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One-size-does-not-fit-all: The heterogeneous impact of BITs on regions participating in GPNs

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ABSTRACT

Bilateral Investment Treaties (BITs) are vital for safeguarding and enhancing foreign investments, pivotal in Global Production Networks (GPNs). This study assesses the impact of BITs on GPNs driven by EU multinational enterprises, with a focus on regions hosting corporate headquarters due to their influence on the local economy. While considering the endogeneity of BITs and their diverse effects on GPN structures, our findings reveal a positive correlation between BITs and GPNs, notably stronger in less globally integrated regions. Additionally, the influence varies based on firms' network role (headquarters or subsidiaries) and the spatial distribution of headquarters. BITs stimulate GPNs in less internationalized regions but have minimal impact in headquarters-rich regions.

1. Introduction

A Global Value Chain (GVC) constitutes a form of economic structure that has brought significant changes to the world economy by streamlining production processes. Indeed, GVCs result in the regional fragmentation of production, offshoring, and regional integration. Most of the GVCs are hierarchical and, to a certain extent, mirror the business structures of Multinational Enterprises (MNEs). This paper focuses on this kind of GVCs, defined by some authors as Global Production Networks (GPNs), or networked FDI (Coe, Yeung, 2015; Baldwin and Okubo., 2014).[1]

The upsurge of GPNs has been driven by two important global phenomena, i.e. the advances in Information and Communication Technology and trade and investment liberalization at both supra-national and national levels. The former has made possible the monitoring and coordination of production processes at a distance, while the latter has drastically reduced the uncertainty concerning entry and exit conditions and, consequently, the costs of doing business abroad.

This paper aims to analyze whether and to what extent the formation of GPNs led by EU MNEs has been conditioned by the proliferation of Bilateral Investment Treaties (BITs). Specifically, the paper addresses two questions: Do BITs affect the formation and development of GPNs controlled by EU MNEs? And, more importantly: is the impact of BITs homogenous across different types of regions of the same country of origin?

Providing an answer to these questions is not only interesting from an academic perspective but also has crucial policy implications since even space-neutral policies, like trade or investment liberation policies, may have spatial effects, which may undermine the aim of the policy if not properly accounted for (Barca et al., 2012). From this perspective, BITs can be considered as a firm-based policy aiming at guaranteeing equal access to foreign opportunities to national firms, regardless of where they are located, and ultimately leading to a more equal geographical distribution of foreign investment-related activities and potential benefits from those activities. However European regions show different social, institutional, geographical, political, and technological characteristics, which provide different challenges and possibilities for the international expansion of indigenous firms, thus questioning the effectiveness of this "one-size-fits-all" policy intervention.

BITs are one of the most important policy instruments to protect and promote investments by companies of one country in the territory of the partner country. BITs aim at generating investor confidence that the

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[1] Networked FDI is the most recent evolution of foreign investments. It emphasizes an important conceptual break in the literature, i.e. the transition from stand-alone foreign enterprises to a set of geographically dispersed foreign affiliates performing complementary activities within the same production chain.

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regulatory framework of the host state guarantees the stability and the predictability of the investment, protecting it from arbitrary legislative or administrative actions. More specifically, BITs regulate the admission of foreign investments, treatment, and dispute settlement, and include provisions dealing with the free transfer of payments, conditions under which expropriation is allowed, and compensation may occur, exceptions to the MFN standard, and the enjoyment of the benefits granted by the treaty (Egger, Merlo, 2012; Berger et al., 2013; Chaisse and Bellak, 2011). Since GPNs encompass firms repeatedly exchanging goods and services, financial capital, personnel, and knowledge and technologies with each other, and by relation-specific investments, BITs represent an important policy instrument to safeguard the investments made by MNEs. Hence, they may encourage the formation and development of GPNs.

From a theoretical perspective, BITs are expected to have a broad positive impact on FDI from contracting parties for at least two reasons. First, they provide insurance for foreign investors by establishing compensation schemes and conflict resolution procedures; and, secondly, they deter non-compliance because of the potential reputation costs for countries breaching the treaties (Kerner, 2009; Busse et al., 2010; Aisbett et al., 2018; Bengoa et al., 2020; Sirr et al., 2017). In addition, it has been demonstrated that BITs may also stimulate foreign investments from third parties since they act as a signal that contracting countries are strongly committed to creating and maintaining an investor-friendly environment (Kerner, 2009; Sirr et al., 2017). These considerations suggest that BITs may make *ceteris paribus* foreign investments more attractive, though the mechanisms through which they exert their beneficial effects cannot be precisely identified (Egger et al., 2022). Generally speaking, BITs grant MNEs a broad set of rights, which may reduce the fixed-foreign affiliate set-up costs concerning political, institutional, and risk-related barriers and, in doing so, increase the rate of return on investment, all else equal. This may create space for additional foreign affiliates (Egger et al., 2022).[2]

Despite this clear conceptual framework, the empirical literature is far from reaching a consensus on the role and implications of BITs. Indeed, the evidence is mixed, suggesting that the impact of BITs may be subject to several contingencies, like the socio-economic characteristics of the (host) countries considered, the type of agreement signed by contracting parties, as well as the characteristics of the research design and of the samples of countries used to analyze the relationship between BITs and FDI flows. A set of studies addressing the relationship between BITs and FDI inflows finds evidence that BITs have encouraged additional foreign investments from advanced economies to several emerging and developing countries (Egger, Merlo, 2012; Kerner, 2009; Neumayer, Spess, 2005; Bengoa et al., 2020; Wang, 2016; Nguyen et al., 2020). However, the magnitude of this impact may vary in relation to whether the agreement has been only signed or ratified (Egger and Pfaffermayr, 2009), the time-lapse considered (Egger, Merlo, 2007), and the characteristics of the institutional environment of the host countries. Indeed, there is a group of studies claiming that BITs may act as substitute for better domestic institutions; therefore, they are expected to exert a more positive effect where the investment environment indicates weaker investment security (Neumayer and Spess, 2005; Busse et al., 2010; Sirr et al., 2017; Tobin and Rose-Ackerman, 2011). Other works, instead, find evidence of the opposite, suggesting that the positive effect of BITs strongly depends on the presence of a supportive political and economic environment in the host countries (Rose-Ackerman, Tobin, 2005; Hallward-Driemeier., 2003).[3]

This paper adds to the existing literature by changing the perspective of the analysis. More specifically, it adopts a regional-level approach, thus trying to disentangle the potential heterogeneous effects that national policies aiming at promoting further integration at the world level may have at a sub-national level. Corporate headquarters, being in charge of the most important strategic functions of firms, are crucial to the economy of regions where they are located. They arrange the production networks by optimizing resource distribution among industrial chains and gather the most knowledge-intensive segment of the value chains, thus enhancing growth prospects and strengthening development trajectories of the regions where they are located. However, the distribution of corporate headquarters is quite uneven over space; therefore, understanding whether BITs support the formation and development of GPNs in regions at the top or the bottom of the distribution is a relevant issue that has never been explored, at least in our knowledge.[4] Secondly, the focus is on GPNs, rather than traditional bilateral FDI, regardless of how they are measured. With the advent of GVCs, stand-alone MNEs do not exist anymore. What is observed today, instead, is a network of firms – made of at least a headquarters and many affiliates – performing different but strongly integrated tasks and functions aimed at producing the same final good that will be sold in the global market (Ascani et al. 2020; Bettarelli and Resmini, 2022). Thirdly, we investigate the heterogeneity of the effects of BITs by wondering whether BITs consolidate existing GPNs by stimulating parent houses already active in that location to further expand their activities there or promote the formation of new GPNs by attracting foreign affiliates controlled by MNEs not present in the pre-BIT period. We refer to the first case as the "consolidation" effect and to the second one as the "creation" effect of BITs. These new perspectives represent a true novelty in the current debate, mainly focused on bilateral FDI flows or stocks at the country- or at the firm-level, which may further enrich the existing debate on the implications of investment liberation policies at the sub-national level.

From a methodological perspective, we used a Pseudo Poisson Maximum Likelihood (PPML) approach, which provides advantages over traditional OLS panel estimates in dealing with relevant econometric concerns, like the presence of heteroscedasticity and zero-investment observations (Egger, Merlo, 2012). Moreover, to address the endogeneity of BITs we used a control variable technique, with an instrument based on the domino effect theory (Baldwin and Jaimovich, 2012).

Our results suggest that the entry into force of a BIT had a positive and significant effect on both the creation and consolidation of GPNs, with the latter effect larger than the former. This aggregate outcome was shown to mask quite different experiences at different dimensions, which include the position of the regions along the distribution of companies' headquarters over space and the sector of activities of MNEs leading GPNs. In particular, where MNEs' headquarters are highly concentrated, we found no significant effect of BITs, suggesting that these regions are already sufficiently strong to render BITs superfluous

[2] The *Ceteris paribus* hypothesis implies that BITs, as any other liberalization policy, are a necessary but not a sufficient condition for the occurrence of foreign investments. BITs may encourage additional foreign activities, but there is no guarantee that investments will actually occur. Other (economic) determinants must be at work for investments to flow into host locations. This principle is well acknowledged in the literature on FDI (see, e.g., UNCTAD, 1998).

[3] Some studies relax the hypothesis of homogeneity of BITs by focusing on the association between the characteristics of BITs and their impact on FDI flows (e.g. Chaisse, Bellak, 2011; Dixon, Haslam, 2016; Bengoa et al., 2020; Frenkel, Walter, 2018; Aisbett et al., 2018; Berger et al., 2013; Haslam, 2007). The underlying idea is that though BITs address the same issues, they do not necessarily offer the same degree of protection since this depends on the number of and the substantive details of the provisions included in the BIT. The empirical evidence remains however inconclusive. In this paper BITs are considered as a whole, with no specific focus on a single provision. Foreign investors, indeed, may not be fully aware of the details included in every treaty (Bellak, Leibrecht, 2023).

[4] The non-homogeneity of regions within countries is well-known, but it has only recently been included in the literature on global value chains (Bolea et al., 2022; Almazán-Gómez et al., 2023).

regardless of the sector of activity of companies headquartered there. Where BITs were shown to have strong, significant, and positive effects was in regions hosting a limited number of corporate HQs. This outcome suggests that BITs promote the internationalization of less experienced regions, providing sufficient protection to companies headquartered there. By adding the sectoral dimension, we uncovered that the entry into force of a BIT had a positive and significant effect on GPNs led by manufacturing MNEs in regions at the bottom of the distribution of corporate headquarters over space, and by MNEs operating in the services sectors in regions with an intermediate position. These results were confirmed by our robustness checks.

The rest of the paper is organized as follows. Section 2 discusses the data and reports an initial descriptive analysis. Section 3 describes the empirical strategy, while Section 4 presents our main findings along with results from robustness tests. Section 5 provides some concluding remarks and discusses policy implications.

2. Data sources and description

2.1. EU-centred GPNs

To shed light on the differential impact that BITs may exert on GPNs, we assembled a novel dataset that develops across space and time. Specifically, the unit of observation is the pair region-country, where the former refers to the EU NUTS-2 regions where MNEs leading GPNs are headquartered, and the latter to the foreign countries hosting their subsidiaries.

To trace GPNs to which each region-destination country pair belongs, we used data at the firm level drawn from Amadeus, which includes comprehensive information on financials and detailed corporate structure of about 21 million companies across Europe. In particular, we first collected data about European Global Ultimate Owners (GUOs), that is, the independent companies at the top of the corporate structure, and their foreign affiliates.[5] Then, as Amadeus provides the exact location of each firm—in terms of city, province, and country—we assigned a NUTS-2 code to each GUO, using the 2016 NUTS classification system. Finally, we aggregated GUOs by NUTS-2 regions and connected each EU region with the foreign countries hosting the affiliates controlled by GUOs headquartered there. In detail, we summed the number of GUOs in each region *r* of EU country *c*, and their subsidiaries (SUB) in the destination country *d* at time *t*. This translated into the following formula:

$$GPN_{rcd,t} = GUO_{rcd,t} + SUB_{rcd,t} \tag{1}$$

where, by definition, *GPN* identifies that part of GPNs created by EU MNEs headquartered in region *r* of EU country *c* and their foreign investments in host country *d*.[6]

GPNs have been observed at three different moments in time, i.e. 2007, 2014, and 2017. Indeed, one may consider that it takes time to establish production facilities abroad and to build an effective network. Moreover, GPNs are characterized by high entry and exit costs, given the presence of relation-specific investments and repeated interactions among firms within the network. These considerations suggest that it may take some time to observe changes in the structure of GPNs.[7]

Thus, we can potentially observe 63,506 region-country dyads, i.e. 281 European regions times 226 host countries, for a total of 190,518 possible dyads by year observations. However, the number of usable observations is far less for two reasons. First, in the regression analysis, we can estimate parameters only from units for which we observed a change in the dependent variable, i.e. the GPNs. Thus, all permanent zero investments have been deleted. Secondly, control variables are not available for all destination countries and years included in the sample. After this cleaning, the number of regions in the sample is 276 and the number of destination countries is 151. The operative sample amounts to 31,782 observations.[8]

2.2. The distribution of GUOs over space

A defining characteristic that shapes a region's ability to take advantage of a BIT and expand its capacity to control global production networks is the number of GUOs headquartered in that region. Indeed, regions with a large cluster of corporate headquarters typically have a more developed and robust business ecosystem, which is a conducive environment for businesses to thrive and collaborate. Furthermore, established GUOs often come with a bulk of knowledge and expertize accumulated over time in various areas, such as industry-specific skills, technology, management practices, and market insights. These considerations seem to suggest that the impact of BITs on regions may be ambiguous. On the one hand, one may expect that only regions hosting GUOs may benefit from the proliferation of these treaties, since these GUOs may be stimulated to further extend their production facilities in partner countries. On the other hand, regions hosting large agglomerations of corporate headquarters may not need the protection created by BITs since they already possess the necessary conditions to promote the internationalization of local firms. To disentangle this issue, we classified EU regions into three distinct groups, based on the distribution of GUOs over space in 2007 (Table 1).To further highlight the structural differences existing among the three groups of regions, we complemented this classification with ANOVA tests (Table A1 in the appendix) on some regional characteristics in 2005 (GDP per capita, population density, share of people with tertiary education, innovation capacity, and railway and airways connectedness).[9]At the top of the distribution (90th percentile), there are regions with the largest clusters of corporate headquarters, which range from 592 to a maximum of 9890. These 28 headquarters (HQ) regions function as command hubs from where EU corporations manage GPNS. Conversely, the lower half of the distribution comprises what we call non-HQ regions, i.e. regions with 65 or fewer headquartered GPNs. As it can be seen in table A1, these regions (about 141) struggle to attract corporate headquarters due to their peripheral location, simple economic structure, lack of

[5] Affiliates located in the same country of the GUO were not considered since their set up is not driven by investment liberalization at international level.

[6] As BITs involve only two countries, we also had to "bilateralise" GPNs. Despite that, this approach is still consistent with the nature of modern FDI, made of many subsidiaries controlled by a single GUO (Ascani et al. 2020; Bettarelli, and Resmini, 2022).

[7] To consistently trace GPNs over time, one should also know potential changes in the ownership corporate structure of EU MNEs. To obtain this information, different annual releases of Amadeus are needed. The only publicly available at the University of Milano-Bicocca were those from January 1st, 2008, 2015 and 2018. To get the final dataset, we followed the same procedure

(*footnote continued*)
as Kalemli-Ozcan et al. (2015), thus obtaining a nationally representative and consistent over time EU MNE level dataset. To further check the validity of our dataset, at least at national level, we compared our data with other official statistics, i.e. (i) FDI outward flows (in 2018, in million US dollars) by EU countries towards all destination countries, drawn from OECD, and (ii) the number of foreign affiliates of EU enterprises, aggregated at country level, in 2018, drawn from Eurostat. The ranking of countries in our dataset is in line with official data, with correlation rates ranging between 0.897 and 0.944. Results are available upon request by the authors.

[8] Regions excluded from the sample are the French departments beyond the seas. We did not expect their exclusion might bias results.

[9] The results of the ANOVA tests reported in Table A1 concern the between-group population means for each group of regions. They show meaningful differences among groups of regions regarding their economic and structural characteristics in 2005; since the test statistic is much larger than the critical value, we reject the null hypothesis of equal population means and conclude that there are highly statistically significant differences among the population means for each group.

Table 1
The distribution of Headquarter regions in the EU.

Type of Regions	N° of regions	Min n° of GPNs	Max n° of GPNs	Total n° of subsidiaries	Percentage of total subsidiaries
Headquarters	28	592	9889	221,429	64.3%
Intermediate	112	67	584	113,150	32.8%
Non-Headquarters	141	0	65	9902	2.9%

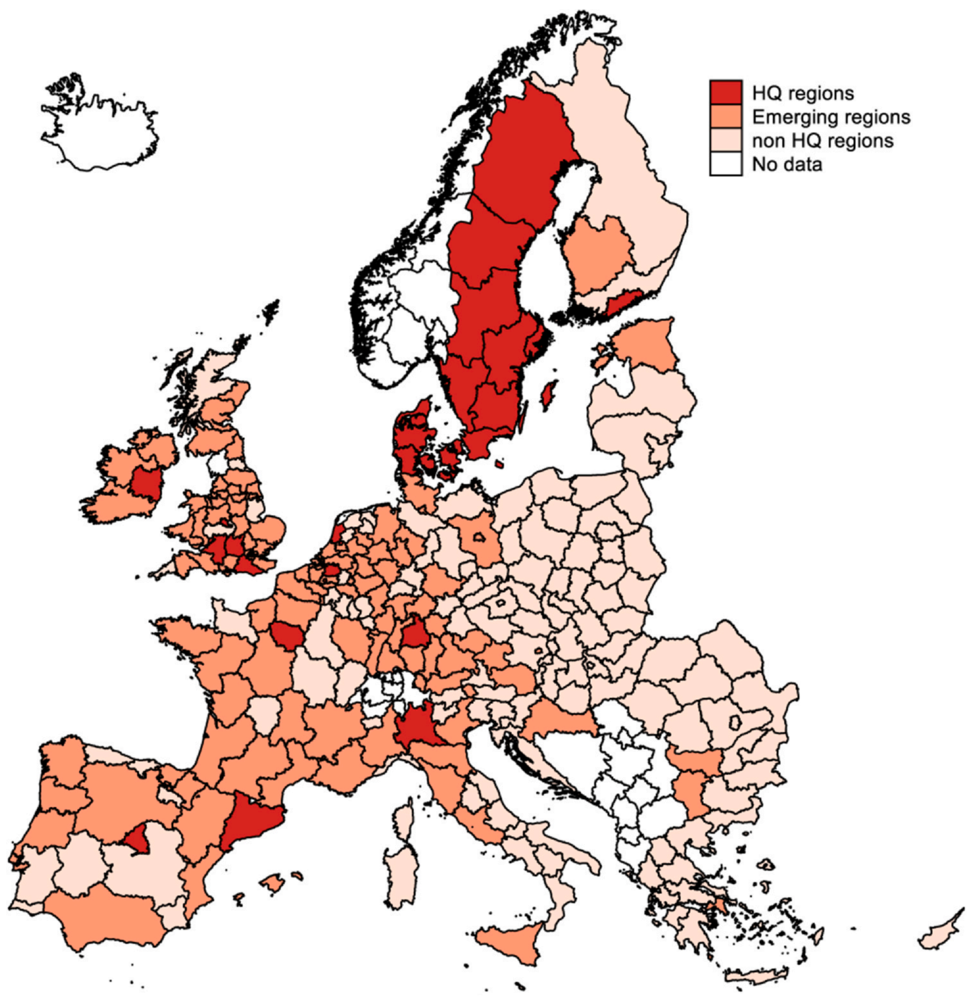

Fig. 1. HQ, Emerging HQ, and non-HQ regions in the European Union (2007).

strong connections with the global economy, limited human capital, and innovation capacity. Lastly, there are regions hosting small clusters of EU corporate headquarters, spanning from the median to the 90th percentile, with more than 65 and less than 592 GUOs headquartered. Although these regions have only moderate control over GPNs, they can benefit from knowledge inflows generated by local firms investing abroad. They show a high potential to become command hubs in the future, provided that external knowledge collected by existing MNEs is translated into local capacity conducive to more growth and development (Ascani et al., 2020; Morrison, 2008). Because of their intermediate position within the distribution of GUOs over space, we refer to them as intermediate HQ regions.

Fig. 1 illustrates this taxonomy. It demonstrates significant variation among European regions in their capacity to host the headquarters of GPNs. As expected, HQ regions are predominantly found in economically developed regions such as Lombardy (IT), Catalunya (ES), Baden-Württemberg (DE), as well as London, Paris, Copenhagen, and Stockholm metropolitan areas. In 2007 these seven regions alone hosted around 30% of the total number of EU GUOs. Intermediate HQ regions are quite dispersed across different countries, like France, Germany, the Netherlands, Ireland, North Spain, and Italy while most of the non-HQ regions belong to the South and East peripheries of the EU. We will use this taxonomy to investigate the potential heterogeneous effects of BITs across space.

2.3. Bilateral investment treaties

Data on BITs have been drawn from the EDIT database (Alschner et al., 2021), a comprehensive full-text database of international investment agreements provided by the World Trade Institute – University of Bern. It includes 2549 treaties in force, of which 1170 involve at least one EU member state. 207 of these BITs entered into force in the sample period (2007–2017), regardless of the date of signature. Although the literature demonstrated that signed (or ratified) treaties may generate some positive effect on MNEs' location decisions since they signal the commitment of contracting parties to a friendly investment

Table 2
Number of Subsidiaries and number of BITs entered into force between 2007 and 2017 by Destination Area.

Destination area	N. of SUBs	%	N. of BITs	%
East Asia (EA)	16,202	5%	17	8%
European Union (EU)	197,094	61%	2	1%
Latin America & the Caribbean (LAC)	19,431	6%	20	10%
Middle East and North Africa (MENA)	7303	2%	58	28%
North America (NA)	44,938	14%	4	2%
Other Europe (OE)	16,139	5%	30	14%
Oceania (OCE)	6256	2%	0	0%
South Asia (SA)	3985	1%	10	5%
Sub-Saharan Africa (SSA)	7751	2%	41	20%
Central Asia (CA)	4365	1%	25	12%
Total	323,464	100%	207	100%

environment (Egger, Merlo, 2012; Kerner, 2009), we preferred to focus on BITs in force since this is the only status that ensures full enjoyment of benefits granted by the treaty. Moreover, we believe that if the treaty enters into force several years after its signature, the anticipation effects associated with the signature and the ratification of treaties are negligible or insignificant (Egger, Pfaffermayr, 2009).

The distribution of BITs into force by destination areas is reported in Table 2, which also provides a first comparison between the distribution of BITs and that of foreign subsidiaries controlled by EU MNEs. 99 BITs (48% of the sample) have been signed with MENA (Middle East and North Africa) or Sub-Saharan African (SSA) countries. In contrast, only 3% of these BITs involve developed countries like other EU or North American countries (column 2).[10] These figures suggest that, at least in the sample period, EU member states used BITs to strengthen investors' protection against political risks and arbitrary administrative decisions in countries usually poorly endowed with sound institutional settings, like on average developing and emerging countries. It is however worth noticing that these countries are not among the preferred locations for EU MNEs. Indeed, most foreign subsidiaries controlled by EU MNEs operate in other EU member states (61%) or in North (14%) and South (6%) America as column (1) of Table 2 indicates. This asymmetry suggests, on the one hand, that policy factors other than BITs may have driven MNEs' location decisions within the EU, all else equal; on the other hand, that EU countries' Governments consider BITs as a substitute for weak institutional settings. These uncontroversial facts, however, do not undermine the validity of our assumptions on the potential cost-reduction effects of BITs in (risky) host countries. We will come back to this issue later in this paper.

Table 3, instead, shows that although all EU countries have at least one BIT into force in the sample period, Germany, the Belgium and Luxembourg Economic Union, and Finland were the most active countries with 19, 17 each for Belgium and Luxembourg, and 16 BITs in force, respectively, followed by Slovakia (15 treaties) and Spain and Italy (12 and 11 treaties, respectively).

[10] Intra-EU BITs amounted to about 200. Most of them were agreed upon in the 1990 s, before the latest EU enlargements (2004, 2007, and 2013). Only one of them, i.e. the Croatia-Lithuania BIT signed in 2008, entered into force in the sample period. All these BITs are terminated since they were mainly signed between existing and prospective members of the EU. Indeed, all Member States are subject to the same EU rules, and all EU investors benefit from the same protection thanks to EU rules (e.g. non-discrimination on grounds of nationality). The United States of America signed BITs with 9 Central and Eastern EU member states. All of them entered into force before 2004. Canada signed BITs with 11 Central and Eastern EU member states, but only four of them entered into force during the sample period.

Table 3
Number of BITs entered into force between 2007 and 2017 by country of origin.

Country of origin	N° of BITs
AUT	4
BEL	17
BGR	4
CYP	5
CZE	10
DEU	19
DNK	6
ESP	12
EST	4
FIN	16
FRA	9
GBR	2
GRC	6
HRV	2
HUN	2
IRL	0
ITA	11
LTU	8
LUX	17
LVA	4
MLT	3
NLD	9
POL	0
PRT	10
ROU	4
SVN	0
SVK	15
SWE	8
TOT	**207**

2.4. Other variables

We complemented our dataset with some information about the destination countries taken from the World Bank datasets. In particular, we considered factors able to attract foreign investments. Following the literature, we included in the sample the degree of development, broadly measured by GDP per capita, the size of the host country, measured in terms of population, and the capital-labor ratio as a proxy of the relative endowment of factors of production (Egger and Merlo, 2012; Bergstrand and Egger, 2007; Blonigen et al., 2003). Similar works also indicate that skilled labor endowments, the quality of the institutions, and corporate tax rates are crucial drivers for foreign plant setups (Bénassy-Quéré et al., 2007; Tondl and Antonakakis, 2015). However, introducing these variables would have led to a huge loss of usable observations so we decided not to use them. However, the potential omitted variable bias should not be relevant, given that the GDP per capita proxies both the quality of the institutions and the level of education of the population, among many other factors (e.g. Dixon and Haslam., 2016).[11]

2.5. Summary statistics

Table 4 reports the mean and standard deviation of the variables discussed above, based on the final dataset used for the econometric analysis. Also reported in this table are means and standard deviations of the same set of variables for HQ, intermediate, and non-HQ regions. GPNs driven by MNEs headquartered in HQ regions encompass more firms (around 35 firms) than those driven by MNEs located in other regions. Moreover, HQ regions have, on average, 10 GUOs active in each destination country, each controlling on average 26 subsidiaries, while non-HQ regions host fewer GUOs (1.6 on average) controlling a

[11] In the case of corporate tax rate variable, its inclusion would have resulted in the loss of approximately 10% of observations in the operational sample, and, more significantly, in the loss of one third of the destination countries.

Table 4
Summary statistics, 2007–2017.

	Whole sample	HQ regions	Intermediate HQ regions	Non-HQ regions
Dependent variables				
GPNs	14.31	35.57	9.22	4.35
	(73.74)	(135.30)	(37.57)	(33.80)
GUOs	4.13	9.79	2.71	1.66
	(17.35)	(28.04)	(11.23)	(13.22)
Subsidiaries	10.18	25.78	6.51	2.69
	(59.98)	(113.14)	(28.25)	(20.95)
Other variables				
BITs	0.024	0.027	0.026	0.016
	(0.15)	(0.16)	(0.15)	(0.12)
Ln GDP per capita of the destination country	9.44	9.11	9.46	9.72
	(1.26)	(1.34)	(1.26)	(1.09)
Ln population of the destination country	16.59	16.41	16.61	16.73
	(1.19)	(1.62)	(1.60)	(1.61)
Ln of capital/labor ratio	8.68	8.38	8.71	8.92
	(1.19)	(1.30)	(1.19)	(1.01)
N. of Observations	31,782	7420	17,412	6950

smaller number of subsidiaries (2.7) per destination country. Intermediate regions are somewhere in the middle, with an average of 2.71 GUOs controlling about 6.5 subsidiaries per destination. No significant differences in the characteristics of the destination countries emerge when we consider different types of regions. On average each region-destination country dyad experienced the entry into force of 0.024 BITs in the period considered, with some differences across regions, with 0.016 BITs per destination country in non-HQ regions and 0.027 BITs in HQ regions.

3. Methodology

To investigate the relationship between bilateral treaties and GPNs, we used a Poisson Pseudo-Maximum Likelihood (PPML) estimator. As Santos Silva and Tenreyro (2006) pointed out, this estimator provides some advantages over traditional OLS panel estimates in addressing relevant econometric concerns. In particular, heteroscedasticity will not result in biased estimates, and zero-investment observations do not represent an issue, since the PPML estimator remains consistent with and without the inclusion of the zero-investment observations (Egger, Merlo, 2012). Furthermore, with this technique, being a special case of the Generalized Non-Linear Model (GNLM) with variance proportional to the mean, there is no need for a distribution assumption of the dependent variable since only its conditional mean should be correctly specified to get consistent estimates (Gourieroux et al. 1984).

In detail, we estimated the following equation, in which the unit of observation is the pair region – destination country:

$$GPN_{rcd,t} = \exp\ (BIT_{cd,t-1}\beta + X_{d,t-1}\gamma + \delta_t)\varepsilon_{rcd} \quad (2)$$

where $GPN_{rcd,t}$ is a measure of the GPN connecting region *r*, in the origin country *c*, and the destination country *d* at time *t*; $BIT_{cd,t-1}$ is a variable indicating that a BIT between countries *c* and *d* is entered into force; $X_{d,t-1}$ is the set of time-varying variables defined at destination country level observed at *t-1*; δ_t are year dummies, and ε_{rcd} is our set of fixed effects, defined at the region- and destination country level.

As a dependent variable, we considered first the network as a whole (Eq. 1), and then its two components, i.e. the number of GUOs located in region *r* of country *c*, with subsidiaries in destination country *d* at time *t* ($GUO_{rcd,t}$), and the number of subsidiaries that GUOs headquartered in region *r* have in destination country *d* at time *t* ($SUB_{rcd,t}$), separately. As a means to reduce the risks associated with expropriation, host-country restrictions on foreign investors, and discrimination in favor of local or third firms, etc., we expected that BITs might raise both the number of EU firms that invest in the destination country, thus promoting the *creation* of new networks, and the number of foreign affiliates per EU MNEs already active in a specific host country, and hence supporting the *consolidation* of existing networks.

The variable $BIT_{cd,t-1}$ is a step variable switching from zero to one the year after a BIT between the country of origin of the GPN, *c,* and the destination country *d* entered into force. In doing so, we focused on the changes occurring over time rather than cross-sectionally and, by taking lagged values, avoided reverse causality. Standard errors are clustered at the unit of observation level.[12]

The inclusion of region-destination country dyad fixed-effects captures all the time-invariant characteristics regarding the pairs and also absorbs all the time-invariant characteristics of each country, both of origin and destination. Furthermore, the inclusion of dyad fixed effects applies to the variables included in the model in a within transformation. Thus, the parameter β measures the effect of the entry into force of a BIT by comparing the within-pair (post–pre) difference in GPNs of those pairs affected by BITs with the same difference computed for pairs not affected by BITs.

The vector $X_{d,t-1}$ contains control variables defined at the destination country level. As discussed above, these variables include the (log of the) GDP per capita ($lnGDPpc_{d,t-1}$), the (log of the) population and the (log of the) capital-labor ratio one year lagged. Year dummies are included to control for common macroeconomic global shocks.

Countries' self-selection into signing BITs can introduce bias into the coefficient β in Eq. (2). Indeed, the key assumption in our identification strategy is that the decision to sign a BIT is independent of future changes in GPNs. To address this potential bias and ensure the identification of an unbiased effect, a robustness exercise has been conducted using a control variable technique. This approach has been inspired by Baldwin and Jaimovich (2012), who discussed the existence of a domino effect in Preferential Trade Agreements, which we argue may also exist when dealing with investment treaties. In simpler terms, if countries *c* and *d* show a high degree of economic integration, there is a higher likelihood that country *c* will be interested in signing a BIT with country *d* to avoid any negative impact on its investments, an effect known as the "investment diversion effect". To deal with this issue, we instrumented the BIT in force between the country pair *cd* with the total number of BITs each country has signed with other countries, excluding the one they have in common.[13] Since the PPML model is non-linear and includes fixed effects at the unit of observation level, an instrumental variable approach may encounter the incidental parameter problem. To overcome this, we followed the two-step procedure suggested by Lin and Wooldridge. (2019). More specifically, we first

[12] We run some sensitivity checks about the level at which standard errors are clustered in the devoted section.

[13] Orefice and Rocha (2014) and Yue et al. (2023) used a similar instrument for Preferential Trade Agreements and Regional Trade Agreements respectively.

Table 5
The effect of BITs on GPNs. Baseline estimates. Poisson pseudo-maximum likelihood estimates (PPMLE), 2007–2017.

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	GPNs	GUOs	SUBs	GPNs	GUOs	SUBs
BIT	0.200***	0.147***	0.214***			
	(0.0664)	(0.0552)	(0.0771)			
BIT*non-HQ regions				0.746***	0.719***	0.746**
				(0.277)	(0.206)	(0.346)
BIT*Intermediate HQ regions				0.418***	0.312***	0.452***
				(0.0887)	(0.0803)	(0.0999)
BIT*HQ regions				0.0519	0.0159	0.0605
				(0.0798)	(0.0730)	(0.0904)
Constant	-50.76***	-26.35***	-61.88***	-50.70***	-26.30***	-61.81***
	(5.318)	(4.566)	(6.028)	(5.321)	(4.569)	(6.031)
N. of Observations	31,782	31,782	31,782	31,782	31,782	31,782

Notes: BIT is a step variable that switches to one the year after a BIT entered into force. Each regression includes the GDP per capita, the population, and the capital/labor ratio of the country of destination (in log, and one year lagged) and region-destination country fixed effects. Full estimates are reported in Table A.1. Standard errors clustered at region-destination country pairs in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

estimated the probability of a BIT to enter into force over the one-year lagged instrument with a linear probability model which includes dyad fixed-effects and the controls used in the baseline Eq. (2). Then, the residuals from this estimation have been included in our main regression equation to control and account for any unobserved differences caused by the self-selection process.

4. Results

4.1. Main results

Table 5 shows the results of our baseline regression equation (Eq. 2).[14] Column (1) indicates that a positive and significant relationship between BITs and GPNs considered as a whole does exist. When we split the network into its two main components, we uncovered that the creation effect – i.e. captured by the impact of BITs on the number of GUOs headquartered in a specific region – is lower compared to the consolidation effect, i.e. the impact on the foreign subsidiaries controlled by GUOs headquartered in a given region, as indicated by the corresponding coefficients in Columns (2) and (3), respectively. In detail, the entry into force of a new BIT is associated, on average, with a 16% increase in the number of GUOs headquartered in region r with subsidiaries in a given destination country, and with a 24% increase in the number of foreign affiliates controlled by GUOs already active in the destination country d.[15] Overall, these results support the prediction that BITs, by protecting investors against policy risks, can affect both the formation and the consolidation of GPNs led by national companies.

The estimated coefficients of the covariates, reported in Table A2 in the Appendix, are statistically significant and rather robust across different specifications, as indicated by columns from (1) to (3). On average, destination countries attracting more foreign investments from EU MNEs have a high development level (GDP per capita), are large in size (population), and are relatively more labor-abundant, as suggested by the negative sign of the capital-labor ratio.

4.2. Spatial and sectoral implications of BITs

As mentioned before, not all regions within a country possess sufficient resources to become a headquarters economy. Thus, the impact of BITs may be conditioned by the distribution of GUOs over space. To investigate the spatial consequences of national investment liberalization policies, we estimated the impact of BITs by distinguishing HQ, intermediate, and non-HQ regions.[16] Columns (4)-(6) of Table 5 show the results. Quite interestingly, we uncovered that BITs still have positive effects, but they diminish as the clusters of corporate headquarters hosted by regions become larger. More specifically, we observed positive and significant effects only in less internationalized regions, such as intermediate HQ and non-HQ regions. In these regions, firms have limited experience with foreign markets, and BITs serve to reassure them about the risks involved in doing business abroad. In each group of regions, the consolidation effect is larger than the creation effect, as indicated by the size of the estimated coefficients. This implies that BITs are more effective in raising the number of subsidiaries of existing MNEs rather than in stimulating new GUOs to enter a given destination country.

Regarding sectoral heterogeneity, Fig. 2 indicates that in non-HQ regions, BITs seem to be an effective policy instrument in both the service and manufacturing sectors. In the latter, the consolidation and the creation effects are similar (0.899 and 1.155), while in the service sector, the difference is more pronounced (0.831 and 1.438). For intermediate regions, the effect of BITs is significant only in the service sector, with lower coefficients (0.465 and 0.734). Finally, in HQ regions, BITs do not seem to be decisive. In fact, in the manufacturing sector, they have a negative creation effect. This result requires further investigation, but it could indicate that processes of backshoring are underway (Capello, Cerisola, 2023).

These results seem to outline a scenario in which BITs promote GPNs the lower the level of internationalization of the region of origin of GUOs and the more intangible the sector in which GUOs operate. Indeed, the intangible nature of services requires the presence of suppliers and customers in the same place to be traded internationally. Furthermore, these results may suggest that BITs are effective in creating and expanding GPNs that are not overly extensive. The production chain of services tends to be shorter and less fragmented than that of manufactured goods. It is plausible that the same applies to manufacturing networks with headquarters in less developed regions (non-HQ), as indicated by the figures shown in Table 2. To further expand larger and more fragmented production networks, it may be necessary to employ more complex policy instruments that facilitate the flow of people, goods, services, financial capital, and technology not

[14] Table A3 in the appendix replicates our baseline results in columns 1 and 4 clustering standard errors at different levels. Since the standard errors are quite similar, in the rest of the paper we clustered standard errors at the unit of analysis.

[15] Given the discrete nature of the BIT explanatory variable, $(e^{\beta} - 1)$ can be considered as a semi-elasticity.

[16] To facilitate the interpretation of the estimated coefficients we used a full interaction approach. In other words, we interacted the dummy BIT with the full set of three dummies, one for each group of regions (HQ, Intermediate and non-HQ regions).

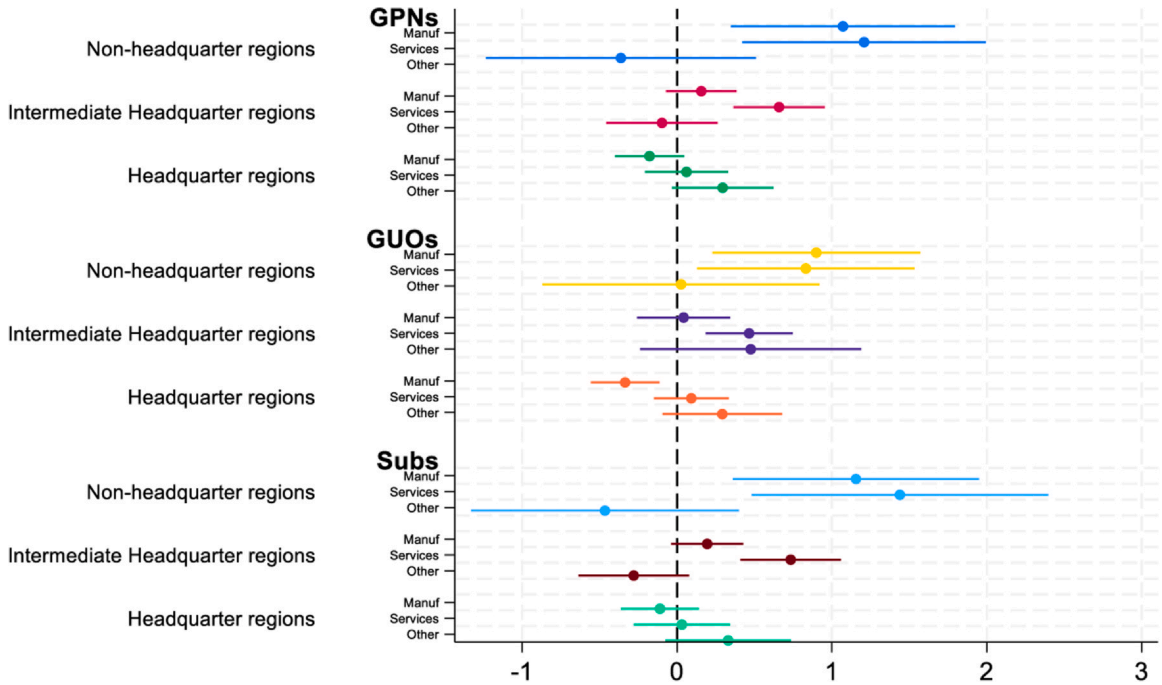

Fig. 2. The effect of BITs on GPNs, GUOs, and SUBs by type of region and sector of activity. Notes: Coefficients (and 95% confidence intervals) come from the estimation of Eq. (2) with three different dependent variables: GPNs, GUOs, and SUBs. Each regression includes region-destination country fixed effects and the GDP per capita, the population, and the capital/labor ratio of the country of destination, all in log and one year lagged. Standard errors are clustered at region-destination country pairs.

only between the country of origin and a specific destination but also between different stages of the production chain carried out in different countries.

In conclusion, BITs, by protecting foreign investments, promote the internationalization processes of less developed regions, where internationalization levels are typically lower, and few multinational enterprises (MNEs) are headquartered, without exerting any influence on the structure of GPNs in regions hosting large agglomeration of MNEs' headquarters. This finding suggests that BITs should not exacerbate regional inequality, a result which deserves further investigation

4.3. Robustness checks

We conducted three types of robustness checks to ensure the reliability of our results. Firstly, we applied the control function approach described in the Methodology Section. In doing so, we considered the GPN as a whole as the dependent variable. Results are shown in Table 6. To assess the effectiveness of the instrument used in the control function approach, we examined the linear probability model (first stage) results shown in column (1) of Table 6. The instrument proves to be quite effective in predicting the probability of a BIT entering into force, as evidenced by the F-test, which amounts to 620. This result indicates that the instrument is not weak and can reliably predict the occurrence of BITs. In the second stage, we added the residuals obtained from the first stage to our baseline equation (Eq. 2). The estimated coefficients remain positive, statistically significant, and slightly higher compared to our baseline estimates, as reported in Table 4. More importantly, these findings confirm the existence of diminishing returns in the impact of BITs, which remain larger in less internationalized regions. Moreover, the residuals themselves are statistically significant in the second stage, indicating that they effectively correct for any unobserved heterogeneity in the data. Overall, this robustness check provides additional support for the validity of our findings, reinforcing the idea of a positive and significant association between BITs and GPNs, while also validating the instrument's reliability in predicting the entry into force of BITs.

Table 6
Control function approach. 2007–2017.

	(1) First stage: linear probability model	(2) Second stage	(3) Second stage
	BITs	GPNs	GPNs
Instrument	0.00385***		
	(0.000155)		
BITS		0.572**	
		(1.685)	
BIT*non HQ regions			1.119***
			(1.700)
BIT*Intermediate HQ regions			0.793***
			(1.688)
BIT*HQ regions			0.426**
			(1.685)
First-stage residuals		-0.374**	-0.377**
		(1.705)	(1.705)
Constant	-3.928***	-49.57***	-49.50***
	(0.116)	(8.699)	(8.703)
Observations	126,208	31,782	31,782
R-squared	0.058		
Number of id	42,725		
Dyads FE	YES	YES	YES
F test	620		

Notes: Column (1) reports estimates from a linear probability model in which BIT is the dependent binary variable. Each regression includes the GDP per capita, the population, and the capital/labor ratio of the country of destination (in log, and one year lagged) and region-destination country fixed effects. Full estimates are reported in Table A.1. Standard errors clustered at region-destination country pairs in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Secondly, to address concerns that outliers may influence the observed results and then reflect factors unrelated to investment liberalization policies, we ran a set of estimates varying the operative sample. In particular, given that more than half of the subsidiaries controlled by

Table 7
Robustness checks: excluding one continent at a time. PPML estimates. 2007–2017.

	(1)	(2)	(3)	(4)	(5)
	Excluding Europe	Excluding Asia and Oceania	Excluding America	Excluding Africa	Excluding London, Copenhagen, and Stockholm
VARIABLES	GPNs	GPNs	GPNs	GPNs	GPNs
BIT*non-HQ regions	0.414*	0.607**	1.386***	0.734***	0.743***
	(0.232)	(0.303)	(0.421)	(0.278)	(0.273)
BIT*Intermediate HQ regions	0.372***	0.361***	0.414***	0.447***	0.434***
	(0.0921)	(0.0922)	(0.121)	(0.109)	(0.0910)
BIT*HQ regions	0.0847	-0.0104	-0.196	0.119	0.0106
	(0.0647)	(0.0956)	(0.130)	(0.0986)	(0.0897)
Constant	-37.22***	-69.73***	-52.54***	-32.86***	-44.07***
	(6.108)	(6.681)	(5.405)	(6.735)	(5.965)
Observations	16,611	25,852	26,811	26,072	30,624

Notes: Standard errors clustered at region-destination country pairs in parentheses. Each regression includes region-destination country fixed effects and the GDP per capita, the population, and the capital/labor ratio of the country of destination (in log, and one year lagged). *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

EU MNEs are located within Europe and that these investments may depend on factors other than BITs, we excluded pairs with an EU member state or another EU country as the destination country from our analysis. Furthermore, we wanted to ensure that any destination area did not drive our results, so we systematically excluded each continent from our sample, one at a time, and examined the estimates, as shown in Table 7. We found that the results remained qualitatively unchanged with respect to our baseline estimates. Therefore, we can conclude that they are robust and not sensitive to the exclusion of specific destination areas.

Thirdly, we investigated the potential influence of the three largest HQ regions in the EU, namely inner London (UKI3), Copenhagen (DK01), and Stockholm (SE11), by excluding them from the sample. Results reported in column 5 of Table 7 remained largely unchanged, suggesting that the presence or absence of these top HQ regions does not significantly impact our findings.

5. Concluding remarks

This paper provided fresh evidence of the impact that one-size-fits-all policy like BITs may exert on different socio-economic systems in the same country. It attests to a large degree of heterogeneity, at geographical, sectoral and also firm – i.e. GUOs vs. subsidiaries – levels.

In particular, using the universe of EU MNEs and their subsidiaries abroad for the period 2007–2017, we found that the effects of BITs are not homogenous within the country of origin of MNEs, as indicated by the estimated coefficients, which are significant only when clusters of corporate headquarters are small or medium in size. Indeed, the impact of BITs diminishes as the number of GUOs headquartered in a given region increases, becoming insignificant for HQ regions, i.e. regions hosting large agglomerations of MNEs. Lastly, the study demonstrated that BITs are more effective in consolidating existing GPNs rather than promoting the formation of new ones by stimulating new GUOs to invest in a specific destination country. From a sectoral perspective, BITs are positively associated with GPNs in the manufacturing sector in non-HQ regions, with similar creation and consolidation effects. In the service sector, instead, the effect is significant in both non-HQ and intermediate HQ regions, although with lesser intensity. Finally, BITs do not appear to play a positive role in any sector in highly internationalized regions. These results seem to suggest that the effect of BITs is greater for intangible goods and lesser for more extensive and fragmented global networks.

This heterogeneity raises significant challenges for policymakers. Quite reassuringly, BITs, although spatially neutral, proved to be a good option to promote convergence among regions, at least in terms of internationalization. However, in order to make investment liberalization policies more efficient and effective, the lack of effects on global core regions and specific economic sectors suggests that they need to be more tailored to the peculiarities of the regions of origin of MNEs and addressed to countries with which there are few economic relations.

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Appendix

Table A1
Oneway ANOVA tests of the differences between groups of regions. 2005.

	Group	Mean (sd)	Source	Sum of squares	df	Mean square	F	Significance
GDP per capita*	Non-HQ regions	803.25 (3803.44)	Between groups	1.8318e+09	2	915,880,426	10.49	0.00
	Intermediate HQ regions	5474.09 (9459.73)	Within groups	2.3915e+10	274	87,280,759.7		
	HQ regions	7296 (21,160.35)	Total	2.5747e+10	276	93,285,105.1		
Population density	Non-HQ regions	204.89 (553.29)	Between groups	14,621,903.1	2	7,310,951	6.79	
	Intermediate HQ regions	542.64 (1117.64)	Within groups	295,029,085	274	1,076,748		0.00
	HQ regions	904.21 (2078.35)	Total	309,650,988	276	1,121,923.87		
Percentage of the population 25–64 with a Tertiary education degree**	Non-HQ regions	18.49 (7.19)	Between groups	5530.55	2	2765.27	47.66	0.00
	Intermediate HQ regions	25.44 (7.78)	Within groups	15,841.00	274	58.02		
	HQ regions	31.74 (8.89)	Total	21,371.56	276	77.71		
Patents**	Non-HQ regions	43.21 (64.61)	Between groups	955,139.856	2	477,569.928	35.66	0.00
	Intermediate HQ regions	150.42 (148.18)	Within groups	3,320,994.74	248	13,391.1078		
	HQ regions	209.19 (144.59)	Total	42,766,134.6	250	17,104.53		
Air transport - freight and mail (in 1000 tonnes) **	Non-HQ regions	15.70 (75.52)	Between groups	690,031.721	2	345,015.86	5.94	0.00
	Intermediate HQ regions	78.71 (280.29)	Within groups	10,798,729.9	186	58,057.6879		
	HQ regions	207.59 (472.30)	Total	11,488,761.7	188	61,110.43		
Railway transport - railway goods transport (tonnes) **	Non-HQ regions	18.675 (82.03)	Between groups	772,768.48	2	386,384.24	6.16	0.00
	Intermediate HQ regions	79.82 (282.13)	Within groups	10,663,376.8	170	62,725.74		
	HQ regions	228.86 (465.97)	Total	11,436,145.2	172	66,489.21		

Notes: *Data downloaded from https://ec.europa.eu/eurostat/data/database 2nd December 2023. **Data refer to 2005 or to the closest year available.

Table A2
Full estimates of the baseline results reported in Table 5.

VARIABLES	(1) GPNs	(2) GUOs	(3) SUBs	(4) GPNs	(5) GUOs	(6) SUBs
BITs	0.200***	0.147***	0.214***			
	(0.0664)	(0.0552)	(0.0771)			
BIT*non HQ regions				0.746***	0.719***	0.746**
				(0.277)	(0.206)	(0.346)
BIT*Intermediate HQ regions				0.418***	0.312***	0.452***
				(0.0887)	(0.0803)	(0.0999)
BIT*HQ regions				0.0519	0.0159	0.0605
				(0.0798)	(0.0730)	(0.0904)
GDP per capita	3.420***	2.555***	3.749***	3.420***	2.555***	3.749***
	(0.310)	(0.230)	(0.367)	(0.310)	(0.230)	(0.367)
Population	1.943***	0.838***	2.430***	1.940***	0.835***	2.426***
	(0.244)	(0.227)	(0.269)	(0.245)	(0.227)	(0.269)
Capital-Labor ratio	-1.405***	-1.167***	-1.520***	-1.404***	-1.166***	-1.519***
	(0.142)	(0.103)	(0.171)	(0.142)	(0.103)	(0.171)
Constant	-50.76***	-26.35***	-61.88***	-50.70***	-26.30***	-61.81***
	(5.318)	(4.566)	(6.028)	(5.321)	(4.569)	(6.031)
Observations	31,782	31,782	31,782	31,782	31,782	31,782

Notes: Each control variable included in the regression is one year lagged. BIT is a step variable that switches to one the year after a BIT entered into force. Each regression includes region-destination country fixed effects. Standard errors clustered at country-destination pairs in parentheses *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table A3
Baseline estimates with different clustering.

	(1) Clustering at dyads level	(2) Robust standard errors	(3) Bootstrapped standard errors	(4) Clustering at country of origin -country of destination pair level
VARIABLES	GPNs	GPNs	GPNs	GPNs
BITs	0.200***	0.200***	0.200***	0.200**
	(0.0288)	(0.0757)	(0.0668)	(0.0794)
Observations	31,782	31,782	31,782	31,782
Number of ids	10,624	10,624	10,624	

Notes: BIT is a step variable that switches to one the year after a BIT entered into force. Each regression includes the GDP per capita, the population, and the capital/labor ratio of the country of destination (in log, and one year lagged) and region- destination country fixed effects. Standard errors clustered at region-destination country pairs in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

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