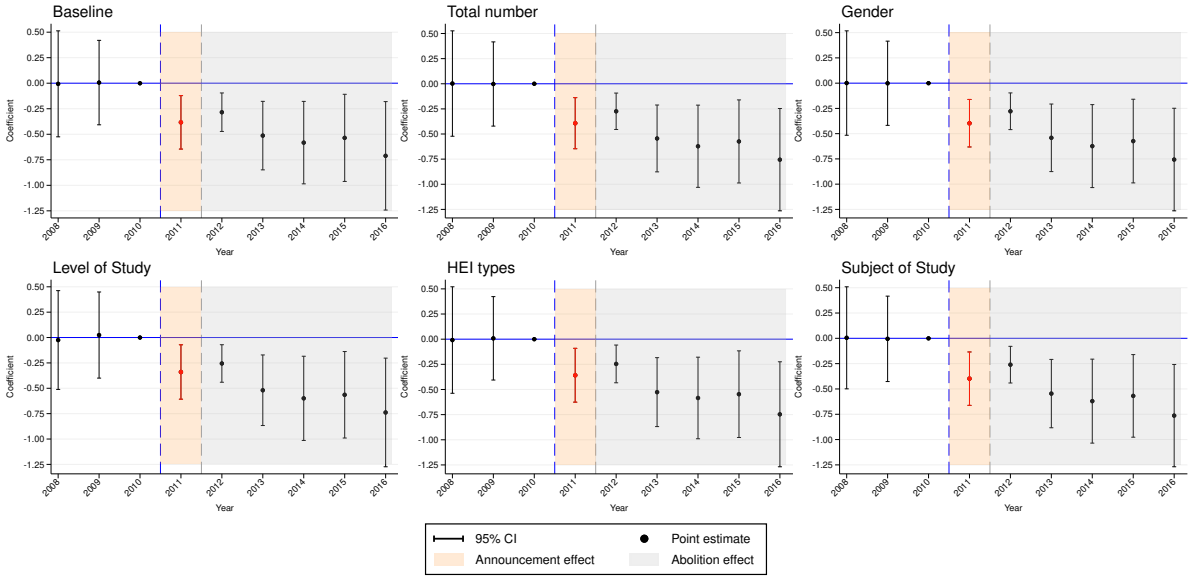


Figure 9: Announcement effects of the PSW visa abolition

Notes: The figure is the estimation results based on Equation 2 with moving one year ahead. The point estimate in red indicates the announcement effect. The confidence interval is computed based on robust standard errors clustered at the country level.

5.4.2 Extended post-treatment period

The baseline model stops in 2016 to take account of the Brexit referendum, which might contaminate the treatment effects by affecting the control group, international students from EU countries. Amuedo-Dorantes and Romiti (2021) find that the Brexit referendum has a negative impact on international student applications in the UK, especially for those from EU countries. The growth rate of international student applications decreased by 14 percent after Brexit referendum. However, the abolition of PSW visa might has lagged effects, it is still worthy to test with extended post-treatment period.

We extend the post-treatment period from 2016 to 2019, the year before COVID-19

happens. Table 6 shows the result of the extended post-treatment period[29]. The estimations remain consistent with those in Table 3. The abolition of the PSW visa continues to have a negative impact on the cultural goods export trade, though it is diluted in an extended treatment period. Compared to the baseline results, all the coefficients estimated with extended post-treatment period minimize about half. When accounting for the student characteristics, only two features, level of study and subject of study, still have effects on cultural goods export trade.

Figure 10 sheds light on the dynamics of treatment effects in the extended post-treatment period. The extended three years are highlighted in red and show upward trends. The coefficient plot indicates that lagged effects emerge as the time span is extended, the negative impact on cultural goods export trade persisted into 2017. However, this adverse effect is transient and eventually disappear in the subsequent two years.

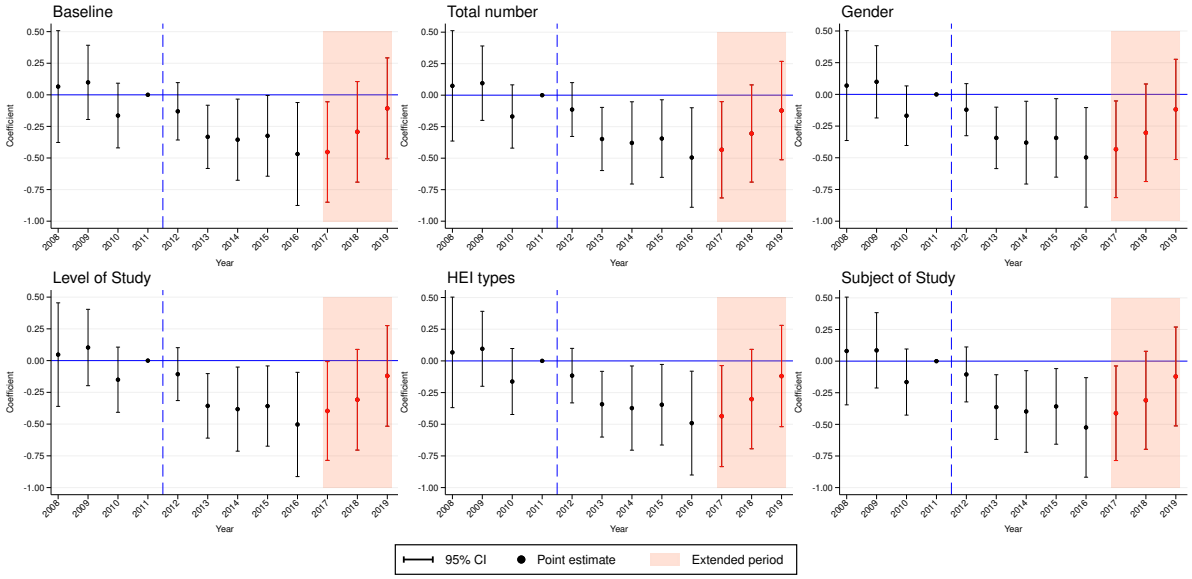


Figure 10: Effect of the PSW abolition with extended post-treatment period

Notes: The figure captures the treatment effect of PSW visa abolition with an extended post-treatment period. The point estimates in red indicate the effect of extended years. The confidence interval is computed based on robust standard errors clustered at the country level.

[29]We also check the effect on the cultural goods import trade, which has no significant effect on the post-treatment period 2012-2016. However, the PSW visa abolition remains insignificant to the UK's cultural goods import trade, even with the extended post-treatment period. The regression results of import trade with extended post-treatment period shown in Table A.9.

Table 6: Extended post-treatment period

	(1) Baseline	(2) Total Number	(3) Gender	(4) Level of Study	(5) HEI types	(6) Subject of Study
StuGroup x Post	-0.259*	-0.276*	-0.272*	-0.280**	-0.273*	-0.284**
	(0.143)	(0.141)	(0.143)	(0.140)	(0.143)	(0.137)
Total students		0.435				
		(0.369)				
Male students			0.366			
			(0.269)			
Female students			0.075			
			(0.227)			
Undergraduate students				0.100		
				(0.183)		
Taught postgraduate students				0.343*		
				(0.202)		
Research postgraduate students				0.037		
				(0.104)		
Students in RG university					0.097	
					(0.212)	
Students in Old university					0.130	
					(0.188)	
Students in New university					0.077	
					(0.133)	
Students in Other university					0.072	
					(0.073)	
Students major in STEM						0.010
						(0.202)
Students major in Social science						0.452*
						(0.239)
Students major in Liberal arts						0.192*
						(0.109)
Students major in Other subjects						-0.001
						(0.015)
Constant	-6.233	-4.112	-4.090	-3.864	-4.181	-3.682
	(11.938)	(12.191)	(12.194)	(11.813)	(12.545)	(11.741)
Controls	✓	✓	✓	✓	✓	✓
Year FE	✓	✓	✓	✓	✓	✓
Country FE	✓	✓	✓	✓	✓	✓
Observations	1104	1104	1104	1104	1104	1104
Clusters	92	92	92	92	92	92
R^2	0.937	0.937	0.937	0.938	0.937	0.938

Notes: The reported results are estimating from equation (1) wherein the dependent variable is cultural goods export trade. Standard errors in parentheses are clustered at country level. * p <0.10, ** p <0.05, *** p <0.01. New universities refer to those with polytechnic or central institution roots which obtained university status since 1992. Old universities refer to those founded before 1992 but not one of the 24 Russell Group (RG) universities.

5.4.3 Effects on other goods trade

To further investigate the effects of PSW visa abolition on trade, we adopt the (log) value of other goods trade as new dependent variable, which is the total trade minus the cultural goods trade. In contrast to its exclusive impact on the export trade of cultural goods, the abolition of the PSW exhibits an inverse effect on the trade of other goods, influencing solely the import sector. This differential outcome highlights the distinctive role of international students, who significantly impact the import trade of other goods, but not their export,

illustrating a disparate pattern from their impact on cultural goods trade[30].

Results of other goods import trade are reported in the Table 7. The PSW vias abolition negatively impacts on other goods import trade and the impacts even larger than that on cultural goods export trade. Figure 11 further exhibits the dynamic treatment effects of other goods import trade. The results can be interpreted through two lenses: Firstly, international students demonstrate a preference for and demand of goods from their home countries, potentially stimulating the import trade. Secondly, international students play a crucial role in bridging the information gap during the UK's importation of other goods from their home countries. A lack of significant impact on the export trade of other goods underscores the profound connection between international students and the trade in cultural goods. Consequently, the fluctuated influx of international students impacts solely the export of cultural goods.

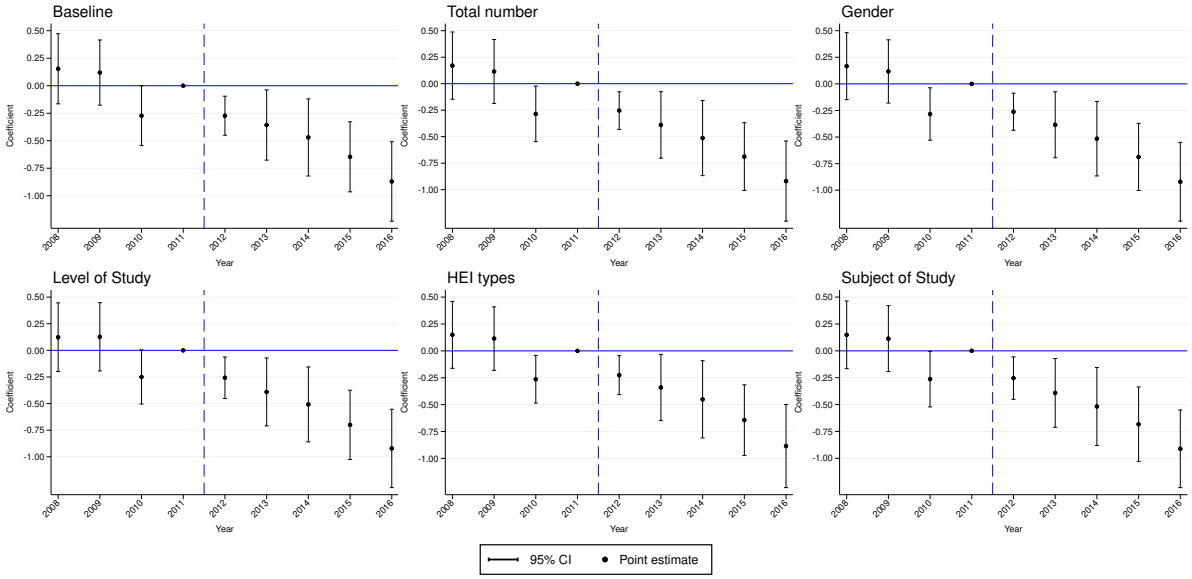


Figure 11: Effects on other goods import trade

Notes: The figure displays the significant effects of PSW visa abolition on other goods import trade and varies across different student characteristics models. The negative impact on other goods import trade lasted through the whole post-treatment period. The confidence interval is computed based on robust standard errors clustered at the country level.

[30]We also check whether the effect of PSW visa abolition exists on other goods export trade. We switch the dependent variable to the export trade of other goods, which is the other goods trade value of the UK exports to the home countries of international students. However, we find no significant effect on other goods export trade. The results of other goods export trade can be found in Table A.10.

Table 7: Effects of the PSW visa abolition on other goods import trade

	(1) Baseline	(2) Total Number	(3) Gender	(4) Level of Study	(5) HEI types	(6) Subject of Study
StuGroup x Post	-0.465***	-0.509***	-0.505***	-0.516***	-0.473**	-0.502***
	(0.175)	(0.177)	(0.176)	(0.178)	(0.186)	(0.181)
Total students		0.727**				
		(0.356)				
Male students			0.489*			
			(0.271)			
Female students			0.238			
			(0.209)			
Undergraduate students				-0.033		
				(0.173)		
Taught postgraduate students				0.508**		
				(0.228)		
Research postgraduate students				0.052		
				(0.176)		
Students in RG university					0.429	
					(0.306)	
Students in Old university					0.294**	
					(0.147)	
Students in New university					-0.198	
					(0.180)	
Students in Other university					0.253	
					(0.181)	
Students major in STEM						0.172
						(0.232)
Students major in Social science						0.518*
						(0.282)
Students major in Liberal arts						0.062
						(0.224)
Students major in Other subjects						-0.020
						(0.015)
Constant	-31.445	-26.551	-25.895	-28.525	-24.937	-27.589
	(20.675)	(19.113)	(18.826)	(20.158)	(20.074)	(19.276)
Controls	✓	✓	✓	✓	✓	✓
Year FE	✓	✓	✓	✓	✓	✓
Country FE	✓	✓	✓	✓	✓	✓
Observations	828	828	828	828	828	828
Clusters	92	92	92	92	92	92
R^2	0.957	0.958	0.958	0.958	0.959	0.958

Notes: The reported results are estimating from equation (1) wherein the dependent variable is cultural goods export trade. Standard errors in parentheses are clustered at country level. * p <0.10, ** p <0.05, *** p <0.01. New universities refer to those with polytechnic or central institution roots which obtained university status since 1992. Old universities refer to those founded before 1992 but not one of the 24 Russell Group (RG) universities.

5.4.4 Interaction of immigrants and international students

As in Section 5.1, we explore the similarity in the transmission channel of international students' influx on cultural goods trade to that of immigrants. This channel operates through the dual roles of international students: firstly, by providing vital business information to exporters, and secondly, by forming global social networks that facilitate cross-cultural connections, thereby impacting cultural goods trade. We further investigate by adopting the stock of immigrants as a moderator and incorporating interaction terms formed from the

stock of immigrants and student-related variables. Estimation results of interaction terms are exhibited in Figure 12[31]. The coefficient plot indicates that the point estimates are negative and demonstrate statistical significance. This result unveils that the escalation in international student influx attenuates the impact of immigrant stock on cultural goods trade. Substitution effects are evident between the influx of international students and the stock of immigrants, varying notably across distinct characteristics, particularly among TPG students and those specializing in social sciences.

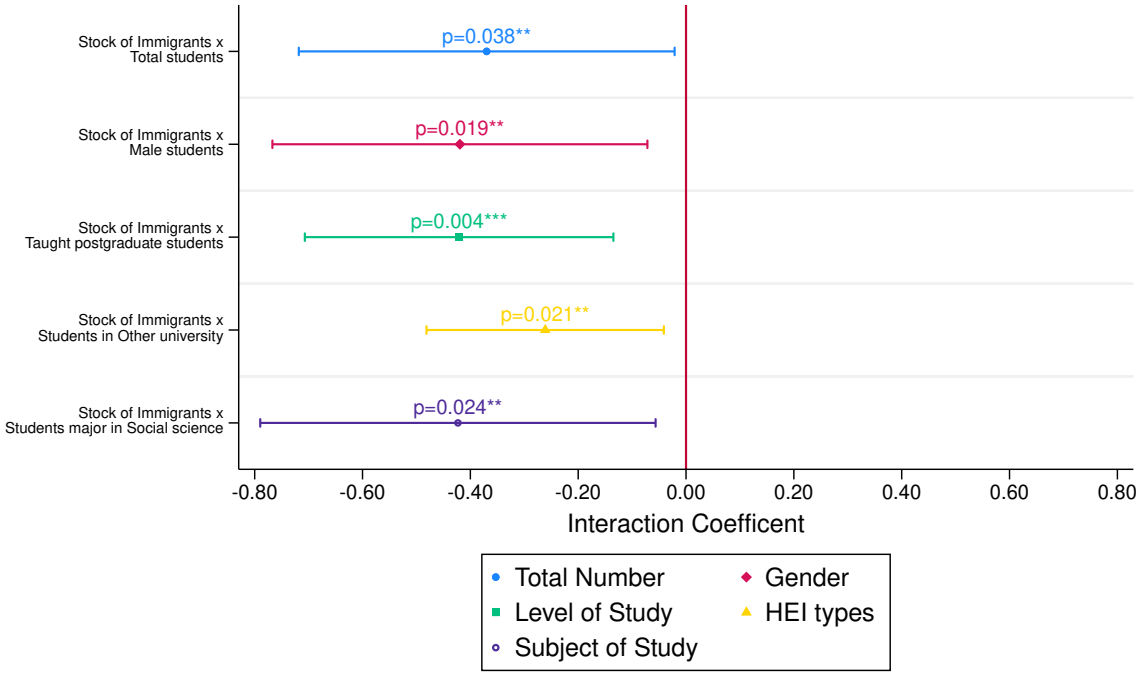


Figure 12: Coefficients of interaction term

Notes: Each mark represents the coefficient of the interaction term computed in separate model. Capped solid lines are associated with 95 percent confidence intervals, and the p-value of each coefficient is shown with a significance level denoted by * p <0.10, ** p <0.05, and *** p <0.01, respectively.

6 Conclusion and Implications

This study sheds new light on the economic impacts of international students on the trade of cultural goods. Empirically, we exploit the extent to which international students

[31]Only the significant interaction terms are included in the coefficient plot. The significant interaction terms are almost consistent with the student characteristics that have significant effects on cultural goods export trade. Check Table A.11 for the full regression results.

have a significant impact on cultural goods export trade under the context of Post-Study Work (PSW) visa abolition in the UK.

We show that the 2012 PSW visa abolition resulted in a remarkable decrease in the UK's cultural goods export trade with non-EU countries, when compared to trade with EU countries which are not affected by the policy, of around 35% on average. Moreover, the estimated effects become stronger when including controls of characteristics of international students, especially their subject of study. Our findings suggest that the influx of international students plays a substantial role in disseminating UK culture. This is further supported by Murat (2014), who found that a 10% increase in the number of international students leads to a more than 4% increase in total goods trade, highlighting the significant impact of international students on trade. Additionally, our research indicates that the fluctuation in the influx of international students does not affect the cultural goods import trade. One possible explanation is that the UK is more open to embracing cultural diversity, and the fluctuation in international students' influx would not impact the cultural goods import trade too much.

Our results have been tested with a series of robustness checks to ensure validity. Firstly, while the pre-treatment period parallel trend assumption cannot be rejected, the treatment effect of PSW abolition persists till the fourth year; secondly, we confirm our results is not affected by unobserved factors by conducting the placebo test; thirdly, we undertake further robustness checks by excluding Chinese students, using alternative commodity classifications, and changing the source of trade data, and the results remained similar; finally, we perform sensitivity analysis through method proposed by Oster, and the estimated effect of PSW visa abolition is unlikely to be driven by confounding unobservables and omitted variables.

Our main findings are consistent with Murat (2014) showing that international students have an impact on trade. However, by using a natural experiment approach and focusing on cultural goods trade and including individual characteristics of international students, the current study not only extends the existing conclusion but also reveals the causal relation between international students and trade with a more plausible identification strategy. By extending the post-treatment period from 2016 to 2019, we find the negative effects on the cultural goods trade still exist but are diminished. And the heterogeneous effects are found by subgrouping the EU and non-EU countries into those with low GDP, population, and high stock of immigrants, respectively. The impacts on cultural goods exports to either the low-GDP or low-population countries are large and significant, given that the decreasing influx of international students leads to a decline in informal information in the countries with a weaker economic background. Nevertheless, the influx of international students forms a social network that overcomes the informal barriers to trade and lowers trade transaction costs. As a result, the export of UK cultural goods to countries with a high stock of immigrants

would suffer negative impacts from the abolition of the PSW visa.

Our findings contribute to existing literature by showing large negative effects on UK cultural goods export trade when the influx of international student is decreasing. Given the unintended large negative impact on cultural goods trade after PSW visa abolition, the government should think twice before taking the drastic action of abolishing it altogether.

Notwithstanding, this study suffers from certain limitations. First, the destination for international graduates is unknown, which stops us from further investigating the labour market trend. Second, we could study the cultural goods trade only at the country level because of the availability of data. Unfortunately, though information about exporters and importers and the goods they trade can be found in HMRC, the trade values and trade partners that correspond to the exporter and importer are not collected. Third, we investigate the cultural goods defined under the UNESCO framework, which mainly focus on the physical goods. In the market for cultural goods, the proportion of digital products and services is rapidly growing (Takara and Takagi, 2022). Due to an insufficiency of data and an underdeveloped classification framework, the current state of the digital market for cultural goods and services presents a challenge for conducting a thorough analysis. These could be the research topics worthy of addressing in the future when the related new administrative data or definition framework become available.

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Appendix A Appendix tables

Table A.1: Variables: definition and sources

Variable	Definition	Source
Trade	The cultural goods trade value between the UK and partner countries	UN Comtrade
International Students	The growth rate of international students in the UK with various individual characteristics	HESA
Distance	Distance from origin country to the UK	
Language	Existence of a common official language (English)	CEPII
Colonial linkage	Dominated by the UK in history	
GDP	Current prices in U.S. dollars	
Population	Persons	IMF
Exchange rate	Domestic currency per U.S. dollar, period average	
Stock of immigrants	Scale of home country's social network in the UK	ONS
Countries or regions	* EU countries (22); Non-EU countries (70); ˆ High GDP; ¤ High Population; § High Stock of Immigrants	

Albania, Algeriaˆ¤, Angola, Argentinaˆ¤, Australiaˆ§, Austria*ˆ, Azerbaijan, Bahrain, Bangladesh¤§, Barbados, Brazilˆ¤§, Brunei Darussalam, Bulgaria*, Cameroon, Canadaˆ¤§, Chileˆ, Chinaˆ¤§, Colombiaˆ¤, Cyprus*§, Czechia*¤, Denmark*ˆ, Egyptˆ¤§, Estonia*, Finland*ˆ, France*ˆ¤§, Gambia, Georgia, Germany*ˆ¤§, Ghana§, Greece*ˆ¤, Hungary*¤, Iceland, Indiaˆ¤§, Indonesiaˆ¤, Iranˆ¤§, Iraqˆ¤§, Ireland*§, Israelˆ, Italy*ˆ¤§, Jamaica§, Japanˆ¤§, Jordan, Kazakhstanˆ, Kenya¤§, Kuwait, Latvia*§, Lebanon, Libya, Lithuania*§, Malawi, Malaysiaˆ¤§, Malta*, Mauritius§, Mexicoˆ¤, Morocco¤, Nepal¤§, Netherlands*ˆ¤, New Zealand§, Nigeriaˆ¤§, Norwayˆ, Oman, Pakistanˆ¤§, Peru¤, Philippinesˆ¤§, Poland*ˆ¤§, Portugal*¤§, Qatar, Rep. of Koreaˆ¤, Russian Federationˆ¤§, Saudi Arabiaˆ¤§, Singaporeˆ§, Slovakia*§, South Africaˆ¤§, Spain*ˆ¤§, Sri Lanka§, Sudan¤§, Sweden*ˆ¤, Switzerlandˆ, Syria, Taiwan - Province of Chinaˆ§, Thailandˆ¤§, Trinidad and Tobago, Turkeyˆ¤§, Uganda¤§, Ukraine¤, United Arab Emiratesˆ, United Rep. of Tanzania¤§, USAˆ¤§, Venezuelaˆ¤, Viet Namˆ¤§, Zambia§, Zimbabwe§

Table A.2: Sample mean characteristics (log number)

	Pre-treatment period (2008 - 2012)				Post-treatment period (2013 - 2016)			
	EU	EU%	NonEU	NonEU%	EU	EU%	NonEU	NonEU%
Outcome								
Export cultural goods trade	17.942 (1.518)	27.645%	16.488 (2.125)	72.355%	17.898 (1.473)	22.822%	16.381 (2.247)	77.178%
Import cultural goods trade	16.906 (2.567)	28.975%	14.469 (3.831)	71.025%	17.125 (2.471)	39.286%	14.327 (3.967)	60.714%
Student characteristics								
Total students	8.119 (0.959)	31.357%	7.228 (1.251)	68.643%	8.181 (0.886)	28.482%	7.287 (1.301)	71.518%
Male students	7.309 (1.018)	46.866%	6.598 (1.267)	54.472%	7.356 (0.944)	46.022%	6.627 (1.307)	49.309%
Female students	7.516 (0.923)	53.133%	6.398 (1.266)	45.527%	7.592 (0.851)	53.953%	6.508 (1.324)	50.681%
Undergraduate students	7.646 (0.967)	61.513%	6.304 (1.389)	43.551%	7.708 (0.934)	61.955%	6.411 (1.456)	47.377%
Taught postgraduate students	6.631 (1.175)	27.561%	6.279 (1.288)	45.653%	6.586 (1.149)	25.874%	6.282 (1.294)	41.527%
Research postgraduate students	5.666 (1.257)	10.926%	5.048 (1.432)	10.796%	5.798 (1.180)	12.171%	5.121 (1.468)	11.097%
Students in RG university	6.867 (0.985)	28.834%	6.053 (1.347)	34.064%	7.088 (0.916)	34.282%	6.168 (1.434)	39.957%
Students in Old university	6.488 (1.054)	21.647%	5.617 (1.256)	19.951%	6.652 (0.946)	22.852%	5.686 (1.319)	20.354%
Students in New university	6.925 (0.986)	31.237%	5.908 (1.361)	31.076%	6.832 (0.919)	26.443%	5.859 (1.397)	25.991%
Students in Other university	6.480 (0.881)	18.283%	5.331 (1.266)	14.910%	6.395 (0.846)	16.422%	5.399 (1.268)	13.698%
Students major in STEM	7.044 (1.103)	39.505%	6.228 (1.348)	38.450%	7.230 (0.975)	41.865%	6.298 (1.348)	35.972%
Students major in Social science	7.122 (0.903)	35.077%	6.320 (1.284)	44.882%	7.122 (0.887)	34.701%	6.421 (1.328)	47.221%
Students major in Liberal arts	6.739 (0.931)	24.353%	5.277 (1.350)	15.839%	6.750 (0.820)	22.737%	5.233 (1.477)	16.133%
Students major in Other subjects	3.381 (1.148)	1.065%	1.948 (1.485)	0.827%	2.837 (1.317)	0.700%	1.773 (1.475)	0.675%
Controls								
Stock of immigrants	10.935 (1.069)	34.208%	10.153 (1.378)	65.792%	11.205 (1.078)	37.912%	10.285 (1.299)	62.088%
Common official language	0.091 (0.289)	9.091%	0.314 (0.465)	31.429%	0.091 (0.289)	9.091%	0.314 (0.465)	31.429%
Colonial linkage	0.136 (0.345)	13.636%	0.486 (0.501)	48.571%	0.136 (0.345)	13.636%	0.486 (0.501)	48.571%
Distance between capitals	7.155 (0.559)	-	8.647 (0.613)	-	7.155 (0.560)	-	8.647 (0.613)	-
GDP	26.127 (1.617)	-	25.633 (1.797)	-	26.104 (1.582)	-	25.783 (1.814)	-
Population	15.923 (1.365)	-	16.800 (1.743)	-	15.927 (1.366)	-	16.873 (1.734)	-
Exchange rate	0.521 (1.463)	-	2.991 (2.900)	-	0.529 (1.431)	-	3.168 (2.772)	-

Notes: Standard deviations in parentheses. All variables related to international students are log number. The percentage of common official language and colonial linkage are those equal 1. Percentages for each student characteristics (gender, level of study, HEI types, and subject of study) correspond to the total student in specific country group and period.

Table A.3: Results of excluding control variables and fixed effects

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Baseline		Total Number		Gender		Level of Study		HEI types		Subject of Study	
StuGroup x Post	-0.577***	-0.457***	-0.792***	-0.635***	-0.757***	-0.584***	-0.842***	-0.645***	-0.726***	-0.587***	-0.813***	-0.655***
	(0.175)	(0.149)	(0.251)	(0.210)	(0.241)	(0.194)	(0.251)	(0.197)	(0.227)	(0.187)	(0.258)	(0.212)
StuGroup	-1.682***	-0.422	-1.458***	-0.241	-1.469***	-0.257	-1.449***	-0.235	-1.454***	-0.187	-1.420***	-0.197
	(0.374)	(0.600)	(0.428)	(0.600)	(0.421)	(0.582)	(0.422)	(0.593)	(0.426)	(0.562)	(0.434)	(0.592)
Post	0.045	-0.017	0.349**	0.208	0.356**	0.211	0.409**	0.240*	0.335**	0.214	0.391**	0.220
	(0.052)	(0.086)	(0.168)	(0.144)	(0.165)	(0.142)	(0.164)	(0.134)	(0.167)	(0.146)	(0.184)	(0.147)
Total students			2.989**	2.327**								
			(1.146)	(0.977)								
Male students					2.605**	2.446***						
					(1.090)	(0.918)						
Female students					0.341	-0.216						
					(0.658)	(0.590)						
Undergraduate students							1.323	0.353				
							(0.808)	(0.497)				
Taught postgraduate students							1.517***	1.427***				
							(0.464)	(0.482)				
Research postgraduate students							0.434	0.556				
							(0.312)	(0.358)				
Students in RG university									2.000**	2.278***		
									(0.808)	(0.750)		
Students in Old university									0.806*	0.649**		
									(0.455)	(0.323)		
Students in New university									-0.199	-0.427		
									(0.396)	(0.326)		
Students in Other university									0.351	0.087		
									(0.251)	(0.202)		
Students major in STEM											1.307*	1.391**
											(0.685)	(0.616)
Students major in Social science											1.663**	0.950
											(0.758)	(0.593)
Students major in Liberal arts											0.367	0.143
											(0.314)	(0.189)
Students major in Other subjects											-0.020	0.002
											(0.040)	(0.032)
Constant	17.265***	3.102	17.016***	3.148	17.021***	3.057	17.025***	3.230	16.959***	2.983	16.971***	3.180
	(0.256)	(2.665)	(0.314)	(2.546)	(0.313)	(2.457)	(0.304)	(2.542)	(0.319)	(2.445)	(0.323)	(2.558)
Controls		✓		✓		✓		✓		✓		✓
Year FE												
Country FE												
Observations	828	828	828	828	828	828	828	828	828	828	828	828
Clusters	92	92	92	92	92	92	92	92	92	92	92	92
R^2	0.108	0.514	0.153	0.539	0.156	0.544	0.159	0.544	0.157	0.558	0.162	0.544

Notes: The reported results are estimating from equation (1) wherein the dependent variable is cultural goods export trade. Standard errors in parentheses are clustered at country level. * p <0.10, ** p <0.05, *** p <0.01. New universities refer to those with polytechnic or central institution roots which obtained university status since 1992. Old universities refer to those founded before 1992 but not one of the 24 Russell Group (RG) universities.

Table A.4: Results of import cultural goods trade

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Baseline		Total Number		Gender		Level of Study		HEI types		Subject of Study	
StuGroup x Post	-0.682*	0.043	-0.837*	0.058	-0.869*	0.062	-0.902*	0.107	-0.979*	-0.019	-0.734	0.125
	(0.400)	(0.423)	(0.474)	(0.428)	(0.480)	(0.428)	(0.492)	(0.429)	(0.516)	(0.426)	(0.453)	(0.420)
StuGroup	-1.957		-1.798		-1.792		-1.804		-1.539		-1.764	
	(1.745)		(1.621)		(1.617)		(1.593)		(1.433)		(1.533)	
Post	0.248		0.445		0.448		0.467		0.463		0.371	
	(0.338)		(0.392)		(0.395)		(0.398)		(0.381)		(0.354)	
Total students			2.032	-0.247								
			(2.148)	(1.049)								
Male students					0.403	0.008						
					(1.281)	(0.710)						
Female students					1.678	-0.221						
					(1.293)	(0.944)						
Undergraduate students							2.718*	0.947*				
							(1.414)	(0.554)				
Taught postgraduate students							-0.167	-1.142*				
							(0.957)	(0.651)				
Research postgraduate students							0.167	0.032				
							(0.521)	(0.462)				
Students in RG university									2.157	-0.468		
									(2.309)	(1.143)		
Students in Old university									0.836	0.353		
									(0.644)	(0.418)		
Students in New university									1.139	0.857		
									(0.943)	(0.845)		
Students in Other university									-1.983	-1.544		
									(1.429)	(1.256)		
Students major in STEM											1.737	0.796
											(1.738)	(0.656)
Students major in Social science											0.025	-1.372*
											(1.212)	(0.697)
Students major in Liberal arts											0.234	0.403
											(0.404)	(0.456)
Students major in Other subjects											-0.199*	-0.141**
											(0.104)	(0.064)
Constant	-29.528***	139.555**	-29.489***	137.893**	-29.358***	138.674**	-29.753***	140.402**	-29.455***	136.440**	-29.573***	138.112**
	(9.036)	(58.196)	(8.909)	(59.532)	(8.840)	(60.714)	(8.769)	(60.613)	(8.718)	(61.499)	(8.870)	(59.003)
Controls	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Year FE		✓		✓		✓		✓		✓		✓
Country FE		✓		✓		✓		✓		✓		✓
Observations	828	828	828	828	828	828	828	828	828	828	828	828
Clusters	92	92	92	92	92	92	92	92	92	92	92	92
R^2	0.495	0.842	0.499	0.842	0.499	0.842	0.504	0.844	0.515	0.849	0.503	0.846

Notes: The reported results are estimating from equation (1) wherein the dependent variable is cultural goods import trade. Standard errors in parentheses are clustered at country level. * p <0.10, ** p <0.05, *** p <0.01. New universities refer to those with polytechnic or central institution roots which obtained university status since 1992. Old universities refer to those founded before 1992 but not one of the 24 Russell Group (RG) universities.

Table A.5: Change the trade data source to HMRC (SITC code)

	(1) Baseline	(2) Total Number	(3) Gender	(4) Level of Study	(5) HEI types	(6) Subject of Study
StuGroup x Post	-0.330*	-0.372**	-0.362**	-0.381**	-0.365**	-0.382**
	(0.174)	(0.174)	(0.175)	(0.172)	(0.176)	(0.170)
Total students		0.698**				
		(0.323)				
Male students			0.576*			
			(0.307)			
Female students			0.111			
			(0.179)			
Undergraduate students				-0.093		
				(0.183)		
Taught postgraduate students				0.554***		
				(0.189)		
Research postgraduate students				0.083		
				(0.091)		
Students in RG university					0.414**	
					(0.190)	
Students in Old university					0.151	
					(0.168)	
Students in New university					0.062	
					(0.119)	
Students in Other university					0.127	
					(0.097)	
Students major in STEM						0.067
						(0.184)
Students major in Social science						0.480*
						(0.267)
Students major in Liberal arts						0.248**
						(0.116)
Students major in Other subjects						0.005
						(0.019)
Constant	-23.953	-19.254	-18.148	-20.703	-17.698	-18.899
	(18.399)	(17.743)	(17.866)	(18.093)	(17.770)	(17.103)
Controls	✓	✓	✓	✓	✓	✓
Year FE	✓	✓	✓	✓	✓	✓
Country FE	✓	✓	✓	✓	✓	✓
Observations	828	828	828	828	828	828
Clusters	92	92	92	92	92	92
R^2	0.936	0.937	0.938	0.938	0.938	0.938

Notes: The reported results are estimating from equation (1) wherein the dependent variable is cultural goods export trade. Standard errors in parentheses are clustered at country level. * p <0.10, ** p <0.05, *** p <0.01. New universities refer to those with polytechnic or central institution roots which obtained university status since 1992. Old universities refer to those founded before 1992 but not one of the 24 Russell Group (RG) universities.

Table A.6: Results in High / Low GDP groups

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Baseline		Total Number		Gender		Level of Study		HEI types		Subject of Study	
StuGroup x Post	0.213	-0.583***	0.218	-0.657***	0.199	-0.648***	0.215	-0.679***	0.267*	-0.651***	0.220	-0.670***
	(0.149)	(0.199)	(0.151)	(0.202)	(0.152)	(0.205)	(0.162)	(0.204)	(0.155)	(0.210)	(0.151)	(0.206)
Total students			0.139	0.855**								
			(0.360)	(0.418)								
Male students					-0.380	0.653*						
					(0.383)	(0.359)						
Female students					0.545*	0.186						
					(0.307)	(0.264)						
Undergraduate students							-0.135	-0.070				
							(0.178)	(0.287)				
Taught postgraduate students							0.013	0.649**				
							(0.251)	(0.281)				
Research postgraduate students							0.345	0.065				
							(0.285)	(0.084)				
Students in RG university									0.057	0.511**		
									(0.255)	(0.240)		
Students in Old university									0.424**	-0.016		
									(0.168)	(0.257)		
Students in New university									-0.101	0.196		
									(0.116)	(0.175)		
Students in Other university									-0.072	0.122		
									(0.144)	(0.102)		
Students major in STEM											-0.045	0.193
											(0.179)	(0.313)
Students major in Social science											0.147	0.496
											(0.246)	(0.315)
Students major in Liberal arts											0.160	0.203
											(0.125)	(0.140)
Students major in Other subjects											-0.008	-0.001
											(0.017)	(0.020)
Constant	16.049	-21.698	19.622	-17.103	17.955	-15.957	27.276	-19.309	27.217	-16.246	18.318	-17.063
	(44.008)	(14.430)	(51.399)	(13.378)	(51.912)	(13.820)	(62.487)	(13.897)	(56.702)	(13.411)	(51.590)	(12.865)
Controls	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Year FE	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Country FE	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Observations	414	414	414	414	414	414	414	414	414	414	414	414
Clusters	46	46	46	46	46	46	46	46	46	46	46	46
R^2	0.967	0.925	0.967	0.927	0.968	0.928	0.968	0.929	0.969	0.928	0.968	0.928

Notes: The reported results are estimating from equation (1) wherein the dependent variable is cultural goods import trade. Standard errors in parentheses are clustered at country level. * p <0.10, ** p <0.05, *** p <0.01. New universities refer to those with polytechnic or central institution roots which obtained university status since 1992. Old universities refer to those founded before 1992 but not one of the 24 Russell Group (RG) universities.

Table A.7: Results in High / Low Population groups

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Baseline		Total Number		Gender		Level of Study		HEI types		Subject of Study	
StuGroup x Post	-0.315	-0.380**	-0.312	-0.498**	-0.339	-0.475**	-0.306	-0.472**	-0.276	-0.493**	-0.294	-0.516**
	(0.263)	(0.187)	(0.264)	(0.215)	(0.275)	(0.212)	(0.253)	(0.201)	(0.274)	(0.218)	(0.256)	(0.221)
Total students			0.036	0.978*								
			(0.292)	(0.497)								
Male students					-0.592	1.017***						
					(0.381)	(0.353)						
Female students					0.588**	-0.024						
					(0.268)	(0.251)						
Undergraduate students							0.062	-0.145				
							(0.160)	(0.310)				
Taught postgraduate students							0.002	0.698**				
							(0.248)	(0.314)				
Research postgraduate students							-0.028	0.100				
							(0.338)	(0.082)				
Students in RG university									0.015	0.471**		
									(0.196)	(0.230)		
Students in Old university									0.308	0.014		
									(0.272)	(0.257)		
Students in New university									-0.201*	0.353**		
									(0.119)	(0.153)		
Students in Other university									0.086	0.050		
									(0.145)	(0.108)		
Students major in STEM											-0.170	0.153
											(0.194)	(0.354)
Students major in Social science											0.155	0.587
											(0.303)	(0.365)
Students major in Liberal arts											0.174	0.234
											(0.160)	(0.170)
Students major in Other subjects											-0.022	0.010
											(0.023)	(0.021)
Constant	-32.002	-16.495	-31.513	-11.338	-32.746	-8.329	-31.493	-15.644	-27.577	-10.357	-33.830	-10.752
	(36.492)	(16.247)	(36.632)	(14.151)	(35.499)	(14.069)	(35.014)	(15.567)	(36.350)	(14.220)	(35.864)	(13.338)
Controls	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Year FE	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Country FE	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Observations	414	414	414	414	414	414	414	414	414	414	414	414
Clusters	46	46	46	46	46	46	46	46	46	46	46	46
R2	0.936	0.948	0.936	0.950	0.937	0.951	0.936	0.951	0.937	0.950	0.936	0.950

Notes: The reported results are estimating from equation (1) wherein the dependent variable is cultural goods import trade. Standard errors in parentheses are clustered at country level. * p <0.10, ** p <0.05, *** p <0.01. New universities refer to those with polytechnic or central institution roots which obtained university status since 1992. Old universities refer to those founded before 1992 but not one of the 24 Russell Group (RG) universities.

Table A.8: Results in High / Low Stock of immigrants groups

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Baseline		Total Number		Gender		Level of Study		HEI types		Subject of Study	
StuGroup x Post	-0.381***	-0.158	-0.369***	-0.222	-0.355***	-0.224	-0.373***	-0.229	-0.396***	-0.208	-0.375***	-0.228
	(0.112)	(0.184)	(0.118)	(0.173)	(0.116)	(0.177)	(0.133)	(0.179)	(0.119)	(0.173)	(0.121)	(0.171)
Total students			-0.238	0.926***								
			(0.215)	(0.298)								
Male students					0.088	0.474						
					(0.375)	(0.331)						
Female students					-0.344	0.455*						
					(0.310)	(0.264)						
Undergraduate students							-0.065	-0.046				
							(0.132)	(0.249)				
Taught postgraduate students							-0.170	0.656***				
							(0.241)	(0.239)				
Research postgraduate students							0.174	0.062				
							(0.354)	(0.075)				
Students in RG university									0.267	0.375*		
									(0.431)	(0.188)		
Students in Old university									0.082	0.075		
									(0.149)	(0.216)		
Students in New university									-0.145	0.135		
									(0.174)	(0.117)		
Students in Other university									-0.270	0.221**		
									(0.193)	(0.107)		
Students major in STEM											-0.226	0.143
											(0.155)	(0.240)
Students major in Social science											-0.121	0.631**
											(0.212)	(0.239)
Students major in Liberal arts											0.135	0.207
											(0.161)	(0.131)
Students major in Other subjects											-0.015	0.009
											(0.013)	(0.021)
Constant	-15.287	-25.834	-15.521	-18.437	-15.214	-18.291	-16.995	-21.825	-11.067	-19.028	-16.481	-17.897
	(14.966)	(15.919)	(14.876)	(14.952)	(15.026)	(15.293)	(13.917)	(15.369)	(18.209)	(14.698)	(16.356)	(14.902)
Controls	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Year FE	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Country FE	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Observations	414	414	414	414	414	414	414	414	414	414	414	414
Clusters	46	46	46	46	46	46	46	46	46	46	46	46
R^2	0.968	0.936	0.968	0.938	0.968	0.938	0.968	0.939	0.969	0.938	0.968	0.938

Notes: The reported results are estimating from equation (1) wherein the dependent variable is cultural goods import trade. Standard errors in parentheses are clustered at country level. * p <0.10, ** p <0.05, *** p <0.01. New universities refer to those with polytechnic or central institution roots which obtained university status since 1992. Old universities refer to those founded before 1992 but not one of the 24 Russell Group (RG) universities.

Table A.9: Extended post-treatment period for import trade

	(1) Baseline	(2) Total Number	(3) Gender	(4) Level of Study	(5) HEI types	(6) Subject of Study
StuGroup x Post	-0.205	-0.204	-0.205	-0.204	-0.338	-0.134
	(0.468)	(0.478)	(0.468)	(0.486)	(0.469)	(0.462)
Total students		-0.037				
		(0.993)				
Male students			-0.671			
			(0.567)			
Female students			0.547			
			(0.848)			
Undergraduate students				0.722		
				(0.733)		
Taught postgraduate students				-0.662		
				(0.720)		
Research postgraduate students				-0.149		
				(0.426)		
Students in RG university					-1.605	
					(0.971)	
Students in Old university					0.507	
					(0.557)	
Students in New university					1.128	
					(0.813)	
Students in Other university					-0.555	
					(0.959)	
Students major in STEM						-0.144
						(0.545)
Students major in Social science						-0.066
						(0.982)
Students major in Liberal arts						0.079
						(0.529)
Students major in Other subjects						-0.136**
						(0.059)
Constant	30.940	30.760	30.940	32.401	26.296	27.661
	(61.756)	(58.942)	(61.756)	(60.939)	(55.905)	(57.256)
Controls	✓	✓	✓	✓	✓	✓
Year FE	✓	✓	✓	✓	✓	✓
Country FE	✓	✓	✓	✓	✓	✓
Observations	1104	1104	1104	1104	1104	1104
Clusters	92	92	92	92	92	92
R^2	0.784	0.784	0.784	0.785	0.790	0.785

Notes: The reported results are estimating from equation (1) wherein the dependent variable is cultural goods import trade. Standard errors in parentheses are clustered at country level. * p <0.10, ** p <0.05, *** p <0.01. New universities refer to those with polytechnic or central institution roots which obtained university status since 1992. Old universities refer to those founded before 1992 but not one of the 24 Russell Group (RG) universities.

Table A.10: Effects of the PSW visa abolition on other goods export trade

	(1) Baseline	(2) Total Number	(3) Gender	(4) Level of Study	(5) HEI types	(6) Subject of Study
StuGroup x Post	-0.121	-0.141	-0.137	-0.139	-0.155	-0.126
	(0.138)	(0.147)	(0.144)	(0.145)	(0.149)	(0.146)
Total students		0.328				
		(0.293)				
Male students			0.213			
			(0.291)			
Female students			0.088			
			(0.142)			
Undergraduate students				-0.049		
				(0.147)		
Taught postgraduate students				0.214*		
				(0.109)		
Research postgraduate students				0.074		
				(0.086)		
Students in RG university					0.087	
					(0.136)	
Students in Old university					-0.070	
					(0.170)	
Students in New university					0.219*	
					(0.131)	
Students in Other university					0.030	
					(0.051)	
Students major in STEM						-0.037
						(0.148)
Students major in Social science						0.316
						(0.264)
Students major in Liberal arts						0.087
						(0.090)
Students major in Other subjects						-0.036***
						(0.013)
Constant	-1.306	0.904	1.049	0.528	0.205	-0.692
	(11.950)	(11.017)	(10.459)	(10.675)	(10.873)	(10.350)
Controls	✓	✓	✓	✓	✓	✓
Year FE	✓	✓	✓	✓	✓	✓
Country FE	✓	✓	✓	✓	✓	✓
Observations	828	828	828	828	828	828
Clusters	92	92	92	92	92	92
R^2	0.955	0.956	0.956	0.956	0.956	0.957

Notes: The reported results are estimating from equation (1) wherein the dependent variable is other goods export trade. Standard errors in parentheses are clustered at country level. * p <0.10, ** p <0.05, *** p <0.01. New universities refer to those with polytechnic or central institution roots which obtained university status since 1992. Old universities refer to those founded before 1992 but not one of the 24 Russell Group (RG) universities.

Table A.11: Moderate effects on the stock of immigrants

	(1) Total Number	(2) Gender	(3) Level of Study	(4) HEI types	(5) Subject of Study
StuGroup x Post	-0.405***	-0.403***	-0.391**	-0.405***	-0.410***
	(0.139)	(0.141)	(0.150)	(0.142)	(0.137)
Total students	4.189**				
	(1.798)				
StuIm	-0.370**				
	(0.175)				
Male students		4.354**			
		(1.656)			
Female students		-0.137			
		(0.865)			
MaleIm		-0.419**			
		(0.175)			
FemaleIm		0.046			
		(0.103)			
Undergraduate students			-1.940		
			(2.059)		
Taught postgraduate students			4.485***		
			(1.465)		
Research postgraduate students			0.307		
			(1.361)		
UGIm			0.188		
			(0.198)		
TPGIm			-0.421***		
			(0.144)		
PGRIm			-0.022		
			(0.144)		
Students in RG university				1.257	
				(1.932)	
Students in Old university				-0.955	
				(1.416)	
Students in New university				0.445	
				(0.645)	
Students in Other university				2.685**	
				(1.115)	
RG24Im				-0.098	
				(0.200)	
OLDIm				0.110	
				(0.135)	
NEWIm				-0.047	
				(0.068)	
OtherIm				-0.261**	
				(0.111)	
Students major in STEM					1.320
					(1.699)
Students major in Social science					3.461**
					(1.574)
Students major in Liberal arts					-0.358
					(1.692)
Students major in Other subjects					0.074
					(0.163)
STEMIm					-0.136
					(0.167)
SocSciIm					-0.312**
					(0.156)
LibArtIm					0.058
					(0.168)
OtherSubIm					-0.008
					(0.015)
Constant	-18.758	-17.884	-21.005	-20.234	-18.788
	(13.228)	(13.538)	(13.797)	(13.615)	(13.252)
Controls	✓	✓	✓	✓	✓
Year FE	✓	✓	✓	✓	✓
Country FE	✓	✓	✓	✓	✓
Observations	828	828	828	828	828
Clusters	92	92	92	92	92
R^2	0.943	0.943	0.944	0.943	0.943

Notes: The reported results are estimating from equation (1) wherein the dependent variable is cultral goods export trade. Standard errors in parentheses are clustered at country level. * p <0.10, ** p <0.05, *** p <0.01. New universities refer to those with polytechnic or central institution roots which obtained university status since 1992. Old universities refer to those founded before 1992 but not one of the 24 Russell Group (RG) universities.

Appendix B HESA Data

B.1 Basic pre-processing

The HESA data is recorded in the academic years, which we convert into calendar years for merging trade data and other variables. For example, the academic year 2007/08 is converted to the calendar year 2009. The students' number is counted by the Full Person Equivalent (FPE), which is able to consider the situation when students undertake more than one course during the reporting year[32].

In Figure B1 we show the distribution of international students' mean values among pre-treatment period (i.e., 2008-2012) groups in EU and non-EU countries. The 5% quantile values are chosen as the threshold to exclude countries with a small number of international students, for which the EU countries is 4176 and non-EU countries is 1077. Thereafter, each observation is weighted by the mean of the international student population in the pre-treatment period, and the weights are used in all models.

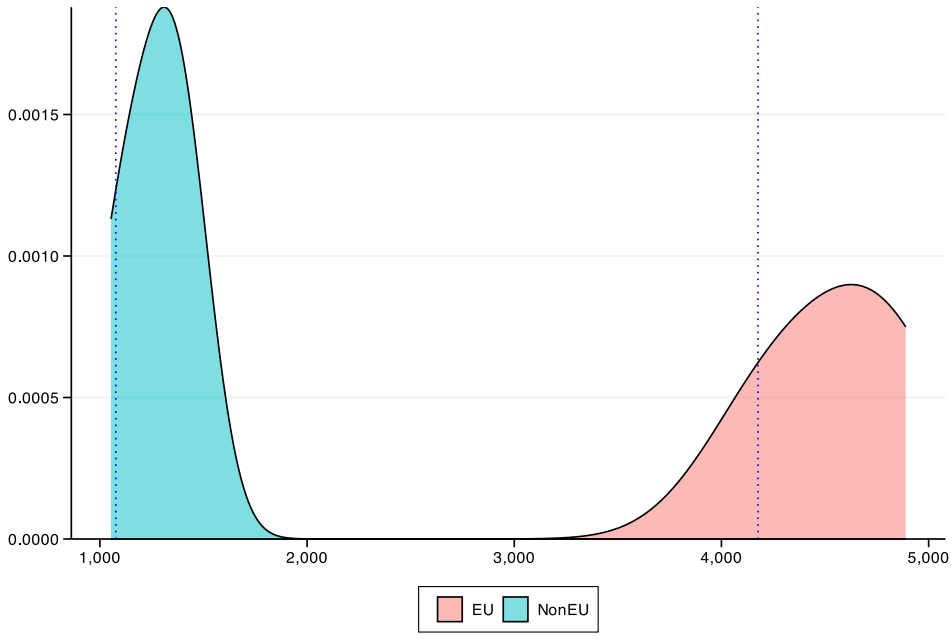

Figure B.1: Distribution of EU & Non-EU IS (mean values) in pre-treatment period

[32]For further details of definition, check HESA website: https://www.hesa.ac.uk/support/definitions/students

B.2 Involved Higher Education Institutions (HEI)

There are 223 of HEIs included in our sample. Some HEIs might be excluded from our sample because they either enrolled enough students met the student population definition or they requested not to disclose their data. HEIs are divided into sub-groups due to the selectivity. The first tier HEI is the Russell Group, which is the self-selected association of 24 "elite" research intensive universities; the second tier "Old" universities are those founded before 1992 but outside the Russell Group; the third tier "New" universities are those gained university status after 1992, in this study focus on those with polytechnic or central institution roots; the rest HEIs in the whole sample classified as "Other" universities.

The 24 HEIs in Russell Group are the following: Cardiff University; Imperial College London; King's College London; London School of Economics and Political Science; Newcastle University; Queen Mary University of London; Queen's University Belfast; The University of Birmingham; The University of Bristol; The University of Cambridge; The University of Edinburgh; The University of Exeter; The University of Glasgow; The University of Leeds; The University of Liverpool; The University of Manchester; The University of Oxford; The University of Sheffield; The University of Southampton; The University of Warwick; The University of York; University College London; University of Durham; University of Nottingham.

The 28 "Old" universities are the following: Aston University; Brunel University London; City, University of London; Heriot-Watt University; Keele University; Loughborough University; The Open University; The University of Aberdeen; The University of Bath; The University of Bradford; The University of Buckingham; The University of Dundee; The University of East Anglia; The University of Essex; The University of Hull; The University of Kent; The University of Lancaster; The University of Leicester; The University of Reading; The University of Salford; The University of St Andrews; The University of Stirling; The University of Strathclyde; The University of Surrey; The University of Sussex; The University of Wales; Ulster University; University of London.

The 38 "New" universities are the following: Abertay University; Anglia Ruskin University; Birmingham City University; Bournemouth University; Coventry University; De Montfort University; Edinburgh Napier University; Glasgow Caledonian University; Kingston University; Leeds Beckett University; Liverpool John Moores University; London Metropolitan University; London South Bank University; Middlesex University; Oxford Brookes University; Robert Gordon University; Sheffield Hallam University; Staffordshire University;

Teesside University; The Manchester Metropolitan University; The Nottingham Trent University; The University of Brighton; The University of Central Lancashire; The University of East London; The University of Greenwich; The University of Huddersfield; The University of Lincoln; The University of Portsmouth; The University of Sunderland; The University of the West of Scotland; The University of West London; The University of Westminster; The University of Wolverhampton; University of Hertfordshire; University of Northumbria at Newcastle; University of Plymouth; University of South Wales; University of the West of England, Bristol.

The rest 133 HEIs (i.e., Other universities) included in the whole sample are the following: Aberystwyth University; AECC University College; Bangor University; Bath Spa University; Bell College; Birkbeck College; Bishop Grosseteste University; Bretton Hall College of HE; British Postgraduate Medical Federation; Buckinghamshire New University; Camborne School of Mines; Canterbury Christ Church University; Cardiff Metropolitan University; Charing Cross and Westminster Medical School; Coleg Normal; Conservatoire for Dance and Drama; Courtauld Institute of Art; Craigie College of Education; Cranfield University; Cumbria Institute of the Arts; Dartington College of Arts; Duncan of Jordanstone College of Art; Edge Hill University; Edinburgh College of Art; Falmouth University; Glasgow School of Art; Glyndŵr University; Goldsmiths College; Gower College Swansea; Grŵp Llandrillo Menai; Grŵp NPTC Group; Guildhall School of Music and Drama; Harper Adams University; Hartpury University; Heythrop College; Homerton College; Institute of Education; Kent Institute of Art and Design; La Sainte Union College of HE; LAMDA Limited; Leeds Arts University; Leeds College of Music; Leeds Conservatoire; Leeds Trinity University; Liverpool Hope University; Liverpool School of Tropical Medicine; London Business School; London Guildhall University; London Medical Consortium; London School of Hygiene and Tropical Medicine; Loughborough College of Art and Design; Manchester Business School; Moray House Institute of Education; Newman University; North Riding College Higher Education Corporation; Northern College of Education; Northern School of Contemporary Dance; Norwich University of the Arts; Plymouth College of Art; Queen Margaret University, Edinburgh; Ravensbourne University London; Roehampton University; Rose Bruford College of Theatre and Performance; Royal Academy of Dramatic Art; Royal Academy of Music; Royal Agricultural University; Royal College of Art; Royal College of Music; Royal Conservatoire of Scotland; Royal Free Hospital School of Medicine; Royal Holloway and Bedford New College; Royal Northern College of Music; Royal Postgraduate Medical School; Royal Welsh College of Music and Drama; Salford College of Technology; SOAS University of London; Solent University; SRUC; St Andrew's College of Education; St Bartholomew's Hospital

Medical College; St George's, University of London; St Mary's University College; St Mary's University, Twickenham; Stranmillis University College; Swansea Metropolitan University; Swansea University; The Arts University Bournemouth; The College of Guidance Studies; The Institute of Cancer Research; The Liverpool Institute for Performing Arts; The London Hospital Medical College; The National Film and Television School; The Royal Central School of Speech and Drama; The Royal College of Nursing; The Royal Veterinary College; The School of Pharmacy; The Scottish College of Textiles; The Surrey Institute of Art and Design, University College; The University College of Osteopathy; The University of Bolton; The University of Chichester; The University of Manchester Institute of Science and Technology; The University of North London; The University of Northampton; The University of Wales, Newport; The University of Winchester; Trinity Laban Conservatoire of Music and Dance; Trinity University College; United Medical and Dental Schools, Guy's and St Thomas's Hospitals; University College Birmingham; University for the Creative Arts; University of Bedfordshire; University of Chester; University of Cumbria; University of Derby; University of Gloucestershire; University of St Mark and St John; University of Suffolk; University of the Arts, London; University of the Highlands and Islands; University of Wales College of Medicine; University of Wales Trinity Saint David; University of Worcester; Welsh Agricultural College; West London Institute of HE; Westhill College; Westminster College; Wimbledon School of Art; Winchester School of Art; Writtle University College; Wye College; York St John University.

B.3 Subject of study

Students enter higher education system to study toward a particular subject goal. In this study, the Joint Academic Coding System (JACS) code is the framework adopted to classify the subject of study. There are over 160 principal subject codes (2-digits) included in the JACS, which has three history version, where version 1 used during 2002/03-2006/07; version 2 used during 2007/08-2011/12; version 3 used during 2012/13-2018/19. The JACS principal subject codes is aggregated into 20 JACS subject groups as shown in Table B1. Among the 20 subject groups, STEM subjects are less relevant to the cultural industry, while Liberal Arts subjects have a higher relevance to the cultural industry, and Social Science subjects are separated from the Liberal Arts group due to a higher return.

Table B.1: Subject Categories

JACS subject groups		Four subject groups	
1	Medicine and dentistry	1	STEM
2	Subjects allied to medicine	1	STEM
3	Biological sciences	1	STEM
4	Veterinary science and Agriculture	1	STEM
5	Physical sciences	1	STEM
6	Mathematical and Computer sciences	1	STEM
7	Engineering	1	STEM
8	Mineral technology	1	STEM
9	Architecture, building and planning	1	STEM
10	Social, economics, and political studies	2	Social Science
11	Law	2	Social Science
12	Business and administrative studies	2	Social Science
13	Mass communications and documentation	3	Liberal Arts
14	English and Classical studies	3	Liberal Arts
15	European Languages	3	Liberal Arts
16	Modern Languages	3	Liberal Arts
17	Historical and philosophical studies	3	Liberal Arts
18	Creative arts and design	3	Liberal Arts
19	Education	3	Liberal Arts
20	Combined and Other	4	Combined and Other

B.4 Level of study

The level of study is the qualification awarded to the student in their final year. There are 8 categories included in our sample: *Doctorate (research)*, *Doctorate (taught)*, *Masters (research)*, *Masters (taught)*, *Other postgraduate (research)*, *Other postgraduate (taught)*, *First degree*, *Other undergraduate*.

The undergraduate students consist of *First degree* and *Other undergraduate* students, who will be awarded bachelor's degrees (e.g., BSc and BA). Postgraduate students are divided into two groups. One is the research postgraduate who studied primarily through research, and another is the taught postgraduate. *Doctorate (taught)*, *Masters (taught)*, and *Other postgraduate (taught)* defined as the taught postgraduate students who will be awarded degrees like MSc and MA. The research postgraduate students consist of *Doctorate (research)*, *Masters (research)*, and *Other postgraduate (research)*, who will be awarded degrees like PhD and MPhil.