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International Graduates' Stay Rate, Country-Level Economic Differences and Social Networks: Evidence From 25 European Countries

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ABSTRACT

This paper investigates the relationship between the stay rate of international university graduates, economic characteristics of their origin and destination countries, and proxies of their social networks. It contributes to the literature by jointly testing predictions of the neoclassical and migration network theories using regression analysis, employing a unique dataset of 1655 observations that provides macro-level information about stay rates of non-EU graduates from 94 origin countries in 25 European destination countries in 2017. The findings show that stay rate is higher in destination countries with higher GDP growth rate and lower youth unemployment, and for graduates who come from countries with lower GDP per capita. The stay rate is also higher for graduates whose origin country constitutes a lower share of graduates in their destination country, and for graduates from the US, Canada and Australia. Together, measures suggested by both theories explain over 50% of stay rate.

1 | Introduction

International student mobility (ISM) has expanded rapidly in recent years. As of 2019, 6.1 million university students studied in a country that was different from their country of origin (OECD 2021). Many governments introduce policies to attract students from abroad in the hope that they will stay in their countries as workforce, offsetting labour shortages and demographic decline while contributing to economic growth and innovations (Geddie 2010; Gribble 2008; Hazen and Alberts 2006; OECD 2019; Wadhwa 2012). International students are often seen as 'ideal immigrants' by destination country governments: they hold locally recognisable qualifications; possess country-specific skills and work experience; and are familiar with and adapted to their destination countries' way of life (Alberts and Hazen 2005; Hawthorne 2009; Migration Policy Group 2012).

Examples of policies aimed at attracting international students are EU's Students and Researchers Directive and UK's 2019 International Education Strategy (EMN 2018; Hubble and Bolton 2020). These policies often assume that attracting students from abroad is synonymous with their retention. However, not all international students stay. As of 2009, stay rate in major ISM destinations varied between 17.4% in Austria and 33.0% in Canada (OECD 2011). Understanding the factors that are related to stay rate is essential for formulating policies aimed at increasing the retention of international graduates.

This paper investigates the relationship between the stay rate of international university graduates and (1) economic characteristics of their origin and destination countries and (2) proxies of international graduates' social networks. As detailed in the Methodology section, it defines stay rate as the share of

graduates who changed their living permit status reason from 'study' to 'remunerated activity'. Theoretically, the paper takes a novel approach by simultaneously drawing on two theories about migration: neoclassical theory, which conceptualises mobility primarily in economic terms, and migration networks theory, which highlights the role of connections such as migrants' social ties. The paper innovatively tests whether the predictions of these theories, discussed in the literature review, hold even when exploring the stay rate. It also stands out by comparing the usefulness of the two theories for explaining the stay rate.

This paper further complements previous research, which has very rarely explored whether the predictions of the neoclassical theory hold in the field of ISM. One notable exception is Bratsberg's (1995) analysis of visa adjustment rate among international students in the US. This study substantially expands upon Bratsberg (1995) by examining multiple destination countries across Europe, employing a more recent and considerably larger dataset, and incorporating additional indicators such as youth unemployment. It also stands out by assessing whether micro-level theoretical predictions about migrant behaviour can explain macro-level phenomena such as stay rate. Beyond its academic contribution, the paper also offers practical advice to stakeholders such as policymakers and higher education institutions on ways of increasing international student retention.

The data concerns a unique combined dataset of 1655 observations, created by merging secondary datasets from several sources. The dataset provides macro-level information about stay rates of non-EU graduates from 94 origin countries in 25 European countries, economic characteristics of international graduates' origin and destination countries, and various measures that proxy international graduates' social networks, all as of 2017. Methodologically, I utilise these data to test hypotheses based on the neoclassical and migration networks theories using statistical models. This methodology and the large dataset that contains data from multiple countries complement the qualitative analyses of interviews that prevail in the ISM literature and aim to obtain findings with greater external validity. Using European data is advantageous, as Europe is a major ISM destination and was home to around a third of all international students in 2019 (OECD 2021). The paper focusses on degree-mobile students who undertook their entire degree abroad.

The findings show that stay rate is higher in destination countries with higher GDP growth rate and lower youth unemployment, and for graduates who come from countries with lower GDP per capita. The stay rate is also higher for graduates whose origin country constitutes a lower share of graduates in their destination country, and for graduates from the US, Canada and Australia. Measures suggested by neoclassical theory and migration networks theory each explain around a fifth of the stay rate. After combining both sets of measures and controlling for one aspect of government policy, I explain just over one half of the stay rate. The results indicate that the stay rate is associated with a multitude of factors that cannot be accounted for by a single theory, and the most appropriate way of examining it is therefore offered by both theories simultaneously. The paper also discusses the policy implications of these findings.

2 | Literature Review and Hypotheses

2.1 | Neoclassical Theory of Migration

According to the neoclassical conceptualisations of mobility, migrants are rational individuals who migrate with the aim of maximising expected utility while accounting for monetary and non-monetary costs of migration (Borjas 1999). The concept of expected utility also considers non-economic motivations; however, neoclassical literature argues that the main determinant of migration are geographical differences in economic advantage, primarily wages and that migrants move to maximise income (Borjas 1999).

Neoclassical theory is also relevant to the study of ISM. Literature acknowledges the importance of economic factors in explaining the reasons behind students' migration choices (K. Geddie 2013; Hazen and Alberts 2006). Nevertheless, there are almost no studies that empirically test neoclassical predictions in the case of ISM. Literature that considers economic and career-related factors is overwhelmingly based on interviews and usually discusses their role with respect to selection into ISM, not its outcomes (Alberts and Hazen 2005; Findlay et al. 2006; Marcu 2015; Migration Policy Group 2012; Robertson et al. 2011).

The small number of papers that consider the role of economic rationales in students' decision-making about their stay decision finds that professional and career-related considerations are usually an argument for staying in the destination country (Ackers et al. 2008; Han et al. 2015; Migration Policy Group 2012). However, to the best of my knowledge, the only paper that uses neoclassical theory to explain the stay rate is an older paper by Bratsberg (1995). Bratsberg regresses visa adjustment rate of international students in the US over economic differences between their origin countries. His findings suggest that the neoclassical theoretical predictions hold even when considering international graduates; for example, graduates are more likely to stay if they come from LEDCs, such as countries with lower Gross National Product (GNP) per capita. However, Bratsberg's paper is only based on the findings from a single destination country and a very small sample (69 observations).

2.2 | Contribution to Neoclassical Literature and Hypothesis

This paper draws on the neoclassical theory to test the association between cross-country economic differences and international graduates' stay rate. This is an unexamined perspective that has only been employed once before by Bratsberg (1995). This paper substantially expands upon his approach by undertaking a more recent study focusing on Europe and by including other important economic indicators such as youth unemployment. Alongside economic differences between multiple origin countries, it also considers the economic differences between multiple destination countries. This recognises the fact that graduates consider economic conditions in both the origin and destination country in their decision-making. Furthermore, the dataset analysed in this paper contains substantially more observations than Bratsberg: 1655 compared to Bratsberg's 69. The paper also tests whether the neoclassical theory's predictions

about choices of individual migrants can also solve macro-level puzzles such as the differences in stay rate of international graduates.

The variables chosen as measures of a country's economic condition are GDP per capita, GDP growth rate and youth unemployment. They are based on the neoclassical literature (Borjas 1999; Bratsberg 1995; Rosenzweig et al. 2006; Thissen and Ederveen 2006). Based on the neoclassical theory, the hypothesis is that the stay rate will be higher in economically better-off destination countries, and for graduates who come from economically worse-off countries. Economically better-off countries are defined as having a higher GDP per capita and GDP growth rate, and lower youth unemployment (Bratsberg 1995; LaLonde and Topel 1997; Pissarides and McMaster 1990).

2.3 | Migration Networks Theory

This paper does not examine the stay rate through the lens of neoclassical theory alone, but also considers it alongside the migration networks theory. This follows Massey et al. (1993, 455), who speak against 'adopting the narrow argument of theoretical exclusivity', as migration is related to a great variety of factors that cannot be accounted for by a single theory. Migration networks are defined as a form of social capital that facilitates migration through reducing its costs and accelerating flows of information, thereby facilitating mobility and inspiring people to achieve newly set mobility aspirations (Mabogunje 1970).

In this paper, I draw on literature that discusses one of the most important forms of migration networks: migrants' social networks. These include international students' social interactions and friendships, all of which influence their migration choices (Brooks and Waters 2010; Urry 2012). Interaction with other students expands international students' aspirations, opportunities and cultural and societal capital, leading to opportunities to stay in the destination country or move on (Bozionelos et al. 2015; Collins et al. 2017; Findlay et al. 2006; Gomes 2015; Mosneaga and Winther 2013). Social networks also provide advice, encouragement, reassurance and lived experience (Beech 2015; Brooks and Waters 2010).

The exact impact of social networks on mobility depends on the nationality of people with whom international students interacted during studies. Spending more time with other foreign students may increase international students' likelihood of undertaking an internationalised, migratory career (Bozionelos et al. 2015; Collins et al. 2017; Gomes 2015). Spending more time with students from their destination country ('local students' hereafter) may increase their likelihood of staying (Findlay et al. 2017; Mosneaga and Winther 2013). This is because it enhances their location-specific socio-cultural capital through becoming familiar with the destination country's culture, adapting to local lifestyle and gaining local contacts (Mosneaga and Winther 2013). It also makes them feel more at home while identifying more strongly with their destination country (Bozionelos et al. 2015; Findlay et al. 2017; Mosneaga and Winther 2013).

2.4 | Contribution to Migration Networks Literature and Hypothesis

This paper contributes to the migration networks literature by testing whether its predictions about the association between social networks and individual-level behaviour of students also hold when looking at stay rate. As discussed below, it also uses measures of social networks that have not been used before in the literature and explores whether past findings, which are usually interview-based, can be confirmed via regressions.

Literature indicates that international graduates are more likely to stay if they interacted more with local students and more likely to follow an international career path if they interacted more with international students. In this paper, I explore whether this logic can also be turned around: will international students be more likely to return to their origin country if they interacted more with co-nationals? The aforementioned literature indicates that this could be the case. For example, if interaction with local students increases international graduates' staying likelihood by increasing their awareness of and interest in job opportunities in the destination country, interaction with co-nationals could instead make them more likely to return to their origin country through increasing their awareness of and interest in work opportunities at home.

More interaction with co-nationals may also increase international graduates' return likelihood through strengthening their identification with their origin country. Research finds that returning graduates possess a stronger sense of identification with home (Marcu 2015; Robertson et al. 2011). However, increased interaction with co-nationals could also have the opposite effect, as these students may instead help international graduates with integrating into the destination country and finding employment there (Fagiolo and Santoni 2016; Fischer et al. 1997).

The measure that this paper uses as a proxy for the intensity of international graduates' interaction with co-nationals is the share of origin country graduates among all graduates in the destination country ('co-national share'). Based on the above literature, the hypothesis is that higher co-national share will be associated with a lower stay rate of graduates from this origin country. Nevertheless, some of the above literature indicates that even the opposite relationship could be found.

Co-national share does not directly capture international graduates' interaction with co-nationals; however, it reflects a structural opportunity for such interaction to unfold. Using it as a proxy is justified by both theoretical and practical research. Theoretically, the concept of 'homophily' postulates that individuals with shared sociodemographic characteristics (such as same country of origin or native language) tend to disproportionately interact and establish the strongest ties with each other, leading to the formation of homogenous social networks (McPherson et al. 2001; Skvoretz 2013). Importantly, larger share of a particular group among a population is associated with increased interaction within that group (Skvoretz 2013). This is supported empirically by Vervoort et al.'s (2011) study of

neighbourhoods in the Netherlands, which found a positive relationship between higher co-ethnic share and more interaction between co-ethnics.

Homophily has also been studied and identified among friendships and interactions at universities (Jackson et al. 2023; Kossinets and Watts 2009). Numerous studies show that co-nationals are the primary source of friendships and social contacts for international students and that strongest bonds exist among co-nationals where these are available (Bochner et al. 1977; Furnham and Alibhai 1985; Halualani et al. 2004; Maundeni 2001; Neri and Ville 2008; Trice and Elliot 1993). Preference of international students to study and spend free time with co-nationals has been found across contexts, including among African students in the UK (Maundeni 2001), international students in Australia (Neri and Ville 2008) and Japanese students in the US (Trice and Elliot 1993). Co-nationals are international students' preferred companions for both group study (Volet and Ang 1998) and interactions such as emotional help, shopping, cinema or party attendance (Furnham and Alibhai 1985). Literature also notes that international students seek monocultural bonds with co-nationals to increase their well-being and decrease loneliness (Bochner et al. 1977; Sawir et al. 2008).

Another proxy of social networks is the 'same language' indicator, which denotes that international graduates' origin and destination country have the same official language. Higher stay rates are associated with having an advanced knowledge of the country's language (Migration Policy Group 2012; Tang et al. 2014). This enables international students to develop a stronger attachment to the destination country, facilitates the development of locally-based social networks and provides a labour market advantage (Ackers et al. 2008; Findlay et al. 2006; King et al. 2010; Mosneaga and Winther 2013). Same language may also proxy the origin and destination country's past colonial links and cultural and ethnic similarity, all of which could ease international graduates' integration and development of locally-based social networks. Therefore, the hypothesis is that a higher stay rate will be associated with international graduates' destination country and origin country having the same official language.

The final proxy of social networks is whether international graduates come from a 'Western' country, defined as either the United States (US), Canada or Australia ('Western origin'). This is also a measure of cultural and economic similarity between international and local students that proxies their likelihood of forming locally-based social networks and stronger attachment to the destination country. Therefore, Western origin should be associated with a higher stay rate, although some literature also finds the opposite relationship (Finn 2010; Migration Policy Group 2012). Finally, all the hypotheses are based on micro-level findings; the results should indicate whether these correctly explain the macro-level relationships.

3 | Data

The analysis is based on a dataset of 1610 observations,[1] which I created by merging different secondary data-files from free, publicly-accessible databases. Table 1 lists the exact data source for each measure. The precise meaning of each measure is explained in the Methodology section. As explained in the Methodology section, I constructed some of the variables through calculations involving multiple indicators from the source datasets. The major data sources are Eurostat and The World Bank. The data sources are respectable institutions whose databases are frequently used by researchers. The data are particularly valuable for allowing cross-country comparisons.

The dataset includes data from 25 destination countries in Europe and 94 non-EU origin countries, listed in Table 2. Europe is a major destination for international students: as of 2019, 30% of all international students studied in the selected destination countries (OECD 2021). Therefore, findings drawn from these data provide information about a large fraction of international students across multiple origin and destination countries. This means that the findings reached using these data may have a greater external validity. The origin countries are all important sources of international students that have sent at least 1000 students to European OECD countries in 2017. Data come from the year 2017, which offered the best trade-off in terms of being relatively recent while having the smallest number of missing data.[2]

I only included non-EU origin countries, as EU students do not require a living permit to study in other EU countries, so it was not possible to calculate their stay rate. However, this still captures the majority of the international graduate population in the EU: in 2017, over 70% of international graduates in the EU came from non-EU countries (European Commission 2019). Table 3 presents the variables' descriptive statistics while Table 4 presents correlations between the variables;[3] I refer to some of these correlations in the analysis when interpreting the results.

For the analyses I omitted all observations with zero graduates and observations where the stay rate is above 100%. Stay rates of over 100% could be a consequence of some students changing status in a year that is different from their year of graduation, or it could indicate a deficiency in the data sources. Given that such values are not substantively interpretable as stay rates, I treated them as data artefacts. Importantly, these omissions affect only a very small number of observations (fewer than 20, which is very low in contrast to the final dataset of 1655 observations), making it unlikely that their omission introduces any unintended bias into the results. Given the nature of the dataset, it was not possible to control for individual-level variation among graduates despite literature suggestions that this also influences the stay rate.

4 | Methodology

This paper tests hypotheses from the literature review by means of regression analyses. The results are presented in three statistical models. This quantitative methodology complements the predominantly qualitative studies in the field. It also answers King and Raghuram's (2013) call for more studies to adopt a quantitative approach that goes beyond descriptive reports, as

TABLE 1 | Data sources.

Measure	Source
Number of international graduates (used to calculate stay rate, co-national shares and Western origin)	Eurostat. (n.d.). *Degree mobile graduates from abroad by education level, sex and country of origin*. Eurostat. Retrieved June 25, 2020 from https://ec.europa.eu/eurostat/databrowser/view/educ_uoe_mobg02/default/table?lang=en.
Number of permit changers (used to calculate stay rate)	Eurostat. (n.d.). *Change of immigration status permits by reason and citizenship*. Eurostat. Retrieved June 25, 2020 from https://ec.europa.eu/eurostat/databrowser/view/migr_reschange/default/table?lang=en.
Total number of graduates (used to calculate co-national shares)	Eurostat. (n.d.). *Graduates by education level, programme orientation, completion, sex and age*. Eurostat. Retrieved August 6, 2021 from https://ec.europa.eu/eurostat/databrowser/view/educ_uoe_grad01/default/table?lang=en.
GDP per capita in origin and destination countries (US$)	The World Bank. (n.d.). *GDP per capita*. World Bank Open Data. Retrieved June 25, 2020 from https://databank.worldbank.org/reports.aspx?source=2&series=NY.GDP.PCAP.CD&country=.
GDP growth rate in origin and destination countries (annual %)	The World Bank. (n.d.) *GDP growth*. World Bank Open Data. Retrieved June 25, 2020 from https://databank.worldbank.org/reports.aspx?source=2&series=NY.GDP.MKTP.KD.ZG&country=.
Youth unemployment in origin and destination countries (%)	The World Bank. (n.d.). *Unemployment, youth total*. World Bank Open Data. Retrieved June 25, 2020 from https://databank.worldbank.org/reports.aspx?source=2&series=SL.UEM.1524.NE.ZS&country=.
Same language	Central Intelligence Agency. (n.d.). *The World Factbook*. Retrieved July 29, 2021 from https:/www.cia.gov/library/publications/the-world-factbook/fields/2098.html.
Residence permit duration	European Commission. (2019). *Retaining third-country national students in the European Union*. EMN Inform. Retrieved June 25, 2020 from https://home-affairs.ec.europa.eu/document/download/cd911af8-3463-4e82-a858-b7265bb14e99_en?filename=00_eu_international_students_study_2018_en.pdf.
	Missing values from: OECD. (2019). *International Migration Outlook 2019*. OECD. Retrieved June 25, 2020 from https://www.oecd-ilibrary.org/social-issues-migration-health/international-migration-outlook-2019_c3e35eec-en.

TABLE 2 | List of origin and destination countries that are included in the dataset.

Origin countries (94)	Afghanistan, Albania, Algeria, Angola, Argentina, Armenia, Australia, Azerbaijan, Bahrain, Bangladesh, Belarus, Benin, Bolivia, Bosnia and Herzegovina, Brazil, Brunei Darussalam, Burkina Faso, Cameroon, Canada, Cape Verde, Chile, China (including Hong Kong), Colombia, Comoros, Congo, Costa Rica, Cote d'Ivoire, Cuba, Democratic Republic of Congo, Djibouti, Dominican Republic, Ecuador, Egypt, El Salvador, Ethiopia, Gabon, Georgia, Ghana, Guinea, Haiti, India, Indonesia, Iran, Iraq, Israel, Japan, Jordan, Kazakhstan, Kenya, Kuwait, Lebanon, Libya, Madagascar, Malaysia, Mali, Mauritania, Mauritius, Mexico, Moldova, Mongolia, Morocco, Mozambique, Nepal, Nigeria, Northern Cyprus, North Macedonia, Oman, Pakistan, Palestine, Peru, Philippines, Qatar, Russian Federation, Rwanda, Saudi Arabia, Senegal, Serbia, Singapore, South Africa, South Korea, Sri Lanka, Tanzania, Thailand, Togo, Tunisia, Turkey, Uganda, Ukraine, United Arab Emirates, United States, Uzbekistan, Vietnam, Yemen, Zimbabwe
Destination countries (25)	Austria, Belgium, Czechia, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland, United Kingdom

they argue that the lack of such studies represents a substantial gap in the field of ISM research. This methodology helps to reach findings that disentangle and quantify the associations between individual independent variables and stay rate while other factors are held constant.

4.1 | Dependent Variable

The dependent variable in all models is the stay rate. There are no statistics for stay rates in European countries. I calculated them by dividing the number of graduates who changed their

TABLE 3 | Descriptive statistics of variables.

Variable	Mean	Standard deviation	Minimum value	Maximum value
Stay rate (%)	18.93	26.27	0	100
GDP per capita in origin country (US$)	10,254	14,490	461	61,264
GDP per capita in destination country (US$)	42,222	22,471	13,857	107,361
GDP growth rate in origin country (annual %)	2.09	3.69	−8.19	24.97
GDP growth rate in destination country (annual %)	2.63	1.70	−0.64	6.97
Youth unemployment in origin country (%)	16.34	11.84	0.53	53.57
Youth unemployment in destination country (%)	16.88	9.47	6.76	43.52
Co-national share (%)	0.07	0.29	0	9.39
Same language	0.06	0.24	0	1
Western origin	0.04	0.20	0	1
Residence permit duration (months)	6.52	5.29	0	18

Note: Numbers rounded to two decimal places unless they are whole numbers or larger than 100. Numbers larger than 100 that are not whole numbers are rounded to the nearest whole number.

living permit status reason from 'study' to 'remunerated activity' ('permit changers') by the total number of graduates. A similar approach has been used before (OECD 2011; Rosenzweig et al. 2006; Thissen and Ederveen 2006). The number of graduates is the sum of graduates from bachelor's, master's and PhD courses. The number of permit changers includes individuals who were granted other forms of residence than living permits, such as long-term visas. This accounts for immigration policy differences across countries. Furthermore, it is easily comparable across countries in the dataset, as the legislature in all EU countries is generally very similar and to a large extent regulated by EU law (EMN 2015). The overall stay rate in the dataset is 18.9%.

In calculating the stay rate, I assumed that all permit changers are university graduates and that they changed status in their graduation year. Official sources confirm that this type of permit change is only available to university graduates (EMN 2015; Ministerstvo vnitra 2020; Wakefield 2019). Whereas some countries offer transfer periods of six or twelve months, it is likely that most students change status before the end of the year, as they typically graduate in summer and commence work in autumn. Other literature also assumes that permit change and graduation years are the same (Migration Policy Group 2012; OECD 2011). Overall, I believe that all the above assumptions are fulfilled. However, if some were not, this would likely increase the unexplained component of the model.

4.2 | Notes About Some of the Independent Variables

The economic measures used in the models are GDP per capita, GDP growth rate and youth unemployment. Each measure is accounted for by two variables, one for the origin country and the other for the destination country. This allows me to explore the association between stay rate and original and destination countries' economic characteristics separately. As for the social network measures, I constructed the co-national share by dividing the number of origin country graduates by the number of all graduates in the destination country.

4.3 | Models

In total, I run three models, presented in Table 5. The first model ('economic model') only includes the economic variables suggested by the neoclassical theory, while the second model ('networks model') only includes the network variables suggested by the migration networks theory. This allows me to analyse each theory's usefulness in explaining the stay rate separately. It also allows me to compare the usefulness of the two theories against each other.

The third model ('full model') includes both the economic and network variables together. This allows me to explore whether the variables' association with stay rate (established in the first two models) changes once other measures are controlled for. It also allows me to examine the usefulness of simultaneously considering measures suggesting by both theories in explaining the stay rate. To account for part of the role of policy differences, the full model also includes the "Residence permit duration" variable, which denotes the number of months an international student can stay in the country of study after graduation to seek employment or start their own business. A higher number of months should proxy a friendlier graduate retention policy. Therefore, this variable should have a positive association with stay rate.

4.4 | Additional Remarks and Robustness Checks

In the analyses, I compare the associations of individual variables with stay rate, investigating how and why this association changes across the models. I also compare the models' explained variance. Furthermore, I discuss the value and limitations of the

TABLE 4 | Correlations between variables.

	Stay rate (%)	GDP per capita in origin country	GDP per capita in destination country	GDP growth rate in origin country (annual %)	GDP growth rate in destination country (annual %)	Youth unemployment in origin country (%)	Youth unemployment in destination country (%)	Co-national share (%)	Same language	Western origin	Residence permit duration
Stay rate (%)	1.00										
GDP per capita origin country	−0.21	1.00									
GDP per capita in destination country	−0.01	0.10	1.00								
GDP growth rate in origin country (annual %)	−0.09	−0.19	0.08	1.00							
GDP growth rate in destination country (annual %)	0.40	−0.08	−0.23	−0.13	1.00						
Youth unemployment in origin country (%)	0.16	−0.18	−0.09	−0.28	0.13	1.00					
Youth unemployment in destination country (%)	0.03	−0.12	−0.37	−0.18	0.23	0.15	1.00				
Co-national share (%)	−0.41	−0.10	0.03	0.48	−0.32	−0.24	−0.24	1.00			
Same language	−0.08	0.20	−0.03	−0.21	0.02	−0.11	0.16	−0.26	1.00		
Western origin	−0.08	0.76	0.09	−0.15	0.00	−0.13	−0.06	−0.13	0.32	1.00	
Residence permit duration	0.64	−0.16	0.05	−0.07	0.29	0.17	0.01	−0.35	−0.21	−0.07	1.00

Note: Weighted by the number of graduates from the origin country. All numbers rounded to 2 decimal places.

TABLE 5 | Factors explaining the stay rate.

	Economic model	Networks model	Full model
Constant	2.2 [9.6]	23.4*** [1.9]	6.7 [5.2]
GDP per capita in origin country	−2.4*** [0.7]	—	−2.6*** [0.7]
GDP per capita in destination country	1.5 [1.2]	—	−0.2 [0.7]
GDP growth rate in origin country (annual %)	−0.4 [0.5]	—	0.2 [0.2]
GDP growth rate in destination country (annual %)	6.6*** [1.5]	—	3.3*** [0.7]
Youth unemployment in origin country (%)	0.2 [0.1]	—	−0.0 [0.1]
Youth unemployment in destination country (%)	−0.2 [0.2]	—	−0.2* [0.1]
Co-national share (%)	—	−2.2*** [0.2]	−1.1*** [0.2]
Same language	—	−7.7*** [2.8]	−0.5 [2.2]
Western origin	—	−6.3** [2.6]	6.7* [3.8]
Residence permit duration	—	—	1.7*** [0.2]
R^2 (%)	22.0	21.0	50.9
Number of observations	1610	1610	1610

Note: Numbers in square brackets are heteroskedasticity-robust standard errors. Numbers rounded to one decimal place. Significance at ***1%, **5%, *10%.

two migration theories as a whole and examine which of them is better at explaining the stay rate. If a variable coefficient is not statistically significant at least at 10% level, I consider it statistically insignificant.

Given that each independent variable has a different range of values, I primarily discuss the coefficients' statistical significance and whether they are positive or negative, not the absolute coefficient values. These statistics and the models' explained variance provide enough information to disentangle the association between the independent variables and stay rate and to compare the usefulness of the two theories.[4]

For the analyses, I assigned weight to each observation based on the number of graduates using analytic weights (a-weights). This approach accounts for considerable variation in the number of graduates across observations and ensures that stay rate estimates based on larger numbers of graduates—where statistical variability is lower—receive greater weight in the estimation. Weighting in this way reduces potential bias by reducing the influence of observations with fewer graduates, for which stay rate may be more volatile and potentially driven by idiosyncratic factors, thereby improving the reliability and interpretability of the estimated relationships. The use of analytic weights is particularly suitable in this case, as the stay rate observations are aggregates, each based on a different number of graduates.

Variance inflation factors never exceed three (and rarely exceed two) for any variable in the economic, networks or full model. I applied appropriate tests to ensure the fulfilment of all multiple linear regression assumptions. The aforementioned literature supports the assumption that all relationships among the regression variables are linear. To control for potential heteroskedasticity, I apply heteroskedasticity-robust standard errors in all models. Given the wide range of both GDP per capita variables, the coefficients on these variables are extremely small. To ease their interpretation, I therefore divided all values of these variables by 10,000.

Most studies investigating the impact of the economy on immigration are complicated by the fact that a causal relationship exists in both directions (Gomes 2015; Morley 2006). This could also be an issue when discussing variables that act as proxies of social networks. Furthermore, interpreting macro-level data often requires making assumptions about individual students, which carries the risk of ecological fallacy, as these assumptions cannot be tested using the data available (Nickerson 2022). For

these reasons, I talk of associations between variables instead of making causal claims and remain cautious of ecological fallacy when interpreting the results.

5 | Analysis

5.1 | Results of the Economic Model

The first column in Table 5 shows the results of the economic model. This model only includes variables suggested by the neoclassical theory. It has an explained variance of 22%, which indicates that the neoclassical theory explains a substantial proportion of international students' stay rate. This is an important finding, as previous literature predominantly only used this theory to investigate the migration of workers and little was known about whether it is also applicable to ISM. It also shows that despite the neoclassical theory predominantly making predictions about individuals, it is also valuable in examining macro-level characteristics such as the stay rate. Furthermore, all variable coefficients have signs in the expected direction.

Despite the above, only two economic variables have a statistically significant association with stay rate. Namely, the coefficient on GDP per capita in the origin country equals −2.4 ($p < 0.01$) and the coefficient on GDP growth rate in the destination country equals 6.6 ($p < 0.01$). Both coefficients support the hypotheses that stay rate will be higher in economically better-off countries and for graduates who come from economically worse-off countries. Given that the former variable measures the economic conditions in the origin country while the latter measures the economic conditions in the destination country, this indicates that stay rate is related to economic conditions in both origin and destination countries. This finding is novel, as previous literature found a statistical association between stay rate and economic conditions in the origin countries only (Bratsberg 1995).

Interestingly, stay rate has a statistically significant association with GDP per capita in the origin country alone. Similarly, stay rate has a statistically significant association with GDP growth rate in the destination country alone. Both of these observations could reflect the fact that the destination countries, on average, have a higher GDP per capita than the origin countries. For example, as seen from Table 3, the mean GDP per capita in destination countries is $42,222, while the mean GDP per capita in origin countries is just $10,254. Given that most of the destination countries have high GDP per capita, GDP growth rate may therefore provide a better indication of the countries' economic trajectory. This could in turn give a better indication about the economic advantage of staying, which is reflected in the GDP growth rate's association with stay rate. The opposite is true for the origin countries, many of which have very low GDP per capita. In this case, GDP per capita may reflect the countries' economic situation better than GDP growth rate, as an origin country with high GDP growth rate may still have a very low GDP per capita. However, these interpretations carry the risk of ecological fallacy. Furthermore, they assume that graduates who do not stay are returning to their origin country and that there is a causal association from the economic variables to stay rate.

Another interesting finding is that youth unemployment is virtually unrelated to stay rate. A potential explanation is that these variables measure youth unemployment in the whole population, but this statistic may not be related to youth unemployment in sectors where international graduates seek employment. Indeed, high levels of aggregate unemployment may reflect high unemployment in low-skilled professions, not high-skilled professions that graduates find jobs in (OECD 2022). Furthermore, study abroad greatly enhances graduates' employability and career prospects, which is also one of the main reasons why students choose to embark upon it (Brooks and Waters 2011; Findlay et al. 2012). Therefore, it is possible that international graduates have skills and education which make them highly employable even at the time of high unemployment. Nevertheless, micro-level data would again be needed to confirm this.

5.2 | Results of the Networks Model

The second column in Table 5 shows the results of the networks model. This model only includes the network variables suggested by the migration networks theory. It has an explained variance of 21%, which is considerable and just 1% less than the economic model. Furthermore, all variables have statistically significant coefficients. This indicates that migration networks theory is also very valuable in explaining stay rate. It further shows that migration network theory's micro-level predictions can also be applied to explaining macro-level phenomena such as the stay rate.

Looking at the individual variables, the coefficient on co-national share equals −2.2 ($p < 0.01$). This is in line with the hypothesis. As suggested in the literature review, co-national share proxies the amount of interaction international graduates have with co-nationals. Therefore, the above findings are in line with the prediction that more interaction with co-nationals will be associated with a lower international graduates' stay rate. Given that a higher co-national share may also indicate a lower share of local students, a lower stay rate could also be associated with lower interaction with local students. Nevertheless, micro-level data would be needed to confirm whether this interpretation is correct.

The coefficient on same language equals −7.7 ($p < 0.01$) and the coefficient on Western origin equals −6.3 ($p < 0.05$), both of which contradict the hypothesis. However, the coefficient on same language is not statistically significant in other models in Table 5 and the coefficient on Western origin turns positive in two other Table 5 models. This indicates that their current negative association with the stay rate is a consequence of other important factors not being controlled for.

5.3 | Results of the Full Model

The third column in Table 5 shows the results of the full model. As seen from Table 5, including measures suggested by both the neoclassical and migration network theories, as well as a control for residence permit duration, substantially increased the model's explanatory power. Explained variance now equals 50.9%, which is more than twice the value of the previous two models.

Moving from the economic to the full model, the sizes of the economic variable coefficients changed. However, based on overlapping standard errors, the new coefficients are not statistically different from their counterparts in the economic model. One exception is the coefficient on GDP growth in the destination country. This coefficient decreased by half, indicating that some of its association can be explained by the other variables.

Despite the above change, the direction of association between all economic variables and stay rate remains the same. Furthermore, the statistical significance of the economic variable coefficients also remains unchanged (with one exception). Specifically, the coefficient on GDP per capita in origin country equals −2.6 ($p < 0.01$), while the coefficient on GDP growth rate in destination country equals 3.3 ($p < 0.01$). This indicates that, holding other variables constant, graduates from an origin country with GDP per capita $10,000 higher than that of another origin country have, on average, a stay rate 2.6 percentage points lower. Similarly, graduates in a destination country with GDP growth one percentage point higher have, on average, a stay rate 3.3 percentage points higher.

The coefficients on GDP per capita in destination country, GDP growth rate in origin country, and youth employment in origin country remain statistically insignificant. This indicates that the results of the economic model are generally robust to controlling for the network variables and the policy variable. It also indicates that my interpretations of the economic model results still hold.

One exception to the above findings is the coefficient on youth unemployment in origin country, which became statistically significant in the full model and equals −0.2 ($p < 0.1$). A negative, statistically significant coefficient on this variable is in line with the hypothesis. It shows that, holding other variables constant, graduates from an origin country with youth unemployment rate one percentage point higher than that of another origin country have a stay rate that is, on average, 0.2 percentage points lower. A likely reason for this coefficient becoming statistically significant is that there is a suppressor effect. Nevertheless, due to the overlapping standard errors, this coefficient is not statistically different from its counterpart in the economic model and the size of both coefficients is very similar.

As for the network variables, moving from the network to full model, the coefficient on co-national share halved in absolute terms. However, the coefficient remains negative and statistically significant, equalling −1.1 ($p < 0.01$). This indicates that it is mostly robust to controlling for the economic measures and residence permit duration variable. The coefficient shows that, holding other factors constant, a one-percentage-point higher share of graduates from a given origin country among all destination-country graduates is associated with a 1.1 percentage-point lower stay rate for that group.

The coefficient on Western origin becomes positive in the full model. Its coefficient equals 6.7 ($p < 0.1$) and is in line with the hypothesis. This indicates that, holding other variables constant, graduates from Western countries (the US, Canada or Australia) have, on average, a stay rate 6.7 percentage points higher than other graduates. The coefficient change is likely explained by controlling for GDP per capita in the origin country, which, as seen from Table 4, is strongly positively correlated to Western origin (correlation = 0.76) while being negatively correlated to stay rate. This indicates that in the Networks model, the negative relationship of Western origin with stay rate reflects the higher GDP per capita of the US, Canada and Australia, which is associated with a lower stay rate. Once GDP per capita in the origin country is controlled for, the positive coefficient for Western origin aligns with theoretical expectations.

The coefficient on same language lost statistical significance in the full model. Whereas it remains negative, it is statistically different from its counterpart in the networks model. It is unlikely that this change could be explained by same language's correlation with one of the newly added variables, as it has a correlation of less than 0.2 with most of them. Therefore, the coefficient on same language has likely lost its statistical significance due to the joint effect of the addition of multiple other variables in the full model. This supports the view that same language likely does not have any association with stay rate.

Finally, whereas it is not relevant to the hypotheses investigated by this paper, it is notable that the coefficient on the control variable, residence permit duration, equals 1.7 ($p < 0.01$). This indicates that there is a higher stay rate in countries with a friendlier immigration policy, proxied by this variable. Supposing this association is causal and that there is no ecological fallacy, this indicates that governments can increase the stay rate by offering residence permits to graduates to find work, ensuring that these permits are valid for a longer amount of time.

6 | Discussion and Conclusion

This paper investigated how the stay rate of international university graduates is associated with the economic characteristics of their origin and destination countries and with proxies of their social networks. The findings mostly support the hypothesis that the stay rate of international graduates will be higher in those destination countries that are better off economically. They also usually support the hypothesis that the stay rate will be higher for those international graduates whose origin countries are worse off economically. Nevertheless, this association exists only for some of the economic measures considered.

The full model shows that it is particularly lower GDP per capita in the origin country, higher GDP growth rate in the destination country, and lower youth unemployment in the destination country that are associated with an increased stay rate. In contrast, the remaining economic variables do not have a statistically significant association with the stay rate in the full model. Generally speaking, these findings indicate that ISM and staying can, at least to some extent, be explained by economic factors that also explain other forms of migration.

The findings also usually support the hypotheses based on the migration networks theory. Looking at the full model, stay rate

has the predicted negative association with the co-national share. As I hypothesised, stay rate is also higher for international graduates from the US, Canada and Australia. Contrary to the prediction, however, stay rate does not have a statistically significant association with the same language variable.

Comparing the usefulness of the neoclassical and migration network theories in explaining the stay rate, the results show that both are about equally valuable: looking at the economic and network models, each explains around a fifth of stay rate, which is a relatively large amount. Both theories also have similar limitations, particularly the fact that some of the independent variables they suggested do not have a statistically significant association with stay rate. However, I find it challenging to assess the usefulness of the migration networks theory in explaining the stay rate using the model results. The reason is that, given the macro dataset, I cannot be absolutely certain that the variables used are indeed a good proxy of international graduates' social networks. Furthermore, given the dataset limitations, it is likely that many measures of migration networks have not been accounted for.

The results show that the best way of exploring the stay rate is to not restrict oneself to a single theory, but account for measures suggested by multiple theories. Massey et al. (1993, 432) support this, arguing for an approach that "incorporates a variety of perspectives, levels, and assumptions". The findings demonstrate that the stay rate is associated with many measures suggested by different migration theories, so restricting oneself to a single theory overlooks other important measures. Another advantage of controlling for measures suggested by the two migration theories is that these measures are often related to each other. Therefore, not including one measure risks misinterpreting the role of another measure. An example of this is the Western origin variable, whose coefficient changes considerably when economic measures are controlled for.

The findings indicate that governments which seek to increase the retention of international students should introduce policies aimed at attracting more student migrants (1) from less economically developed countries, defined primarily in terms of GDP per capita, (2) of nationalities that are not as frequently represented among the pool of current international students in their countries, and (3) from the US, Canada and Australia. The reason is that these groups of students have a higher stay rate. The results also indicate that stay rate is higher in destination countries with a friendlier immigration policy, defined as allowing international graduates to stay in the country for a longer time period to search for employment.

The full model explains over 50% of stay rate, which is considerable, but there remains a question of what explains the remainder. One option could be that the stay rate also relates to other economic measures such as the Human Development Index, returns to education, average graduate earnings, unemployment rate of (recent) university graduates, Gini coefficient and the prevalence of graduate occupations in the labour market. Some of these could also be more relevant to international graduates, who are specific from other migrant groups in being young, university-educated and highly skilled. Future research could therefore explore the association of these measures with the stay rate.[5] However, finding suitable secondary data without missing values may be a challenge.

Another factor behind the unexplained component could be the economic variation within countries, as the dataset only controls for economic variation on country-level. The remainder of stay rate could also be explained by individual-level variation in international graduates' friendship networks, partnerships, socioeconomic backgrounds, personalities, risk-aversion and university experiences. Migration networks theory also suggests some of the aforementioned factors, however, they could not be accounted for using the macro-level data available. Many of these factors could be considered by future research.

Given the data and methodology used, the findings likely apply to a substantial proportion of international university students, which adds value to this paper. The policy recommendations should be particularly relevant for governments of European countries and for the EU, as they concern data about international students in European countries.

A limitation is that, given the nature of the data, this paper can only explore the associations between macro-level (i.e., country level) indicators: the stay rate and factors that are related to it. This means that whereas I can deduce hypotheses from existing theories and suggest potential interpretations of the results, individual-level tests would be required to avoid ecological fallacies. One of the directions for future research therefore includes using individual-level data to test migration hypotheses. Similarly, despite the value of using data from 2017, future studies could explore whether the findings hold when using data from different years. Finally, given this paper's focus on non-EU students, future researchers should look for ways of also exploring the stay rate of EU students.

Author Contributions

Filip Němeček: conceptualization (lead); data curation (lead); formal analysis (lead); investigation (lead); methodology (lead); project administration (lead), resources (lead); software (lead); validation (lead); visualisation (lead); writing – original draft (lead); writing – review and editing (lead).

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Conflicts of Interest

The author declares no conflicts of interest.

Data Availability Statement

The data that support the findings of this study come from data sources listed in Table 1 in the manuscript.

Endnotes

[1] As explained later, there were 25 destination countries and 94 origin countries. Therefore, fixing each observation to a particular origin and destination country gives 2350 (25*94) observations. However, some observations were omitted, as they had no international graduates (and hence no value of stay rate). For example, there were no graduates from Togo in Latvia in 2017. Other observations were omitted, as they had a stay rate of over 100% or lacked observations about some of the independent variables used in the analyses. This left 1610 observations.

[2] Data for more recent years have more missing values; for example, statistics about the number of graduates are not available for the UK for most of the more recent years. Using data from a more recent year with more missing data would be disadvantageous, as this would mean using a sample with a lower number of observations that would include information about stay rates in fewer destination countries and about graduates from fewer origin countries. This would mean that the results would have a lower external validity. Furthermore, it is advantageous to use a dataset that includes the UK, as the UK is by far the most important European ISM destination. Unfortunately, other sources without missing data were not available, as Eurostat and World Bank provide the most complete country-level statistics that are also easily comparable. The analysis uses data from a single year, as the key independent variables such as GDP per capita exhibit little year-to-year variation. As a result, extending the analysis to multiple years would primarily replicate the same cross-sectional differences rather than add meaningful new information. Using a single year also avoids inconsistencies due to changes in data definitions and coverage over time.

[3] The correlations are weighted by the number of graduates from the origin country for consistency purposes, as I also apply these weights in the models (I explain the reasons for this in the Methodology section). This also enables me to interpret the model results more easily by referring to the correlations.

[4] An alternative approach would be to use standardised coefficients; however, I avoid this for several reasons. First, as already noted, the comparison of coefficient signs and statistical significance is sufficient to answer the research questions. Second, one of the aims of the paper is to explore how the coefficients change across models; this is more easily done when coefficients are expressed in their original units, as standardisation would rescale coefficients whenever the set of independent variables changes. Third, not using standardised coefficients is consistent with previous work in the field, such as Bratsberg (1995). Finally, reporting unstandardised coefficients enables a more direct and policy-relevant interpretation of the estimated relationships.

[5] The suggestion of alternative economic measures for future research should not be interpreted as a sign that the economic measures used in this paper, namely GDP per capita, GDP per capita and youth unemployment, were too basic or ill-chosen. On the contrary, I chose these measures for having the best fit with the neoclassical theory (Borjas 1999; Bratsberg 1995; Rosenzweig et al. 2006; Thissen and Ederveen 2006). Bratsberg (1995), which is one of the few papers that undertook an analysis similar to mine, also used these or very similar measures. Given the fact that neoclassical theory has been rarely applied to the study of ISM and stay rates before, it was logical to commence by considering the most basic measures that the theory suggests. The fact that many of these measures have the hypothesised association with stay rate and that the explained variance is fairly high supports the argument that they were well-chosen. It also provides stronger evidence of the value of the neoclassical theory for the study of stay rate than if more specific measures (which are more distant from the basic suggestions of this theory) were used. Furthermore, using measures that could be more relevant to international graduates would not necessarily achieve better results. For example, the models in this paper contain a measure of youth unemployment, which is arguably more relevant to this demographic, as graduates are younger than the average working population; however, it has a weaker association with stay rate than the other two economic measures: it becomes statistically significant only in the full model and only at the lowest, 10% level. Adding other economic measures to the models could also lead to high multicollinearity and might not be possible due to a lack of suitable data (particularly data for origin countries). In contrast, the advantage of using the current economic measures is that these statistics were available for all origin and destination countries analysed in the models. This means that the models have a high number of observations and that they provide information about a greater number of international students, which should increase the external validity of findings.

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