Out of sight, not out of mind.
Education networks and international trade

Marina Murat

University of Modena, RECent, Address: Dipartimento di Economia Marco Biagi, Viale Berengario, 51, I-41121 Modena, Italy - Phone: 39 059 2056884 - E-mail: marina.murat@unimore.it

Out of sight, not out of mind. Education networks and international trade

Marina Murat

University of Modena and Reggio Emilia, ReCent.

November 2012

Abstract. This paper investigates the impact of international students and alumni on the UK's bilateral trade with 167 countries during 1999-2009. The general hypothesis is that international network links lower the invisible barriers to trade between countries. University students typically develop ties of friendship and trust, which may last for decades after graduation and evolve into economic and business ties. I find robust evidence that education networks boost bilateral trade between the UK and the home countries of students and alumni. At a more disaggregated level, the networks linked to Sub-Saharan Africa, the Middle East, Asia and the new member countries of the EU have the strongest effects on bilateral trade.

JEL classification: F14, F20, I23, J24,
Bilateral trade, international students, alumni, higher education, networks.

"Doing business is about building relationships, it's people betting on people, so you still want to trust the people you're dealing with. A lot of trust is developed through friendship and professional networks like school alumni relations, business associations, and industry ties". (Saxenian, 2000)

Good morning Exeterians! The company I work for [...] is hiring project managers for large scale mobile marketing campaigns. If anyone is interested feel free to send me an email. Exeter Alumni Greece, Facebook 20 September 2012.

I. Introduction.

It is well-known that the initial links between Silicon Valley in USA and Bangalore and Hyderabad in India were established by Indian graduates at Californian universities, who realised the profitability of offshoring some parts of production abroad and, above all, knew how and where to do it and with whom to establish the first, crucial contacts. Case studies in sociology and politics published since the Nineties have shed light on this and similar facts, concerning Chinese, Taiwanese and other ethnic networks of professionals who graduated in the US (Zweig, 1995, Saxenian, 2000, 2005).

Since then, economists have systematically explored the impact of international social networks on economic exchanges between countries but, unlike the initial case studies on graduates and professional networks, their work has focused on the broader and somewhat different category of international migrants (Gould, 1994; Head and Ries, 1998; Rauch 1999; Rauch and Trindade 2002; Gao, 2003; Tong, 2005; Combes, Lafourcade and Mayer, 2005; Buch, Kleinert and Toubal, 2006; Blanes and Martin-Montaner, 2006; Herander and Saavedra, 2005; Kugler and Rapoport, 2007; Tadesse and White, 2008).

The general hypothesis is that migrants possess specific knowledge about opportunities in foreign markets and are able to supply matching and referral services that can boost the economic exchanges between their home and residence countries (Rauch, 2001). While trade between countries is deterred by invisible barriers, arising from differences in institutions, norms, cultures and languages, knowledge flows easily within networks of individuals who know each other directly or by referral (Granovetter, 1973). For this reason, migrants' knowledge is valuable; it lowers the costs of international transactions and the height of the invisible barriers. One corollary of the basic hypothesis is that the impact of networks on trade should become stronger as the degree of diversity between countries increases, or, in other words, as the invisible barriers separating them grow higher.

Empirical evidence from different countries has provided support to the theoretical predictions: migrant networks do appear to boost trade (a review is in Wagner, Head and Ries, 2002). Also, some studies find that, as expected, their effect is greater when countries are more dissimilar (Girma and Yu, 2002; Aleksynska and Peri, 2012). It has also been found that the

positive impact of skilled individuals is higher than that of the unskilled; a likely reason for this is that skilled migrants are more likely to possess both the knowledge about potential opportunities abroad and the means to make them feasible than the unskilled (among others, Docquier and Lodigiani, 2009; Murat and Flisi, 2011).

This paper focuses on the transnational links of education networks and their impact on bilateral trade. Like the initial case studies, the investigation concentrates on international students and graduates. To my knowledge, however, this is the first time that their effect on trade is analysed systematically. The main questions of this study are, can the international movements of tertiary level students boost bilateral trade? And, also, do the education networks of more diverse countries have more impact on trade?

More specifically, I utilize two proxies for international networks. One is students from 167 countries registered in UK Universities during 1999-2009. The definition adopted by *UNESCO* is that students are classified as international students if they left their country of origin and moved to another country for the purpose of study. Hence, they are individuals that move abroad, mostly temporarily, to invest in human capital and skills. The UK is the second country in the world after the USA when it comes to attracting tertiary level students from abroad and, of the two, has more foreign students as a proportion of the total student population. The other proxy is the groups and associations of alumni of UK universities in those foreign countries.

Now as in the past, college and university students tend to develop robust ties of mutual friendship and feelings of fidelity toward their educational institution. This happens especially in English speaking countries, where higher education takes place on campuses where students live together and, while there, participate in study groups, sports teams, associations, unions, societies and fraternities. (Mayer and Puller, 2008; Marmaros and Sacerdote, 2006, Baker, Mayer and Puller, 2011, Arcidiacono, Khan and Vigdor, 2011). Some of the links born during higher education survive after graduation, partly maintained by the graduates themselves and partly by the educational institutions. They survive not only for sentimental but also for practical reasons; for graduates, they may channel valuable economic information (Cohen, Frazzini and Malloy, 2008) and, for educational institutions, they are an efficient promotion and funding mechanism. Several of these education links extend over many countries, in all continents.

This paper's main findings are that education networks positively and significantly affect bilateral trade between the UK and the home countries of students. Results are robust to different model specifications both when international students and when alumni groups are used as proxies of transnational networks. Moreover, the disaggregated picture appears to support the corollary on diversity: the networks linked to the most dissimilar areas of the world have the largest impact on

the UK's bilateral trade. Specifically, networks from Sub-Saharan Africa positively affect bilateral imports and exports, those from the Middle East influence exports, and from Asia imports. Moreover, and interestingly, students and alumni from the new member economies of the EU also exert a strong positive effect on export flows.

The main implication of this study is that a country's policy of attracting international students can positively affect its economic exchanges with the students' home countries. The paper is organized as follows. Section II presents the data and some descriptive statistics, Section III details the empirical strategy, Section IV discusses the main findings and Section V concludes.

II. Data and descriptive statistics.

There were on average 288,588 international students registered each year in UK universities from 1999 to 2009 (Table 1). This paper considers 167 countries of origin, and about 95% of the total flows of international students to the UK. During this time period, the overall size of the student population and its international component both increased, but the latter grew more than proportionately: international students as a proportion of on the total student population totalled 11% in 1999 and had increased to 15% by 2009. The sources of these and other data are detailed in Table A3, in the Appendix.

The second row in Table 1 lists alumni groups and associations abroad. Data on alumni were collected for this study from the websites of the UK's main universities and, in some cases, on request, were provided by their Alumni central offices.[1] The final outcome is a time-constant variable, *Alumni*, concerning 31 universities, 1575 groups or associations and 123 countries with at least one group (out of the 167 considered). While the data includes only formal groups, there are many other, informal ones, visible on the Internet and, specifically, on social networking sites like Facebook, LinkedIn and Twitter (one example is cited at the beginning of this paper). Also, each group has a different, and in some cases vast, number of members. This implies that the overall number of alumni abroad who maintain some form of contact with their university and former fellow students is likely to be several times higher than the number derived from the associations reported and, presumably, also higher than the number of international students registered in the country each year.[2] Interestingly, from the university websites it emerges that the "contact" or

---

[1] Data were collected during September 2012. It was not possible to obtain figures on older distributions of alumni groups worldwide; however, it is probable that they change only very slowly over time..

[2] Some UK universities publish the extent of their worldwide graduate population and alumni groups. One example is the Alumni website of Warwick University, which reports the existence of 103 alumni groups in 59 countries; it also states that "[t]he University of Warwick has over 164,000 graduates worldwide, [...] a truly global alumni community". This university exists since 1965, but the networks of the oldest UK universities reach a bigger and deeper dimension. In the website of Oxford University is written that "[t]here are more than 160 alumni groups outside the UK in just over

"ambassador" for each alumni group is often a former student with a degree in business, economics, engineering, management or computing, and less frequently in disciplines related to the humanities. This suggests that there are economic as well as sentimental reasons for the existence of the education networks.

Table 1. Summary statistics. All countries

	Total (average year 1999-2009)	mean	standard deviation	within standard deviation	between standard deviation	correlation with time trend*
International students	288,587.82	1,680.30	4,376.10	1,904.20	3,992.40	0.069
International alumni groups	1,575.00	9.43	22.94		22.94	
Imports	462,223.35	2,642.10	8,083.40	2,338.10	7,777.20	0.074
Exports	350,024.67	2,067.00	6,699.00	1,424.60	6,567.30	0.053

*International students: numbers. Imports and exports: current US$, millions. *Correlation between variable and time trend.*

Table 2 presents the distribution of students, alumni, and trade flows over world areas. The first row shows that international students registered with UK universities originate above all from the European Union of 15 countries (member countries before 1999) and North America (Canada, USA and Mexico), and to a lesser extent from Asia, the new EU member states (members of EU27 after 1999) and other world areas. For each world area, the third column in Table 2 provides the correlation coefficients between the time-varying variables, *International students*, exports, imports, and a time trend. Student numbers from the new EU states and the Middle East have increased faster than those of any other group, numbers from Asia and North America have grown at a slower pace, and the time-path of the largest group, of students from the EU15, is fairly stationary if not slightly negative.

The rapid increase in the number of students from the new EU member countries may be related to the acquisition of EU citizenship by students from these economies. By becoming EU citizens, they have gained the opportunity to move freely within the Union, to attend university in any EU country without the need to apply for visas and residence permits and, regarding the UK, to pay substantially lower university fees than before. UK universities have a policy of differentiation between the level of fees paid by EU (same as UK) and non-EU students. During 1999-2009, EU students paid about 70% less than their non-EU peers.[3]

---

80 countries and catering to almost 60,000 alumni." By counting just alumni rather than graduates, this refers directly to the network.

[3] The UK has the highest university fees in Europe and is the preferred destination for tertiary education.

Table 2. Summary statistics. World areas

	mean	standard deviation	correlation with time trend*	mean	standard deviation	correlation with time trend	mean	standard deviation	correlation with time trend
		EU15			EU new countries			Europe no EU	
International students	6,535	6,439.79	-0.07	1,335	2,071.45	0.30	707	980.29	0.04
International alumni groups	18.36	12.57		6.09	6.14		6.07	6.89	
Imports	16,382.20	17,330.00	0.19	2,407.41	5,449.16	0.23	2,273.82	5,367.13	0.16
Exports	13,917.40	13,072.50	0.16	1,031.33	1,281.59	0.22	1,181.33	1,957.58	0.15
		North America			Central America and Caribbean			South America	
International students	6,304	5,280.40	0.13	140	219.51	0.09	260	313.92	0.06
International alumni groups	111.67	127.77		1.39	2.62		5.17	5.51	
Imports	17,894.50	20,050.70	0.09	92.18	184.19	0.07	511.30	863.15	0.20
Exports	19,536.10	23,727.60	0.11	53.93	55.44	0.10	278.18	492.07	0.15
		Middle East			Asia			Oceania and Australia	
International students	987	1,381.41	0.26	3,749	8,251.89	0.15	512	604.51	0.07
International alumni groups	7.36	7.70		15.12	20.33		19.25	24.60	
Imports	603.33	1,242.00	0.16	2,942.12	6,602.47	0.11	1,083.71	1,300.37	0.14
Exports	723.02	992.45	0.17	1,251.43	1,999.79	0.14	1,203.45	1,801.26	0.08
		Sub Saharan Africa							
International students	537	1,346.97	0.11						
International alumni groups	2.79	5.80							
Imports	239.08	923.36	0.06						
Exports	174.54	553.85	0.09						

*International students: total numbers. Imports and exports: current US dollars, milions.*Correlation between variable and time trend.*

Furthermore, the Lisbon Convention of 1997 (*Convention on the Recognition of Qualifications concerning Higher Education in the European Region*)**,** initially signed by the European countries and with 47 signatories in 2012, stipulates that degrees and periods of study abroad must be recognized unless *substantial differences* can be proved by the institution charged with recognition. This represents a further incentive for young Europeans, in general and especially for those from the new member states, to choose a European country to study abroad, since the university degree obtained there can be utilized later in any of the main economies of the large European market.

The second row of Table 2 contains the distribution of *Alumni* groups across world areas. In descending order, the highest numbers are in North America, then in Australia-Oceania, the European Union of 15 countries, Asia and the Middle East. Their worldwide distributions presents a higher variability than that of *International students*. While the average number of alumni groups in North America is about 112 (257 in the USA alone), in Sub-Saharan Africa and Central America these averages fall to 2.8 and 1.4 respectively. There is also a marked heterogeneity within areas, especially, as the Table shows, in Sub-Saharan Africa and in Central America and the Caribbean. Moreover, although alumni groups consist of former international students, the correlation between the two variables is 0.53 (significance at 1%), lower than might have been expected.

In turn, Table 2 shows that the UK trades, in descending order, with North America and the European Union of 15 countries, then with Asia and the rest of Europe. The flows that have grown most rapidly during the period considered are those with Europe (especially the EU new member countries), Asia, South America and the Middle East (figures for each group are in the third column of Table 2).

III. Estimation strategy

Following Bergstrand (1985) and Gould (1994), I use a gravity equation of trade augmented by the variables of the education networks to assess the link between them and bilateral trade between the United Kingdom and students' home countries. The general specification is

$$Y_{ct} = \alpha + \delta \, education \, networks_{ct} + Xc_t\Pi + \alpha_t + \varepsilon_{ct}$$

where Y_{ct} is the volume of UK exports or imports, *education networks*$_{ct}$, depending on the specification, is measured in terms of (i) number of international students registered in the UK from country c at time t, or (ii) alumni groups of UK universities in country c. *International students*$_{ct}$, is measured in flows, while, as mentioned above, *Alumni*$_c$ is a time-constant variable. X_{ct} is a vector of

variables that influence bilateral trade between the UK and country c at time t. I include several control variables, specific to the partner country c, commonly used in the literature on trade determinants.

The gravity model predicts that the volume of trade is positively related to the pair of countries' economic masses (as measured by domestic products), *GDP*, and negatively related to the costs of trade between them. Per capita GDP (*pcGDP*) is used to account for wealth and productivity in the partner economies. Wealthier and more productive countries are assumed to be more open to trade, hence the signs of *GDP* and *pcGDP* are expected to be positive, while geographical distance (*Distance*) is assumed to increase the costs of trade and its coefficient should be negative. The level of development of countries' institutions, a common language, and trade and institutional agreements between them, have been found to be positively related to bilateral trade (Dunlevy, 2006; Hutchinson, 2005; White, 2007). Proxies of these factors are included in the regressions by using an index of quality of the partner country's institutions, *Government quality*; the percentage of the population which speaks English in country c, *Language*; a European Union dummy that takes the value of one if country c was already in the EU in 1999, EU_{15}; a dummy that takes the value of one if country c is in the EU after 1999, *EU new countries*; and a dummy equal to one if country c is in the Commonwealth during 1999-2009, *Commonwealth*. The coefficients of the latter variables and of the dummies are expected to have positive values. α_t is a time dummy intended to capture a host of macroeconomic and trade policy factors that affect the UK's aggregate trade in each time period. The panel is unbalanced; figures for international students and alumni are complete, while about 3% of the data concerning the other variables overall are missing. Variable definitions and sources are listed in Table A3 in the Appendix.

As network effects are likely to depend mainly on older students and graduates, the regressions are also run substituting the time-varying variable *International students* with the time-invariant regressor, *International students$_{1999}$*, which refers to the number of students registered in 1999, the initial year of the database's time-span. It is reasonable to assume that more or less all the students registered in 1999 will have completed their studies within the following few years and will be graduates and alumni when most of the import and export flows of the period 1999-2009 occur. Hence, the coefficient of this variable can be interpreted as a proxy of the influence of graduate networks on bilateral trade.

A more direct proxy of the networking activity of graduates is the variable which refers to the international presence of alumni groups and associations, *Alumni*. Regressions of the base model are therefore run with this variable instead of international students.

As trade can be highly auto-correlated over time, a subsequent specification model includes the endogenous variable lagged one period, both when the variable of interest is *International students* and when it is *Alumni*.

The use of initial values, with *International students$_{1999}$*, is a useful preliminary test for potential reverse causality; but problems of this kind might still affect coefficients. For example, international students might prefer to move to countries with which the home economy already has important trade exchanges because information on these economies is more easily available. The problem is greatly reduced when the variable of interest is *Alumni* because UK universities have a long tradition of maintaining links with their graduates and several groups have been in existence for a long time (or throughout the lifetime of the universities themselves). However, as the data collected on alumni groups are only available for those which exist at present, in principle they could also be subject to some endogeneity problems. Hence, to further control for this possibility as well as for omitted variables bias in coefficients, I utilize instrumental variables.

For this purpose, I consider three instruments. The first two, following Javorcik et al. (2006 and 1011), are the number of international students in North America (Canada and USA) during 1999-2009 and the distance between the students' home countries and North America, specifically the USA capital. Given that the UK and North America are major destinations for international student flows, the flows in the UK and the US should be positively correlated. However, there is less reason to expect that flows in the US are correlated with the error term in the regression. Regarding the second instrument, it can be hypothesised that students deciding where to study take into account the distance to the alternative destinations, including the UK or the US. Here again, the distance of countries from the US is expected to be positively correlated with the presence of students in the UK but not with the error term of the regression. Another potential instrument I consider is the number of Internet users in the partner countries. The information available on the Internet on universities abroad, the possibility of contacting the universities themselves easily and of applying on-line means that the number of Internet users in a country is likely to be correlated with the number of students from the country studying abroad. After testing the appropriateness of each instrument, regressions are re-run using the TSLS approach.

Finally, as already mentioned, a corollary to the main network hypothesis is that the impact of transnational links should increase with the dissimilarities between countries. In this case, coefficients should be higher for networks related to the areas less culturally and institutionally similar to the UK (in Table 2 Sub-Saharan Africa, the Middle East and Asia), while they should be lower for the more similar ones: North America, Europe and Australia-Oceania. To test the impact of education networks across these different groups of countries and world areas, first *International*

students and then *Alumni* are interacted with a dummy corresponding to each of the world regions in Table 2, and regressions are re-run accordingly.

IV. Regression analysis

IV.1. Aggregate results

Tables 3 (a) and (b) show that, as expected, the coefficients of the *International students* variable are always positive and significant in both the imports and exports regressions (first column of Model 1. More specifically, to a 10% increase in the number of international students in the UK corresponds an increase in exports to and imports from the students' home countries of more than 3%. Significance is at 1% in both cases.

The *Alumni* groups abroad also have a strong and significant impact on trade, stronger than that of international students. In the third column of Model 1, to a 10% increase in the number of alumni groups abroad corresponds an increase of about 4.7% in exports and of 3.5% in imports (significance at 1% in both cases).

When the number of students in the initial year, *International students$_{1999}$*, is used as a regressor, coefficients remain high and significant. In fact they are very similar to those of the *International students* variable, for both the exports and the imports regressions. Hence, the three proxies for transnational education networks used in the baseline specification (Model 1) show to be strongly related to the country's bilateral trade flows.

To obviate for the potential correlation of trade between countries over time, Model 2 includes the lagged dependent variable among the regressors. Results show that, conditional on past exports and imports, the impact of *International students* on bilateral trade persists: a 10% increase in the number of registered international students has the long-run effect of increasing exports by 2.6% and imports by 3% (significance level at 5% in both cases).[4] Hence, the long-run coefficient values are similar to those of the baseline model. To have an idea of the magnitude of this effect, let us consider a 10% increase in the average yearly flow of students; in Table 1, this would amount to an increase from 1680 to 1848 students, or 168 per country. The long run value of the exports coefficient, of 2.6%, implies an increase of $68,692 million. This means that one additional average student generates $408,880 extra value of exports. The same calculations, regarding imports, with a coefficient of 3%, show that one additional average student leads to an increase in the value of imports of $369,107 in the long run. [5]

---

[4] From $y - \alpha y_{t-1} = \gamma + \beta x$, the long run value of coefficient β is $\beta/(1-\alpha)$.
[5] A similar result regarding the impact of immigrant business networks on the US bilateral trade during 2010 is obtained by Aleksynska and Peri (2012).

Table 3.a. International students, alumni networks and trade between countries

Dependent variable: **Exports**

	Model 1 OLS			Model 2 LDV		Model 3 IV	
International students	0.329 *** (0.058)			0.019 ** (0.008)		0.523 *** (0.136)	
International students_ 1999		0.326 *** (0.061)					
International alumni groups			0.466 *** (0.103)		0.037 *** (0.013)		0.866 *** (0.143)
GDP partner country	0.562 *** (0.055)	0.576 *** (0.055)	0.581 *** (0.064)	0.050 *** (0.012)	0.046 *** (0.012)	0.413 *** (0.109)	0.387 *** (0.079)
PC GDP partner country	0.177 *** (0.047)	0.173 *** (0.050)	0.169 *** (0.056)	0.000 (0.007)	0.010 (0.007)	0.158 *** (0.041)	0.168 *** (0.057)
Distance	-0.384 *** (0.095)	-0.406 *** (0.093)	-0.457 *** (0.095)	-0.050 *** (0.013)	-0.053 *** (0.012)	-0.329 *** (0.085)	-0.453 *** (0.078)
Governance quality	0.171 ** (0.087)	0.118 (0.091)	0.097 (0.099)	0.016 (0.014)	-0.008 (0.014)	0.206 *** (0.077)	0.026 (0.099)
Language	0.003 * (0.002)	0.003 (0.002)	0.002 (0.002)	0.000 * (0.000)	0.000 (0.000)	0.002 * (0.001)	0.001 (0.002)
EU15	-0.004 (0.220)	-0.108 (0.231)	0.356 (0.241)	-0.045 * (0.025)	-0.025 (0.027)	-0.141 (0.223)	0.461 ** (0.220)
EU new countries	0.134 (0.161)	0.317 * (0.162)	0.312 ** (0.156)	0.028 (0.019)	0.045 ** (0.019)	0.022 (0.165)	0.320 ** (0.142)
Commonwealth	-0.128 (0.192)	-0.133 (0.195)	0.207 (0.173)	-0.020 (0.020)	0.002 (0.019)	-0.489 (0.309)	0.002 (0.164)
Exports $_{t-1}$				0.927 *** (0.016)	0.928 *** (0.015)		
Constant	3.444 *** (0.998)	3.717 *** (0.998)	4.954 *** (0.977)	0.535 *** (0.134)	0.343 ** (0.134)	2.462 ** (0.984)	5.015 *** (0.808)
Adjusted R^2	0.90	0.90	0.89	0.98	0.98	0.891	0.880
N. of observations	1774	1774	1774	1617	1617	1768	1768
Intrumental variables						(a),(b)	(a),(b),(c)
First-stage F-statistics						119.53	123.43
Overidentifying restrictions						0.00	2.57
LM and p values						0.97	0.28

*All variables, except dummies, are in logs. Time-dummies used in all regressions. Robust standard errors in parentheses, * significant at 10%; ** significant at 5%; *** significant at 1%. Istrumental variables: (a) Internet users in countries, (b) International students in North America, (c) Distance to North America (US).*

Table 3.b. International students, alumni networks and trade between countries

Dependent variable:	**Imports**						
	Model 1			**Model 2**		**Model 3**	
	OLS			LDV		IV	
International students	0.327 ***			0.027 **		0.441 ***	
	(0.087)			(0.013)		(0.102)	
International students_ 1999		0.328 ***					
		(0.090)					
International alumni groups			0.350 **		0.018		0.925 ***
			0.165		0.020		0.235
GDP partner country	0.723 ***	0.734 ***	0.800 ***	0.083 ***	0.088 ***	0.637	0.520 ***
	(0.089)	(0.090)	(0.105)	(0.018)	(0.022)	(0.093)	(0.131)
PC GDP partner country	0.040	0.034	0.041	0.014	0.026 **	0.014	0.022
	(0.080)	(0.082)	(0.094)	(0.013)	(0.013)	(0.063)	(0.086)
Distance	0.089	0.059	0.009	-0.017	-0.022	0.114	0.011
	(0.161)	(0.156)	(0.158)	(0.018)	(0.018)	(0.127)	(0.126)
Governance quality	0.592 ***	0.538 ***	0.521 ***	-0.009	-0.014	0.636 ***	0.448 ***
	(0.133)	(0.138)	(0.164)	(0.021)	(0.022)	(0.109)	(0.160)
Language	-0.001	-0.002	-0.002	0.000	0.000	-0.002	-0.004
	(0.003)	(0.003)	(0.003)	(0.000)	(0.000)	(0.003)	(0.003)
EU15	0.499	0.392	0.825 **	0.022	0.039	0.413	0.974 ***
	(0.397)	(0.384)	(0.413)	(0.049)	(0.049)	(0.312)	(0.370)
EU new countries	0.642 **	0.825 ***	0.823 **	0.104 **	0.123 **	0.568 **	0.824 ***
	(0.303)	(0.318)	(0.324)	(0.050)	(0.051)	(0.236)	(0.310)
Commonwealth	0.435	0.426	0.837 ***	0.070 *	0.114 **	0.213	0.527 ***
	(0.316)	(0.314)	(0.292)	(0.043)	(0.045)	(0.305)	(0.260)
Imports _t-1_				0.910 ***	0.916 ***		
				(0.017)	(0.016)		
Constant	-0.047	0.215	1.507	-0.356	-0.178	-0.657	1.524
	(1.654)	(1.626)	(1.569)	(0.221)	(0.199)	(1.354)	(1.307)
Adjusted R^2	0.83	0.83	0.82	0.97	0.966	0.823	0.800
N. of observations	1773	1773	1773	1615	1615	1767	1767
Intrumental variables						(a),(b),(c)	(a),(b),(c)
First-stage F-statistics						364.36	123.43
Overidentifying restrictions						2.54	0.97
LM and p values						0.28	0.62

*All variables, except dummies, are in logs. Time-dummies used in all regressions. Robust standard errors in parentheses - * significant at 10%; ** significant at 5%; *** significant at 1%. Istrumental variables: (a) Internet users in countries, (b) International students in North America, (c) Distance to North America (US).*

When the international students variable is replaced by the *Alumni* regressor, the impact on exports is higher. To a 10% increase in the *Alumni* groups abroad corresponds a long run increase in exports of 5.1% (significance at 1%). The coefficient in the imports regression is also positive, but non-significant.

Returning to Model 1, the *Alumni* and *International students$_{1999}$* variables are less likely than *International students* to be influenced by international trade flows, but coefficients might still be biased because of endogeneity. Hence, the instrumental variables approach is adopted in Model 3. The first stage regressions are in Table A1, in the Appendix. Results in this case show that the coefficients of both the *International students* variable and, especially, of *Alumni,* increase with respect to the baseline specification. The instruments used for the TSLS regression with *International students* are the number of Internet users in foreign countries and the number of international students in North America. The first-stage F-statistics indicates that the instruments are strong, and the overidentifying restrictions test does not reject their validity. If, on the other hand, the third instrument, distance to the US, is also used, the validity of one instrument is rejected. In the regression with the *Alumni* variable, all three instruments are valid and strong. These results reinforce the above findings and suggest that the OLS coefficients are downward biased. Therefore, the transnational links of education networks appear to robustly and substantially affect the UK's bilateral trade with the home countries of international students.

IV.2. World areas

Given these aggregate results, it is now of interest to see whether the education networks of different countries and areas of the world have a different effect on bilateral trade; in particular, whether the network links to the most dissimilar areas have the strongest impact on bilateral trade. Table 4 presents the results of splitting the data of *International students* and *Alumni* into different world areas of origin. More precisely, each of the two variables is, in turn, interacted with a dummy corresponding, respectively, to the *EU15* countries, *EU new countries*, non-EU European countries, and the countries of North, Central and South America, Asia, Sub-Saharan Africa, the Middle East and Oceania. To save space, only the results obtained with the LDV specification (Model 2 in Table 3) are shown; as in the previous regressions, time-dummies are used in all cases.

At a glance, Table 4 shows that coefficients vary markedly across areas of the world and appear to support, although not completely, the prior expectation of stronger effects from links between more dissimilar countries. More precisely, if the cases in which the coefficients of both the *International students* and the *Alumni* regressors are significant are considered, it turns out that the

Table 4. Interactions: world regions with international students and alumni (LDV).

Dependent variable:	Exports		Imports	
EU15*Int. students	0.008		0.030 **	
	(0.008)		(0.014)	
EU15*Int. alumni		0.021		0.010
		(0.017)		(0.026)
EU new countries*Int. Students	0.018 **		0.047 ***	
	(0.008)		(0.016)	
EU new countries*Int. alumni		0.054 ***		0.056
		(0.017)		(0.036)
Europe no27*Int. students	0.011		0.034 **	
	(0.009)		(0.015)	
Europe no27*Int. alumni		0.023		0.012
		(0.018)		(0.027)
Sub Saharan Africa*Int. Students	0.018 **		0.049 ***	
	(0.009)		(0.015)	
Sub Saharan Africa*Int. alumni		0.043 ***		0.044 **
		(0.015)		(0.020)
North America*Int. students	0.008		0.026 *	
	(0.009)		(0.015)	
North America*Int. alumni		0.020		-0.014
		(0.013)		(0.021)
C. America and Caribbean*Int.	0.000		0.047 **	
	(0.009)		(0.020)	
C. America and Caribbean*Int. alumni		-0.019		0.009
		(0.020)		(0.048)
South America*Int. Students	0.017		0.056 ***	
	(0.013)		(0.020)	
South America*Int. alumni		0.037		0.047
		(0.029)		(0.037)
Middle East*Int. students	0.022 ***		0.036 **	
	(0.008)		(0.014)	
Middle East*Int. alumni		0.057 ***		0.024
		(0.016)		(0.022)
Asia*Int. students	0.012		0.041 ***	
	(0.007)		(0.014)	
Asia*Int. alumni		0.032 **		0.031 *
		(0.013)		(0.018)
Oceania*Int. students	0.011		0.056 **	
	(0.011)		(0.024)	
Oceania*Int. alumni		0.025		0.004
		(0.015)		(0.027)
Exports (Imports) t-1	0.919 ***	0.921 ***	0.909 ***	0.920
	(0.017)	(0.016)	(0.017)	(0.015)
Adjusted R^2	0.982	0.982	0.966	0.966
N. of observations	1617	1617	1615	1615

Control variables: GDP, PcGDP, Distance, Governance, Language. All variables, except dummies, are in logs. Robust standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%. Time dummies in all regressions.

strongest and most significant influence on bilateral exports and imports is exerted by the education networks linked to Sub-Saharan Africa. Countries with the largest number of alumni groups within this area are Nigeria, Kenya, South Africa and Ghana. Regarding exports, the strongest effects derive from the Middle Eastern networks; in this case alumni groups are especially numerous in Pakistan, the United Arab Emirates and Turkey. Exports are also affected by links with the new EU new member countries, where the largest alumni groups are in Cyprus, Poland, Bulgaria, Hungary and the Czech Republic. Concerning imports, the strongest effects are those of education networks linked to Asia. Within this region, alumni are found above all in in India, China, Malaysia and Singapore.

These results support the assumption on diversity with one exception: the new EU member countries, which cannot be considered as dissimilar to the UK as the other areas. Therefore, the strong effects on exports of networks linked to the new EU member states may be more due to the common policies on higher education of European countries and the relative agreements on the *European Higher Education Area* than to reasons of diversity. Presumably, these policies have increased the relative presence in the UK of students from Europe and especially from the new member countries, whose students have started to move abroad more recently.

IV.3 Robustness checks

The robustness of the results for the education networks in Table 3 are further tested by taking into account other factors that might potentially affect trade and the impact of international students.

One of these is the substantial enlargement of the European common market area during the period considered, which may have affected both trade and student flows. To control for these effects, regressions have been re-run with varying time dummies; specifically, the dummies of the new EU countries and new non-EU countries have been interacted with a time (year) dummy. Results with this specification do not change significantly. The coefficients of the *International students* variable are significant in both the exports and imports equations and their values remain very similar to those of Model 2 in Table 3 (Model A.a of Table A2). To save space, only the results concerning the LDV specification are presented; the other regressions are available from the author upon request.

While all specifications in Table 3 include variables that change across countries and are time-invariant (*Distance, EU15, EU new countries, Commonwealth*), country-specific macroeconomic factors could still be missing and could affect the coefficients. Hence, countries' fixed effects (FE) have been included in the regressions (Model A.b, in Table A2). The *Alumni*

regressor has not been used because it is time-invariant. As a result of the FE specification, the explanatory power of the equations substantially decreases, which is not surprising, given that, as Table 1 shows, most of the variation in the data is due to differences between rather than within countries. Despite this, the FE specification provides further evidence of the link between international students and trade, particularly in the exports equation, where the coefficient remains positive and significant (at the 5% level); in the imports regression it is positive but not significant.

One further specification includes the stocks of immigrants from each partner country present in the UK during the period considered (model A.c in Table A2). Immigrants may matter because individuals deciding where to study abroad may prefer countries that already host a community of of people from their homeland. If that were the case, then the impact on trade might in fact depend on the immigrant community, rather than on international students. Here again the results are not comparable with those of Table 3, in this case because a very substantial number of data on immigrants are missing (more than 80%). It can be observed, however, that the coefficient of the immigrant variable is non-significant in both the export and import regressions, while that of *International students* is positive and significant in both.

Other factors potentially related to trade have also been tested. They are: religion, as a proxy of cultural similarity (proportion of people of Christian religion living in each country), (Helble, 2007); the status of countries as UK ex-colonies (a dummy with value one for each ex-colony and zero otherwise), as a proxy for similarity in institutions (Head, Mayer and Ries, 2010); the level of literacy in countries, as a measure of human capital; an index of inflation, as a measure of exchange rate volatility, and the history of wars between the UK (or the former Kingdom of Great Britain) and each of the partner countries from 1700 to the present day, as a proxy of trust (Guiso, Spienza and Zingales, 2009; Melitz and Toubal, 2012). In none of these cases were the coefficients significant or robust.

V. Conclusion

To my knowledge, this is the first systematic analysis of the links between education networks and bilateral trade. To date, a few existing studies on international students have focused on brain-drain and innovation in the home or host countries, and on the determinants of studying abroad. No attempt has been made to measure their influence, or that of Alumni networks, on the bilateral trade of the economies involved. This paper clearly reveals the existence of a nexus between transnational education networks and the UK's bilateral trade and, therefore, may contribute to the understanding of the possible overall effects of international students on the economy as a whole.

The splitting of the data into geographical regions has shown that networks linked to dissimilar areas have strong effects on bilateral imports and exports. This provides empirical support to the assumption that the effects of networks will be stronger as the invisible barriers to trade increase, and adds significance to the previous results of the literature on immigrants and business networks (Girma and Yu, 2002; Aleksynska and Peri, 2012). A further interesting finding is that the networks from the new EU member also boost the UK's bilateral exports. This result may be due to the common measures on higher education pursued by European countries during the last fifteen years, which, together with the enlargement of the EU market, may have represented a substantial incentive for students from these states to study abroad and, in particular, in the UK.

While the UK has a long tradition of attracting students from abroad, despite some restrictive measures in recent years, other countries lack clear policies in this respect. This study has shown that the international movements of students can be an effective way of improving the economic exchanges between the countries involved.

Bibliography

Aleksynska M, Peri G (2012) "Isolating the Network Effect of Immigrants on Trade", IZA IZA DP No. 6941.

Angrist DA, Pischke J-S (2009) *Mostly Harmless Econometrics*, Princeton University Press.

Arcidiacono A, Khan S, Vigdor JL (2011) "Representation versus assimilation: How do preferences in college admissions affect social interactions?" *Journal of Public Economics* 95(1): 1-15.

Bergstrand JH (1985) "The gravity equation in international trade: some microeconomic foundations and empirical evidence", *Review of Economics and Statistics* 67(3), August, 174-181.

Baker S, Mayer A, Puller SL (2011) "Do more diverse environments increase the diversity of subsequent interaction? Evidence from random dorm assignment", *Economics Letters*, 110 (2): 110-112.

Blanes JV, Martín-Montaner JA (2006) "Migration flows and intra-industry trade adjustments", *Review of World Economics*, 142 (3): 567-584.

Buch CM, Kleinert J, Toubal F (2006) "Where enterprises lead, people follow? Links between migration and FDI in Germany", *European Economic Review,* 50 (8): 2017-2036.

Cohen L, Frazzini A, Malloy C (2008) "The Small World of Investing: Board Connections and Mutual Fund Returns", *Journal of Political Economy*, 116 (5): 951-79.

Combes P-P, Lafourcade M, Mayer T (2005) "The trade-creating effects of business and social networks : evidence from France", *Journal of International Economics,* 66(1): 1-29.

Docquier F, Lodigiani E (2009) "Skilled migration and business networks", *Open Economies Review*, DOI 10.1007/s11079-008-9102-8.

Dunlevy JA (2006) "The impact of Corruption and Language on the Pro-Trade effect of Immigrants: Evidence from the American States", *Review of Economics and Statistics*, 88(1): 82-186.

Gao T (2003) "Ethnic Chinese networks and international investment: evidence from inward FDI in China", *Journal of Asian Economics,* 14: 611-629.

Girma S, Yu Z (2002) "The link between immigration and trade: evidence from the UK", *Weltwirtschaftliches Archiv,* 138 (1): 115-130.

Gould DM (1994) "Immigrant links to the home country: empirical implications for U.S. bilateral trade flows", *The Review of Economics and Statistics,* 76 (2): 302-16.

Granovetter MS (1973) "The Strength of Weak Ties", *American Journal of Sociology*, 78 (6): 1360-80.

Guiso L, Sapienza P, Zingales L (2009) Cultural biases in economic exchange, *Quarterly Journal of Economics* 124, 1095-1131.

Head K, Ries J (1998) "Immigration and trade creation: econometric evidence from Canada", *Canadian Journal of Economics,* 31 (1): 47-62.

Head K, Mayer T, Ries J (2010) "The erosion of colonial trade linkages after independence", *Journal of International Economics* 81(1):1-14.

Helble M (2007), "Is God good for trade", *Kyklos* 60(3):385-413.

Herander MG, Saavedra LA (2005), "Exports and the structure of immigrant-based networks: the role of geographic proximity", *The Review of Economics and Statistics* 87(2): 323-335

Hutchinson, WK (2005) "'Linguistic distance' as a determinant of bilateral trade", *Southern Economic Journal*, 72(1): 1-15.

Javorcik BS, Oezden C, Spatareanu M, Neagu C (2006) "Migrant networks and Foreign Direct Investment*", Policy Research Working Paper* 4046, The World Bank.

Javorcik BS, Oezden C, Spatareanu M, Neagu C (2011) "Migrant networks and Foreign Direct Investment*", Journal of Development Economics*, (94): 231-41.

Kaufmann D, Kraay A, Mastruzzi M (2009) "Governance matters VIII : aggregate and individual governance indicators 1996-2008," Policy Research Working Paper Series 4978, The World Bank.

Kugler M, Rapoport H (2007) International labour and capital flows: Complements or substitutes? *Economics Letters*, 94*:* 155–162.

Mayer A, Puller SL (2008) "The old boy (and girl) network: Social network formation on university campuses", *Journal of Public Economics* (92): 329–347

Melitz J, Toubal F (2012) "Native language, spoken language, translation and trade, *CEPR* DP 8994.

Marmaros D, Sacerdote B (2006) "How do friendships form?" *Quarterly Journal of Economics*, 121(1): 79-119.

Murat M, Flisi s (2011) "The hub continent. Immigrant networks, emigrant diasporas and FDI", *The Journal of Socio-Economics* 40: 796–805

Rauch, J. (1999) "Networks versus markets in international trade", *Journal of International Economics*, 48, 7–35.

Rauch J (2001) "Business and social networks in international trade" *Journal of Economic Literature,* 39 (4): 1177-1203.

Rauch J, Trindade V (2002), "Ethnic Chinese networks in international trade", *Review of Economics and Statistics* 84(1): 116-130

Saxenian AL (2000) "Silicon Valley's New Immigrant Entrepreneurs'', *The Center for Comparative Immigration Studies*, University of California San Diego, w.p. 15.

Saxenian AL (2005) "From Brain Drain to Brain Circulation: Transnational Communities and Regional Upgrading in India and China" *Studies in Comparative International Development*, 40 (2): 35-61

Tadesse B, White R. (2008) "Do Immigrants Counter the Effect of Cultural Distance on Trade? Evidence from US State-Level Exports", *Journal of Socio-Economics* 37 (6): 2304:2318.

Tong SJ (2005) "Ethnic Networks in FDI and the Impact of Institutional Development", *Review of Development Economics,* 9 (4): 563-580

Wagner D, Head K, Reis J (2002), "Immigration and the trade of provinces", *Scottish Journal of Political Economy*, 49(5): 507-525.

White, R (2007) "Immigrant-trade links, transplanted home bias and network effects", *Applied Economics*, 39(7): 839-852.

Zweig, D, Changgui C (1995) "China's Brain Drain to the United States: Views of Overseas Chinese Students and Scholars in the 1990s" *China Research Monograph 47*, Institute of East Asian Studies, University of California at Berkeley.

Table A1. First stage TSLS

Dependent variable:	International students			International alumni groups		
Internet users in countries	0.213 ***	0.263 ***	0.053	0.157 ***	0.179 ***	0.085 **
	(0.083)	(0.078)	(0.053)	(0.051)	(0.050)	(0.038)
Distance to North America (US)		0.902 ***	1.266 ***		0.399 ***	0.562 ***
		(0.141)	(0.137)		(0.091)	(0.108)
International students in North America			0.603 ***			0.270 ***
			(0.076)			(0.059)
Adjusted R^2	0.74	0.79	0.84	0.76	0.787	0.818
N. of observations	1774	1774	1774	1774	1774	1774

*First stage of Model 3 in Table 3. Variables of interest of regressions run on the more complete specification of Model 1 in Table 3. All variables, except dummies, are in logs. Time-dummies used in all regressions. Robust standard errors in parentheses, * significant at 10%; ** significant at 5%; *** significant at 1%.*

Table A2. Further sensitivity analisis

Dependent variable:	Exports	Imports	Exports	Imports	Exports	Imports
	With varying time dummies (LDV)		With countries fixed effects (FE)		With *Immigrants* variable (OLS)	
International students	0.020 ***	0.030 **	0.061 **	0.026	0.149 *	0.433 ***
	(0.008)	(0.013)	(0.031)	(0.067)	(0.082)	(0.164)
Immigrants					0.082	-0.041
					(0.101)	(0.167)
GDP partner country	0.048 ***	0.080 ***	0.213	-0.096	0.653 ***	0.752 ***
	(0.012)	(0.018)	(0.247)	(0.663)	(0.074)	(0.127)
PC GDP partner country	0.011 *	0.027 **	0.386	0.938	0.222 ***	-0.142
	(0.006)	(0.013)	(0.246)	(0.648)	(0.079)	(0.223)
Distance	-0.047 ***	-0.014	___	___	-0.456 ***	-0.391 **
	(0.012)	(0.019)			(0.093)	(0.177)
Governance quality	-0.001	-0.006	0.115	0.087	0.136	0.907 **
	(0.013)	(0.021)	(0.091)	(0.154)	(0.116)	(0.351)
Language	0.000	-0.001	___	___	0.002	-0.002
	(0.000)	(0.000)			(0.002)	(0.004)
EU15	-0.049 **	0.017	___	___	0.118	-0.424
	(0.024)	(0.049)			(0.208)	(0.415)
EU new countries	-0.205 ***	-0.059	___	___	0.002	-0.004
	(0.070)	(0.094)			(0.221)	(0.407)
Commonwealth	-0.015	0.075 *	___	___	0.304	0.272
	(0.020)	(0.043)			(0.253)	(0.386)
Exports (Imports) $_{t-1}$	0.928 ***	0.910 ***				
	(0.016)	(0.017)				
Constant	0.236 *	-0.319	1.079	-2.184	3.780 ***	4.349 *
	(0.131)	(0.222)	(1.235)	(3.269)	(1.071)	(2.501)
Adjusted R^2	0.98	0.966	0.98	0.96	0.924	0.838
N. of observations	1617	1615	1788	1787	267	267

All variables, except dummies, are in logs. Time-dummies used in Models FE and OLS. Varying time dummies in Model LDV obtained by interacting EU new countries and non-Eu new countries with time (year) dummies. Robust standard errors in parentheses, * significant at 10%; ** significant at 5%; *** significant at 1%.

Table A3. Variable definitions and sources

Variable	Definition	Main source
International students	International students: left their country of origin and moved to another country for the purpose of study. Number of students enrolled refers to the count of students studying in the reference period.	*UNESCO*. International flows of mobile students at the tertiary level (ISCED 5 and 6)
Alumni	International alumni groups and associations of UK universities.	Own database, built during 2012 with data from universities' websites and direct information from Alumni representatives. Includes only officially recognized groups from 31 UK universities.
Internet users	Internet users are people with access to the worldwide network. Total numbers in countries, period 1999-2009.	International Telecommunication Union, World Telecommunication/ICT Development Report and database.
Exports / Imports	International trade, all commodities. Value, current US$.	OECD International trade by commodity statistics, harmonized system, 1998.
GDP		IMF - Statistics
PcGDP	Per capita GDP	IMF - Statistics
Distance	Great circle distance between capital cities and London. Km. /For instrumental variable: distance between capital cities and Washington.	http://www.chemical-ecology.net/java/capitals.html
Language	Proportion of people speaking English over total population.	CIA World Factbook
Governance quality	Worldwide Governance Indicator. Includes six dimensions of governance: Voice and accountability Political stability and absence of violence; Government effectiveness; Regulatory quality; Rule of Law; Control of corruption.	World Bank Developed by Kaufmann et al. (2009). The six indicators are measured in units ranging from about -2.5 to 2.5, with higher values corresponding to better governance outcomes.
Immigrants	Stock of foreign born population by country of birth.	OECD International Migration Database
Commonwealth	Dummy taking value of one if country belongs to Commonwealth during 1999-2009: Antigua and Barbuda, Australia, Bahamas, Bangladesh, Barbados, Belize, Botswana, Brunei, Cameron, Canada, Cyprus, Dominica, Gambia, Ghana, Grenada, Guyana, India, Jamaica, Kenya, Lesotho, Malawi, Malaysia, Maldives, Malta, Mauritius, Mozambique, Namibia, New Zealand, Nigeria, Pakistan, Papua New Guinea, Rwanda, Saint Lucia, Saint Vincent and the Grenadines, Seychelles, Sierra Leone, Singapore, South Africa, Sri Lanka, Swaziland, Rwanda, Tanzania, Trinidad and Tobago, Uganda, Zimbabwe.	
EU15	Dummy taking value of one if country belongs to the European Union in 1999: Austria, Belgium, Denmark, Finland, France, Germany, Greece,	

	Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden, United Kingdom.
EU new countries	Bulgaria, Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Romania, Slovakia, Slovenia.
Europe no EU 27	Albania, Armenia, Belarus, Bosnia and Herzegovina, Croatia, Iceland, Liechtenstein, Moldova, Norway, Romania, Russia, Serbia and Montenegro, Switzerland, Ukraine, Israel*.
North America	Canada, Mexico, USA
Sub-Saharan Africa	Angola, Benin, Botswana, Burkina Faso, Burundi, Cameroon, Cape Verde, Central African Republic, Congo D.R. of, Congo R. of, Cote d'Ivoire, Eq. Guinea, Eritrea, Ethiopia, Gabon, Gambia, Ghana, Guinea, Kenya, Lesotho, Madagascar, Mozambique, Mauritania, Mauritius, Namibia, Niger, Nigeria, Rwanda, Senegal, Seychelles, S. Leone, Somalia, South Africa, Sudan, Swaziland, Tanzania, Togo, Uganda, Zambia, Zimbabwe.
Central America and Caribbean	Antigua and Barbuda, Bahamas, Barbados, Belize, Costa Rica, Dominica, El Salvador, Grenada, Guatemala, Haiti, Honduras, Jamaica, Nicaragua, Panama, Saint Lucia, Saint Vincent and the Grenadines, Trinidad and Tobago.
South America	Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, Guyana, Paraguay, Peru, Suriname, Uruguay, Venezuela.
Middle East	Afghanistan, Algeria, Azerbaijan, Bahrain, Egypt, Georgia, Iran, Iraq, Jordan, Kuwait, Lebanon, Libya, Morocco, Oman, Pakistan, Qatar, S. Arabia, Syria, Tunisia, Turkey, United Arab Emirates, Yemen
Asia	Bangladesh, Brunei, Cambodia, China, Hong Kong, India, Indonesia, japan, Kazakhstan, South Korea, Kyrgyzstan, Macao, Malaysia, Maldives, Mongolia, Myanmar, Nepal, Philippines, Singapore, Sri Lanka, Tajikistan, Thailand, Turkmenistan, Uzbekistan, Vietnam.
Oceania	Australia, Fiji, New Zealand, Papua New Guinea.

*Included in the European and not into the Middle East group due to higher similarity with the former.

"Materiali di Discussione" LATER PUBLISHED ELSEWHERE

N. 546 -   M. Murat and B. Pistoresi, *Emigrants and immigrants networks in FDI*, Applied Economics letters, April 2008, **http://www.informaworld.com/ /content~content=a789737803~db=all~order=author** (electronic publication), **WP No. 546 (December 2006).**

N. 545 -   M.Brunetti and C. Torricelli, *The Population Ageing in Italy:Facts and Impact on Household Portfolios*, in M. Balling & E. Gnan & F. Lierman (eds.), Money, Finance and Demography: The Consequences of Ageing, Vienna, Suerf (2007), **WP No. 545 (November 2006).**

N. 532 –   M: Montanari, Between European Integration and Regional Autonomy: The Case of Italy from an Economic Perspective, Constitutional Political Economy, Vol. 17, 4, pp. 277-301 (2006), **WP No. 532 (March 2006).**

N. 529 **-**   M. Montanari, *Knocking on the EU's door: the Political Economy of EU-Ukraine Relations,* Journal of Contemporary European Research, Vol.3,1, pp.64-78 (2007), **WP No. 529 (February 2006).**

N. 518 -   M.Brunetti and C. Torricelli, *Economic Activity and Recession Probabilities: information content and predictive power of the term spread in Italy*, Applied Economics (2009), **WP No. 518 (December 2005).**

N. 517 -   M. Murat and S. Paba (2006), *I distretti industriali tra immigrazioni e internazionalizzazione produttiva*, in B. Quintieri (ed.) I distretti italiani dal locale al globale, Rubbettino (2006), **WP No. 517 (December 2005).**

N. 491 -   V. Moriggia, S. Muzzioli and C. Torricelli, *On the no arbitrage condition in option implied trees,* European Journal of Operational Research (2009), **WP No. 491 (May 2005).**

N. 482 -   G. Di Lorenzo and G. Marotta, *A less effective monetary transmission in the wake of EMU? Evidence from lending rates passthrough***,** ICFAI Journal of Monetary Economics, Vol. 4, 2, pp. 6-31 (2006), **WP No. 482 (February 2005).**

N. 472 -   M.Brunetti and C. Torricelli, *The internal and cross market efficiency in index option markets: an investigation of the Italian market*, Applied Financial Economics, Vol. 17, 1, pp. 25-33 (2007),   **WP No. 472 (November 2004).**

N. 466 -   G. Marotta, *La finanza del settore non profit tra ritardi nei pagamenti e Basilea 2*, Banca Impresa Società , Vol. XXIV, 1, pp. 35-51 (2005), **WP No. 466 (September 2004).**

N. 453 -   Pederzoli and C. Torricelli, *Capital requirements and Business Cycle Regimes: Forward-looking modelling of Default Probabilities* , Journal of Banking and Finance, Vl. 29, 12, pp. 3121-3140 (2005), **WP No. 453 (February 2004).**

N. 448 -   V. Moriggia, S. Muzzioli, C. Torricelli, *Call and put implied volatilities and the derivation of option implied trees,* Frontiers In Finance and Economics, vol.4, 1, pp. 35-64 (2007), **WP No. 448 (November 2003).**

N. 436 -   M.Brunetti and C. Torricelli, *Put-Call Parity and cross-market efficiency in the Index Options Markets: evidence from the Italian market*, International Review of Financial Analysis, Vl.14, 5, pp. 508-532 (2005), **WP No. 436 (July 2003).**

N. 429 -   G. Marotta, *When do trade credit discounts matter? Evidence from Italian Firm-Level Data*, Applied Economics, Vol. 37, 4, pp. 403-416 (2005), **WP No. 429 (February 2003).**

N. 426 -   A. Rinaldi and M. Vasta, *The Structure of Italian Capitalism, 1952-1972: New Evidence Using the Interlocking Directorates Technique,* Financial History Review, vol, 12, 2, pp. 173-198 (2005), **WP No. 426 (January 2003).**

N. 417 -   A. Rinaldi, *The Emilian Model Revisited: Twenty Years After,* Business History, vol. 47, 2, pp. 244-226 (2005), **WP No. 417 (September 2002).**

N. 375 -   G. Marotta, *La direttiva comunitaria contro i ritardi nei pagamenti tra imprese. Alcune riflessioni sul caso italiano*, Banca, Impresa, Società, Vol. XX, 3, pp. 451-71 (2001), **WP No. 375 (September 2001).**

N. 303 -   G. Marotta and M. Mazzoli, *Fattori di mutamento nella domanda di prestiti ed effetti sulla trasmissione della politica monetaria*, in P. ALESSANDRINI (ed.) Il sistema finanziario italiano tra globalizzazione e localismo, Bologna, Il Mulino, pp. 223-260 (2001), **WP No. 303 (April 2000)**

N. 131 -   G. Marotta, *Does trade credit redistribution thwart monetary policy? Evidence from Italy*, Applied Economics, Vol. 29, December, pp. 1619-29 (1997), **WP No. 131 (1996).**

N. 121 -   G. Marotta, *Il credito commerciale in Italia: una nota su alcuni aspetti strutturali e sulle implicazioni di politica monetaria*, L'Industria, Vol. XVIII, 1, pp. 193-210 (1997), **WP No. 121 (1995)**

N. 105 -   G. Marotta, *Credito commerciale e "lending view"*, Giornale degli Economisti e Annali di Economia, Vol. LIV, 1-3, gennaio-marzo, pp. 79-102; anche in G. Vaciago (a cura di) *Moneta e finanza*, Bologna, Il Mulino (1995), **WP No. 105 (1994).**