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Foreign Languages and Trade

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Abstract

Cultural factors and especially common languages are well-known determinants of trade. By contrast, the knowledge of foreign languages was not explored in the literature so far. We combine traditional gravity models with data on fluency in the main languages used in EU and candidate countries. We show that widespread knowledge of languages is an important determinant for foreign trade, with English playing an especially important role. Other languages (French, German, and Russian) play an important role mainly in particular regions. Furthermore, we argue that the effect of foreign languages on trade may be non-linear. The robustness of our results is confirmed by quantile regressions.

Keywords: Gravity models, foreign trade, language, European integration, quantile regression.

JEL Classification: C23, F15, F40, Z10.

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1 Introduction

Languages facilitate communication and ease transactions. Two individuals who speak the same language can communicate and trade with each other directly whereas those without a sufficient knowledge of a common language must often rely on an intermediary or hire an interpreter. The additional complexity inherent in such a mediated relationship, the potential for costly errors and the increased cost may be large enough to prevent otherwise mutually beneficial transactions from occurring. Consequently, the ability to speak foreign languages should have a positive economic payoff embodied in better employment opportunities and higher wages, in addition to other, non-pecuniary benefits such as the ability to travel, study and live abroad, meet new people, read foreign books or newspapers, and the like. Indeed, the previous literature has found such individual gains to be potentially large.[1]

In this paper, we are interested in economic returns to proficiency in foreign languages at the aggregate level rather than at the individual level. If enough people in both country A and country B speak the same language, they will be able to communicate with each other more readily. Consequently, trade between these two countries will be easier, cheaper, and, in turn, more intensive. Hence, we should expect languages to foster bilateral trade. This observation, of course, is not new. Indeed, most studies using the gravity model to analyze trade account for common official languages between countries (for example, French is the official language of France, Belgium, Luxembourg, Switzerland, Canada, and dozens of former French and Belgian colonies). Such studies invariably find that sharing a language translates into greater trade intensity. However, languages need not be formally recognized as official languages in both countries in order to foster trade: international commerce is increasingly conducted in English, even if neither party to the transaction is from an English speaking country.

[1] Most empirical studies focus on immigrants (e.g. Chiswick and Miller, 2002 and 2007) where positive returns to the ability to speak the host-country language is not surprising. Ginsburgh and Prieto-Rodriguez (2006) estimate the returns to using a foreign language at work for native Europeans and find positive returns which depend on the relative *scarcity* of the foreign language (for instance, English has a much lower return in Denmark than in Spain).

While most gravity-model analyses considered only official languages, Mélitz (2008) goes a step further by considering all indigenous or established languages spoken in a country and accounting for the fraction of the population speaking them. English, for example, is spoken in dozens of former British colonies but often only a small fraction of the population speak it, and Chinese is spoken in a number of South Asian countries even while it does not enjoy an official-language status in all of them. However, a crucial limitation of his data is that it only includes languages that are indigenous or otherwise established in the country. Specifically, the *Ethnologue* database[2] that he uses collects information only on languages spoken by primary speakers, that is native or established (ethnic-minority) populations of each country (including those spoken by people who are bilingual or multilingual). The database, however, omits languages spoken by secondary speakers, that is by those who learned them as foreign languages, although such language abilities often facilitate economic interactions and trade especially: these days, trade relations between, for example, Greek and Swedish firms are more likely to be facilitated by English rather than either Greek or Swedish.

Unlike Mélitz, we consider not only primary but also secondary speakers alike. We utilize a new and previously little used survey data set on knowledge of languages in the member and candidate countries of the European Union. Importantly, the data contain detailed information not only on the respondents' native languages but also on up to three foreign languages that they can speak. These surveys are nationally representative and therefore they allow us to estimate probabilities that two randomly chosen individuals from two different countries will be able to communicate with each other. We use such *communicative probabilities* to investigate the effect of languages on bilateral trade flows in Europe.

We find that greater density of linguistic skills indeed translates into greater trade intensity. In the 'old' 15 EU countries, the average probability that two randomly chosen individuals from two different countries will be able to communicate in English with each other is 22% (this probability makes no distinction between native speakers of English and those who speak it as a foreign language except that we require that the self-assessed proficiency for the latter is at least good or very good). This raises intra-

[2] See http://www.ethnologue.com/.

EU15 trade, on average, by approximately 30%. German and French, in contrast, produce only weak and mixed results. It appears, indeed, that English is the main driver of international trade, at least in Western Europe.

However, the effect of foreign languages is not uniform across countries. When we expand our analysis to include all 29 EU member and candidate countries[3], the effect of English appears weaker or outright insignificant (nevertheless, English appears significant in a sample including only the new members and candidates for membership, without including the old members). This could be due to the two groups' different historical legacies and relatively short and limited history of integration between them. Another potential explanation is that the effect of languages is in fact non-linear: on average, fewer people speak English in the new member and candidate countries than in the old members.

In the following section, we discuss briefly the available literature on the effect of languages on international trade. In section 3, we introduce our data. Section 4 contains the empirical analysis, and section 5 presents sensitivity analysis using median and quantile regressions. The final section summarizes and discusses our findings.

2 Languages and Trade

The gravity model (see Linder, 1961, Linnemann, 1966, Anderson and van Wincoop, 2003), relates bilateral trade to the aggregate supply and aggregate demand of, respectively, the exporting and importing country, to transport and transaction costs, and to specific bilateral factors (e.g. free trade agreements). It has proved an extremely popular tool for applied trade analysis. In particular, models based on the gravity relation have been used to assess the impact of trade liberalization and economic integration, to discuss the so-called 'home bias' (McCallum, 1995) and to estimate the effects of currency unions on trade (Rose, 2000).

Accounting for common official languages has become a standard feature of gravity models. The gravity equation is thus augmented to include a common-language dummy,

[3] At present, Croatia and Turkey are the only countries with the candidate status.

alongside other potential determinants of bilateral trade such as common border, landlocked dummy and indicators of shared colonial heritage.[4] Most studies, however, pay little attention to the effect of languages that they estimate. Rather, they account for common language primarily to help disentangle its effect from the effect of preferential trade liberalization. For instance, several languages have the status of the official language in two or more European countries: English (UK, Ireland and Malta), German (Austria, Germany and Luxembourg), French (France and Belgium), Dutch (Belgium and Netherlands), Swedish (Sweden and Finland), and Greek (Greece and Cyprus). It is natural to expect that having the same official language fosters bilateral trade. Therefore, failure to account for the common-language effect would likely result in an upward-biased estimate of the effect of economic integration in the EU.

Some studies, such as Rauch and Trindade (2002), find that immigrants help foster trade links between their country of origin and the ancestral country. To the best of our knowledge, however, the only study that focuses specifically on the relationship between bilateral trade and languages is Mélitz (2008). He goes beyond focusing on official languages and instead considers all indigenous or established languages spoken by at least 4% of the population, in addition to official languages.[5] He finds that both categories of languages that he defines, 'open-circuit' and 'direct communication'[6] languages, increase bilateral trade. Nevertheless, as he only considers indigenous or established languages, he fails to measure the effect of foreign languages.

[4] More recent studies often include these factors as fixed effects.

[5] His analysis, is based on the Ethnologue database (see http://www.ethnologue.com/), complemented using the CIA World Factbook.

[6] Open-circuit languages are those that either have official status or are spoken by at least 20% of the population in both countries. Direct-communication languages are those that are spoken by at least 4% in each country. The former are measured using dummy variables, the latter as the probability that two randomly chosen individuals from either country can communicate directly in any direct-communication language.

3 Data

We base our analysis on data set of bilateral trade flows among 29 countries that are at present member states or candidates for membership of the European Union. The trade flows are observed between 2001 and 2007 and were compiled from the IMF Direction of Trade Statistics. Trade flows are expressed in US dollars; nominal GDP data, based on the IMF International Financial Statistics, are converted to US dollars as well. The distance between countries is measured in terms of great circle distances between the capitals of country *i* and country *j*.

An important strength of our analysis is that we are able augment the trade and output data with survey data on European's ability to speak various languages. The data draw upon a Eurobarometer survey[7] that was carried out in the late 2005 in all member states and candidates countries of the European Union. The respondents, who had to be EU citizens (although not necessarily nationals of the country in which they were interviewed), were asked to list their mother's tongue (allowing for multiple entries when applicable) and up to three other languages that they 'speak well enough in order to be able to have a conversation'. Additionally, the respondents were asked to rate their skill in each of these languages as basic, good or very good. These surveys are nationally representative (with the limitation that they do not account for linguistic skills of non-EU nationals) and therefore we can use them to estimate the share of each country's population that speaks each language.[8]

English is the language spoken by the largest number of Europeans: 33% of the 29 countries included in our analysis speak it as their native language or speak it well or very well (Figure 1). Five EU non-English-speaking countries have majority of their population proficient in English and only two countries have proficiency rates below 10%. German is spoken by 22%, French by 17% and Russian by 4% (Figure 2 through

[7] Special Eurobarometer 243 (EB64.3), Europeans and their languages, European Commission. See http://ec.europa.eu/public_opinion/archives/ebs/ebs_243_sum_en.pdf for detailed information.

[8] The data report figures for all EU official languages, regional languages of Spain (Catalan, Basque and Galician), and selected non-EU languages (Arabic, Russian, Chinese, Hindi, Urdu, Gujarati, Bengali and Punjabi).

Figure 4).[9] Unlike English, these three languages are mainly spoken in their native countries or (in case of Russian) in countries that have large minorities of native speakers. Note that no language attains a 100% proficiency rate in any single country, not even in the country where it is native; this is because of immigrants who do not possess sufficiently good linguistic skills in the host-country language.

We use the average proficiency rates, ω, to estimate probabilities, $P_{f,ij}$, that two randomly chosen individuals from countries i and j will be able to communicate in a language or set of languages f,

$$P_{f,ij} = \omega_{f,i}\omega_{f,j}. \quad (1)$$

In doing so, we make no distinction between those who are native speakers of the language and those who speak it as a foreign language, except that we require that the respondent's self-assessed proficiency, if not native, is good or very good rather than merely basic.

Our data contain information on proficiency in 32 languages. However, it is obvious that only a relatively small subset of them can realistically serve as conduits of inter-country communication. We select such languages by imposing a requirement that it should be spoken by at least 10% of the population in at least three countries. This yields English, German, French and Russian – the last being spoken mainly in the new member countries and also in Germany (8% of population). Note that this relatively strict definition leaves out Italian, which, outside of Italy, is spoken by 3-5% of Austrian, Belgian, French and Luxembourgish population and 7-9% of Croats and Slovenes. Similarly, Spanish, although spoken widely outside of the EU, has relatively small linguistic constituencies in Europe – between 2-7% of Austria, Denmark, France, Germany, Netherlands and Portugal – and therefore it is not included. Lowering the threshold to 4% would add these two languages and also Swedish (spoken by 8% of Danes and 20% of Finns) and Hungarian (spoken by 7% of Romanians and 16% of Slovaks).

[9] The shares of those speaking fluently Italian, Spanish and Polish are 12, 10 and 7%, respectively.

English again appears as the most likely conduit for inter-country communication: the average communicative probability for the 29 countries is 17% (22% for the EU15). Even excluding Ireland and the UK, this probability remains very high at 15%. In several cases, the probability that English may serve as the communication language exceeds 50% (e.g. for Netherlands-Sweden and Netherlands-Denmark). In turn, there are only few bilateral pairs which display probabilities below 10%; in general these are all countries with Romance languages.

German and French lag far behind English, with 5 and 3% average communicative probabilities respectively (or 7 and 5% in the EU15). Nevertheless, there are some cases where the communicative probability is relatively high: for example, the probability that a Dutchman and a Dane will be able to speak German with one another is 16%. For all the remaining languages, the average communicative probability is essentially zero, although it is often non-negligible for specific pairs of countries.[10]

Finally, we construct the cumulative communicative probability not only for individual languages but also for sets containing multiple languages, in particular we consider English, French and German and the three most widely spoken languages. Constructing such a probability over a set of languages is not trivial: adding up the respective probabilities would result in some pairs of countries with overall communicative probability exceeding 1, as some individuals can speak two or three languages. We take care therefore that each type of individual (as indentified by their linguistic skills) is counted only once.

[10] The less obvious examples include Russian between Germany and Bulgaria (2%), Polish between Poland and Lithuania (13%), Hungarian for Slovakia and Romania (1%), Italian in case of Malta and Slovenia (3%), Czech and Slovak between the Czech and Slovak Republics (22% for Czech and 16% for Slovak), and Swedish in case of Finland and Denmark (1%).

Figure 1: Proficiency in English (native, very good or good proficiency)

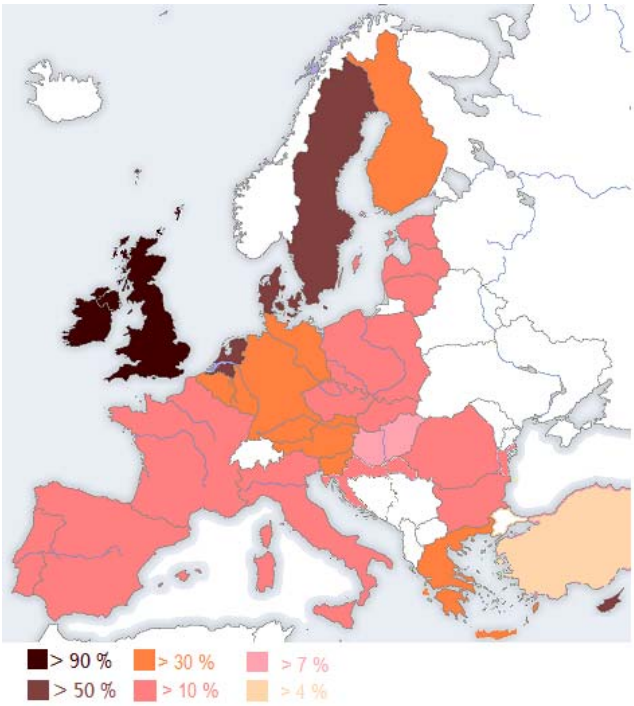


Figure 2: Proficiency in French (native, very good or good proficiency)

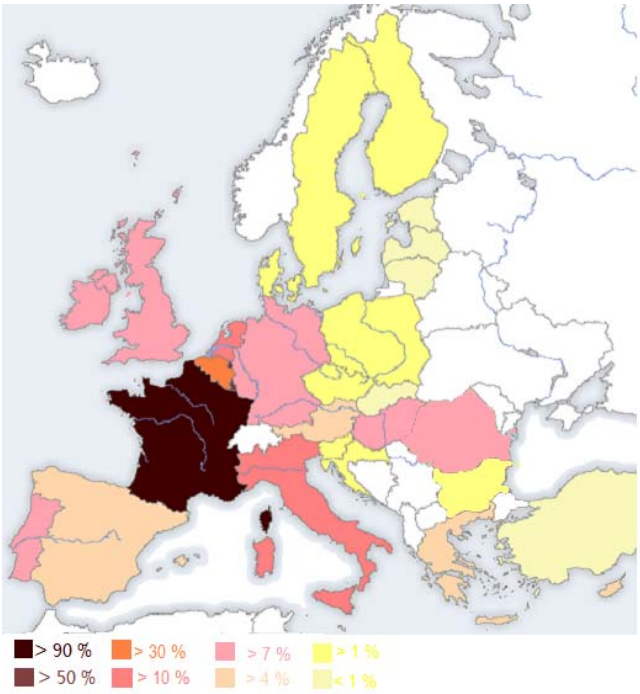


Figure 3: Proficiency in German (native, very good or good proficiency)

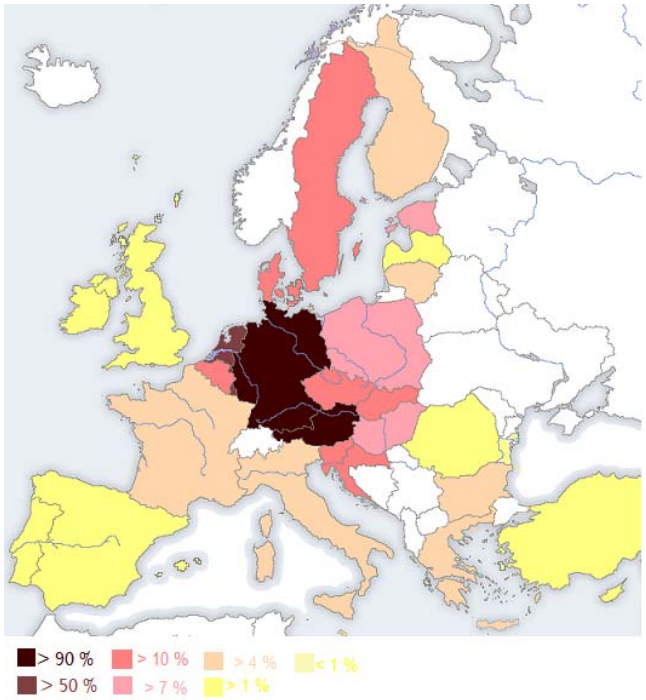
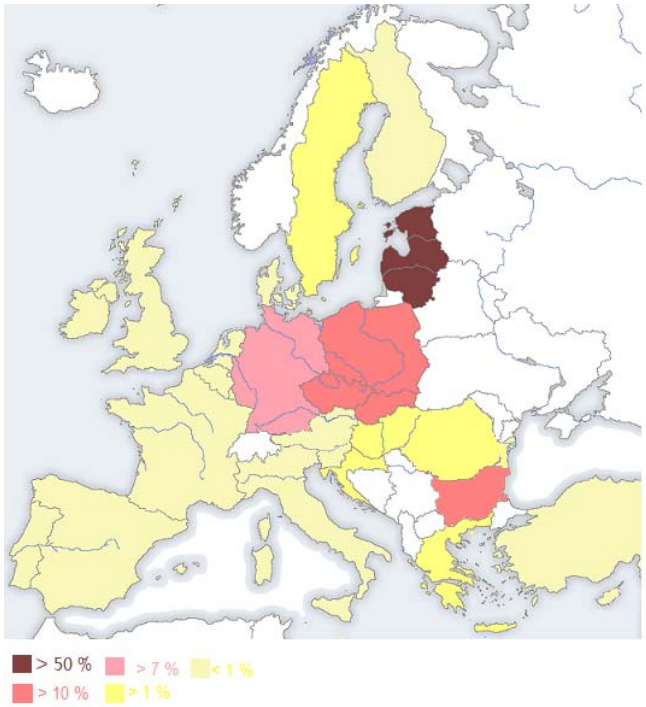


Figure 4: Proficiency in Russian (native, very good or good proficiency)



4 Gravity Model with Languages

We estimate the following gravity equation (all variables are in logarithms):

$$T_{ijt} = \theta_{ijt} + \beta_1 \left(Y_{it} + Y_{jt} \right) + \beta_2 D_{ij} + \beta_3 B_{ij} + \beta_4 F_{ij} + \beta_5 EU_{ij} + \sum_{d}^{D} \delta_d L_{d,ij} + \sum_{f}^{F} \delta_f P_{f,ij} + \varepsilon_{ijt}, \qquad (2)$$

where T_{ijt} corresponds to the size of bilateral trade between country i and country j at time t, Y_{it} and Y_{jt} stand for the nominal GDP in the countries i and j at time t, and D_{ij} is the distance between them proxying for transport costs. The income elasticity of foreign trade, β_1 is expected to be positive, while transport cost elasticity, β_2, should be negative. We also include a control variable for geographic adjacency, B, for former federations in East Europe, F, which broke up in the early 1990s, and for EU membership, EU. Both variables are expected to have positive effects on trade. Finally, $L_{d,ij}$ and $P_{f,ij}$ are indicators for languages d and f, respectively, specific to each pair of countries, which are discussed below.

We follow Baldwin's and Taglioni's (2006) critique of common approaches to estimating gravity model. Firstly, we define trade volume as the average of logs of exports and imports, instead of log of average of exports and imports. This precludes possible bias if trade flows are systematically unbalanced, which is commonly observed between countries of the European Union. Secondly, we include trade flows and GDP in nominal terms (but converted to euros using contemporaneous exchange rates). This reflects the fact that gravity models can be derived from expenditure functions of consumers (see discussion of the so called gold medal error in Baldwin and Taglioni, 2006). Thirdly, we include country specific time dummies, which stand for all time-invariant and time-variable country specific factors.[11]

In addition to the core variables of gravity models, we include two sets of indicators on bilateral language relationships between the countries. First, we use official-language dummies, which are used commonly in gravity models. Thus, we use dummies for English (Ireland, Malta and the UK), French (France, Belgium and Luxembourg),

[11] Alternative specifications of gravity models with simple country dummies (Mátyás, 1997 and 1998) or as a standard OLS, which are also popular in the literature, are available upon request.

German (Germany, Austria and Luxembourg), Swedish (Sweden and Finland), Dutch (Belgium and the Netherlands), and Greek (Greece and Cyprus). Second, we include communicative probabilities for English, French, German, and Russian (constructed as explained in section 3).[12] These indicators measure the probability that two randomly chosen inhabitants of country *i* and *j* can communicate in the specific language. Importantly, in computing the probabilities, we make no distinction whether the individuals are native speakers of the language or whether one or both of them speaks it as a foreign language. Clearly, language can facilitate trade also when one or both parties to the transaction speak an acquired rather than native language.

A potential problem is presented by the fact that the bilateral trade intensity and the knowledge of foreign languages are likely to be endogenous. On the one hand, people have more incentives to learn languages which they can use subsequently in their job or business. For example, only a negligible fraction of European population speaks fluently Latin despite many cultural, academic and historical reasons to learn Latin. On the other hand, knowledge of languages which are not used frequently is likely to diminish after some time. For example, the share of population with a good or very good proficiency in Russian in the new member states has declined to between 10% and 20% (and to 1.4% in Hungary), despite a long tradition of obligatory and rather extensive teaching of Russian in the formerly communist countries.

Therefore, we use two stage least squares as an alternative to OLS. The communicative probabilities are likely to be correlated with the language groups. Trade between two countries with e.g. Germanic languages is more likely to be done in English or German, because of linguistic similarities. Similarly, two countries with native Romance languages are more likely to use French in their communication. In addition we add a dummy variable for the countries participating in the Marshal plan.[13] Finally, we include also dummies for Baltic countries and for Eastern Europe. All instrumental variables have the expected signs and are significant in the first stage equation.

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[12] Further results for Spanish, Italian, Swedish and Hungarian are available upon request from authors.

[13] The following countries participated in the Marshal plan: Germany, France, the Netherlands, Sweden, Denmark, Italy, the UK, Ireland, Austria, Belgium, Portugal, Greece, and Turkey. Norway also participated in the Marshal plan, but we do not include it in the study because of lack of language data.

We start with an analysis of trade flows among the EU15 countries because they constitute a relatively homogenous group of countries with regard to many economic, historical and cultural characteristics. Table 1 compares the results obtained with the various alternative ways of controlling for bilateral language relations between countries. OLS results are in columns (1), (3) and (5) while the remaining columns present the 2SLS estimates. All regressions feature the official-language dummies for English, French, German, and Swedish: common official languages raises bilateral trade between 1.2 (French) and 1.8 times (German). Dutch, in contrast, appears to lower trade slightly. This may be due to the fact that Dutch is only one of two official languages of Belgium (in addition to French).

In column (1), we include the communicative probability only for English. Ability to communicate in English has a positive impact on trade and is strongly significant. As an example, the communicative probability for the UK and Ireland is 0.97 which translates into 3.1-fold increase in trade. Overall, trade between UK and Ireland is therefore more than 5 times higher than what can be ascribed only to economic factors and geography (this combines the effects of the official-language dummy and communicative probability, both of which are significant and increase trade). The proficiency in English is an important for trade between other countries too. For example, the trade between the Netherlands and Sweden is increased by three quarters and Dutch trade with the UK is more than doubled. With English communicative probability 22% in the EU15 on average, the ability to communicate in English increases trade by approximately one fifth.

In column (3), we add communicative probabilities for French and German. Communicative probability in French appears to raise trade but its effect is insignificant. German appears even to have a negative impact. While this appears somewhat counter-intuitive, it merely shows that countries whose nationals could easily communicate in German (mainly the Netherlands and Denmark) fail to capitalize on this potential (possibly because of historical animosities between these countries and Germany), or use English instead; having German as an official language does fosters trade, however. Importantly, adding further languages affects the regression estimates for English little. Finally, in column (5) we introduce the cumulative probability for all three languages, which has also a positive and significant effect on foreign trade.

The instrumental regressions confirm the positive effect of English on trade. Moreover, the 2SLS estimates tend to be higher than the OLS ones, suggesting that endogeneity of communicative probabilities tends to translate into a downward bias. According to the 2SLS results, French also appears to have a positive impact on trade while the negative effect of German disappears. The coefficient for cumulative probability similarly turns out larger when estimated with 2SLS.

Table 2 presents similar results for the new member states and candidate countries (NMSC). Because French plays only a marginal role in this group of countries, we are not including this language here. Instead, columns (3) and (4) feature Russian. No official-language dummies are included because there are no two or more countries with the same official language, but we include a dummy variable for countries which arose from the break-up of the former federations in Eastern Europe (Czechoslovakia and the USSR). The communicative probabilities for all languages (including German) again have a strong positive impact on trade, which is also confirmed by the 2SLS results. The cumulative communicative probability, likewise, raises trade. As before, the 2SLS results suggest a stronger relationship than the one stipulated by OLS.

When comparing the regression results estimates for the EU15 and the MNSC, it is striking that the coefficients appear much larger for the latter group of countries. In interpreting the regression results, however, one one must bear in mind the generally lower levels of foreign language proficiency in the new members and candidates (for example the average communicative probability in English is 11% in NMSC).[14] Nevertheless, the effect is sizeable: on average, the ability to communicate in English raises trade by 74% in these countries.

Finally, Table 3 merges the two groups of countries – although we are aware that the previous results show that both regions are very different with respect to proficiency in foreign languages and their effects. We now add one more common official language, Greek, along with the communicative probabilities in all of the above-listed languages,

[14] The same caveat applies to interpreting the relatively large effect of French in column (4) of Table 1. Furthermore, when we include additional, more marginally used, languages such as Italian and Spanish, we get similarly large or even larger coefficient estimates for their effects (results available upon request).

and a dummy for the membership in the EU. English is again significant in all OLS specifications and also in the 2SLS regression with all included languages (column 4). French and Russian communicative probabilities are positive and significant but German again appears to lower trade. The cumulative probability is significant only with OLS.

The mixed and generally disappointing results in Table 3, and also the large differences between the EU and NMSC results, can be due to two factors. First, while the EU15 countries share a long legacy of economic integration, the NMSC – and in turn also the EU29 – constitute much more heterogenous groups. Second, the impact of language proficiency on trade can be non-linear. In particular, communicative probability can have diminishing returns so that trade is increased more for low to moderate levels than for relatively high levels. The latter especially would explain why we find significant results for both groups of countries in separate regressions but relatively weak results when we merge them, and why the language effects estimated for the NMSC appear stronger (the NMSC have lower communicative probabilities and therefore the estimates are clustered closer to the origin, where the non-linear regression line would be expected to be steeper).

We can use our estimates to assess the potential (hypothetical) effects of improvements in English proficiency. An increase in English proficiency in all EU15 countries by 10 percentage points (keeping UK and Irish proficiency levels constant) would increase the intra-EU15 trade by 15% on average. This increase would not be shared uniformly by all countries: while Portuguese trade would go up by some 9%, Dutch trade could increase by as much as 24% (UK and Ireland would be close behind with 21% trade increases). An even greater increase, one that would bring all countries to the level of English proficiency attained by the Netherlands (again, assuming that the UK and Ireland's proficiency levels would remain unchanged), would bring about an average increase in EU15 trade by 70%.

To explore the possibility of non-linear relationship between communicative probability and trade, we add the square of the communicative probability to our regressions. Table 4 presents again first the results for the EU15 countries. Focusing on the impact of English communicative probability, all regressions suggest that it indeed has a hump-

shaped effect on trade flows. The effect peaks when the communicative probability is approximately 70%. Note, however, that although this seems to suggest that English-speaking countries could do better by lowering their English proficiency, they also receive the positive impact of having English as their official language (captured by the common-language dummy) – and this effect rises when we control for the English communicative probability. Table 5 and Table 6 present similar results for the new members and candidates and for all countries together. The results are again generally weak – the only language that now appears to have a significant effect on trade is Russian in the NMS sample. Therefore, while there is some evidence that that the returns to English proficiency may be non-linear, the EU15 and the new members and candidates again appear very heterogenous.

Table 1: Trade effects of Foreign Languages, EU15

Variable	(1) OLS		(2) 2SLS		(3) OLS		(4) 2SLS		(5) OLS		(6) 2SLS	
Intercept	15.175	***	15.049	***	15.415	***	9.652	***	14.573	***	13.925	***
	(49.699)		(48.411)		(45.150)		(4.446)		(45.386)		(41.997)	
GDP	0.897	***	0.904	***	0.885	***	0.888	***	1.007	***	1.013	***
	(47.047)		(47.281)		(44.808)		(14.004)		(52.995)		(52.081)	
Distance	-0.748	***	-0.741	***	-0.761	***	-0.345	**	-0.754	***	-0.710	***
	(-26.831)		(-26.399)		(-25.893)		(-2.305)		(-25.109)		(-23.367)	
Contiguity	0.471	***	0.463	***	0.491	***	0.566	***	0.478	***	0.427	***
	(13.310)		(13.203)		(13.696)		(7.639)		(12.470)		(10.687)	
Official languages												
English	0.543	***	0.449	***	0.570	***	0.558	**	0.786	***	0.492	***
	(6.536)		(4.980)		(6.646)		(2.582)		(9.899)		(5.859)	
German	0.581	***	0.587	***	0.853	***	-0.137		0.336	***	-0.197	*
	(13.379)		(13.612)		(10.409)		(-0.107)		(4.620)		(-1.974)	
French	0.186	**	0.196	**	0.101		-11.652	***	-0.033		-0.474	***
	(2.328)		(2.433)		(0.382)		(-3.522)		(-0.324)		(-4.207)	
Swedish	0.279	***	0.310	***	0.235	**	0.442	**	0.218	**	0.362	***
	(3.300)		(3.591)		(2.728)		(2.773)		(2.423)		(3.820)	
Dutch	-0.263	***	-0.242	***	-0.340	***	-1.188	***	-0.287	***	-0.149	**
	(-4.529)		(-4.086)		(-5.028)		(-5.100)		(-4.474)		(-2.213)	
Proficiency												
English	1.152	***	1.449	***	1.074	***	2.015	***				
	(9.261)		(8.327)		(8.352)		(4.272)					
French					0.080		19.552	***				
					(0.226)		(3.468)					
German					-0.408	***	1.271					
					(-3.948)		(0.670)					
Cumulative[a]									0.396	***	1.349	***
									(3.543)		(8.358)	
N	1470		1470		1470		1470		1470		1470	
Adjusted R^2	0.974		0.974		0.974		0.906		0.973		0.971	

Note: a – cumulative probability that two inhabitants of the country pair can communicate in English, French or German (reflecting knowledge of two or all three languages). Country-specific time dummies are not reported. *t*-statistics are in parentheses. ***, **, and * denote significance at 1 per cent, 5 per cent, and 10 per cent, respectively. The instrumental variables include dummies for countries with Germanic, Romanic, Slavonic and Finno-Ugrian languages, Baltic States and Eastern Europe (excluding Turkey, Malta and Cyprus), and countries participating in the Marshal plan.

Table 2: Trade effects of Foreign Languages, NMS and Associated Countries (including Turkey)

Variable	**(1)** OLS		**(2)** 2SLS		**(3)** OLS		**(4)** 2SLS		**(5)** OLS		**(6)** 2SLS	
Intercept	19.372	***	18.866	***	17.119	***	11.993	***	19.176	***	18.581	***
	(11.050)		(11.006)		(8.450)		(4.541)		(10.711)		(10.583)	
GDP	0.573	***	0.576	**	0.566	***	0.561	**	0.574	**	0.576	**
	(2.446)		(2.459)		(2.405)		(2.154)		(2.433)		(2.431)	
Distance	-1.024	***	-1.007	***	-0.817	***	-0.314		-1.001	***	-0.967	***
	(-6.148)		(-6.374)		(-4.128)		(-1.185)		(-5.868)		(-5.935)	
Former Fed.	2.292	***	2.306	***	1.478	***	0.765	***	2.299	***	2.317	***
	(11.428)		(11.765)		(10.418)		(3.907)		(11.303)		(11.516)	
Contiguity	0.531	***	0.519	***	0.650	***	0.861	***	0.538	***	0.533	***
	(4.835)		(4.952)		(5.473)		(5.886)		(4.863)		(5.015)	
Proficiency												
English	5.074	***	10.566	***	5.182	***	8.667	***				
	(3.371)		(6.961)		(3.440)		(5.917)					
German					13.381	*	82.753	***				
					(1.738)		(2.865)					
Russian					3.748	***	7.330	***				
					(8.954)		(6.903)					
Cumulative									4.978	***	9.442	***
									(3.235)		(6.298)	
N	1254		1254		1254		1254		1254		1254	
Adjusted R^2	0.850		0.847		0.858		0.844		0.850		0.848	

Note: See Table 1.

Table 3: Trade effects of Foreign Languages, All Countries (EU29)

Variable	(1) OLS		(2) 2SLS		(3) OLS		(4) 2SLS		(5) OLS		(6) 2SLS	
Intercept	19.114	***	19.386	***	19.180	***	18.988	***	18.983	***	16.829	***
	39.247		(38.749)		38.680		(33.704)		38.828		(31.218)	
GDP	0.767	***	0.752	***	0.769	***	0.760	***	0.843	***	0.988	***
	(31.328)		(29.395)		(31.523)		(17.438)		(36.810)		(38.584)	
Distance	-1.029	***	-1.036	***	-1.035	***	-1.083	***	-1.028	***	-1.035	***
	(-23.330)		(-23.399)		(-22.574)		(-18.977)		(-22.772)		(-22.910)	
Former Fed.	2.455	***	2.459	***	1.961	***	1.526	***	2.466	***	2.462	***
	(30.024)		(29.924)		(25.275)		(13.264)		(29.965)		(29.738)	
Contiguity	0.325	***	0.321	***	0.339	***	0.541	***	0.317	***	0.319	***
	(7.200)		(7.060)		(7.538)		(7.149)		(7.111)		(7.115)	
EU	0.235	***	0.257	***	0.216	***	0.116	*	0.246	***	0.258	***
	(4.450)		(4.721)		(4.051)		(1.828)		(4.688)		(4.740)	
Official languages												
English	0.715	***	0.886	***	0.739	***	0.638	***	0.802	***	0.888	***
	(5.523)		(6.640)		(5.700)		(2.920)		(6.340)		(6.705)	
German	0.571	***	0.567	***	0.910	***	7.400	***	0.337	***	0.490	***
	(9.600)		(9.533)		(8.337)		(4.415)		(3.218)		(3.246)	
French	0.056		0.041		0.230		-4.529	***	-0.160		-0.028	
	(0.511)		(0.372)		(0.697)		(-3.038)		(-1.257)		(-0.181)	
Greek	2.333	***	2.322	***	2.316	***	2.289	***	2.333	***	2.324	***
	(14.889)		(14.863)		(14.588)		(12.706)		(14.923)		(14.889)	
Swedish	0.162	***	0.144	**	0.134	**	-0.128		0.162	**	0.147	**
	(2.814)		(2.468)		(2.302)		(-1.401)		(2.747)		(2.453)	
Dutch	-0.622	***	-0.621	***	-0.638	***	-1.827	***	-0.614	***	-0.619	***
	(-10.040)		(-10.009)		(-9.584)		(-13.261)		(-9.739)		(-9.837)	
Proficiency												
English	0.664	***	0.139		0.569	***	1.525	**				
	(4.430)		(0.582)		(3.754)		(2.525)					
French					-0.315		6.387	**				
					(-0.702)		(2.679)					
German					-0.470	***	-9.597	***				
					(-3.233)		(-4.164)					
Russian					1.603	***	2.147	***				
					(8.146)		(10.173)					
Cumulative[a]									0.386	***	0.128	
									(2.825)		(0.566)	
N	5634		5634		5634		5634		5634		5634	
Adjusted R^2	0.930		0.930		0.931		0.904		0.930		0.930	

Note: See Table 1.

Table 4: Trade effects of Foreign Languages, Non-Linear Specification, EU15

Variable	(1)		(2)		(3)	
Intercept	14.084	***	14.569	***	14.445	***
	(42.399)		(40.016)		(41.129)	
GDP	0.955	***	0.921	***	1.009	***
	(47.613)		(44.312)		(52.117)	
Distance	-0.726	***	-0.748	***	-0.750	***
	(-26.881)		(-26.781)		(-24.945)	
Contiguity	0.429	***	0.451	***	0.471	***
	(12.615)		(14.712)		(12.156)	
Official languages						
English	1.369	***	1.672	***	0.875	***
	(12.209)		(13.622)		(7.683)	
German	0.661	***	0.030		0.374	***
	(15.015)		(0.210)		(4.795)	
French	0.292	***	0.400		-0.034	***
	(3.650)		(1.621)		(-0.331)	
Swedish	0.362	***	0.256	***	0.227	***
	(4.428)		(3.370)		(2.526)	
Dutch	-0.283	***	-0.404	***	-0.283	***
	(-5.053)		(-6.444)		(-4.425)	
Proficiency						
English	5.157	***	6.005	***		
	(10.526)		(11.581)			
French			1.119	***		
			(2.439)			
German			-2.633	***		
			(-8.132)			
Cumulative[a]					0.803	*
					(1.809)	
Proficiency (Quadratic)						
English	-3.580	***	-4.481	***		
	(-8.600)		(-9.879)			
French			-1.552	***		
			(-3.178)			
German			3.230	***		
			(7.235)			
Cumulative[a]					-0.378	
					(-0.987)	
N	1470		1470		1470	
Adjusted R^2	0.975		0.977		0.973	

Note: a – cumulative probability that two inhabitants of the country pair can communicate in English, French or German (reflecting knowledge of two or all three languages). Country-specific time dummies are not reported. *t*-statistics are in parentheses. ***, **, and * denote significance at 1 per cent, 5 per cent, and 10 per cent, respectively.

Table 5: Trade effects of Foreign Languages, Non-Linear Specification, NMS and Associated Countries (including Turkey)

Variable	(1)		(2)		(3)	
Intercept	19.176	***	17.181	***	19.277	***
	(10.296)		(8.290)		(9.538)	
GDP	0.701	***	0.765	***	0.688	***
	(7.533)		(8.308)		(7.249)	
Distance	-0.994	***	-0.809	***	-0.988	***
	(6.106)		(4.183)		(-5.829)	
Former Federation	2.330	***	1.367	***	2.327	***
	(11.790)		(12.693)		(11.715)	
Contiguity	0.542	***	0.643	***	0.549	***
	(4.98)		(5.375)		(5.022)	
Proficiency						
English	-0.861		3.002			
	(0.192)		(0.670)			
German			6.571			
			(0.380)			
Russian			1.632	*		
			(1.800)			
Cumulative[a]					-1.664	
					(-0.350)	
Proficiency (Quadratic)						
English	13.504		5.293			
	(1.542)		(0.595)			
German			143.128			
			(0.456)			
Russian			3.833	***		
			(2.781)			
Cumulative[a]					14.996	
					(1.625)	
N	1254		1254		1254	
Adjusted R^2	0.850		0.857		0.850	

Note: See Table 4.

Table 6: Trade effects of Foreign Languages, Non-Linear Specification, EU29

Variable	(1)		(2)		(3)	
Intercept	19.264	***	19.308	***	19.199	***
	(31.470)		(30.226)		(31.100)	
GDP	0.857	***	0.855	***	0.851	***
	(33.600)		(31.383)		(35.040)	
Distance	-1.078	***	-1.081	***	-1.076	***
	(-17.865)		(-16.407)		(-17.480)	
Former Federation	2.340	***	1.936	***	2.346	***
	(22.805)		(22.225)		(22.714)	
Contiguity	0.289	***	0.297	***	0.280	***
	(4.465)		(4.602)		(4.395)	
EU	0.117	*	0.111	*	0.129	**
	(1.999)		(1.680)		(2.249)	
Official languages						
English	0.749	***	0.761	***	0.893	***
	(3.124)		(3.092)		(4.026)	
German	0.614	***	1.289	***	0.653	***
	(6.687)		(3.909)		(3.855)	
French	0.124		0.308		0.048	
	(0.669)		(0.533)		(0.222)	
Swedish	0.047		0.034		0.037	
	(0.571)		(0.395)		(0.452)	
Dutch	-0.693		-0.687		-0.702	***
	(-7.299)		(-6.575)		(-7.547)	
Greek	2.063	***	2.049	***	2.065	***
	(10.661)		(10.459)		(10.696)	
Proficiency						
English	0.527		0.535			
	(0.814)		(0.802)			
French			-0.672			
			(-0.660)			
German			0.317			
			(0.430)			
Russian			1.076			
			(1.221)			
Cumulative[a]					0.965	*
					(1.683)	
Proficiency (Quadratic)						
English	-0.144		-0.216			
	(-0.226)		(-0.320)			
French			0.434			
			(0.407)			
German			-1.144			
			(-1.103)			
Russian			0.419			
			(0.320)			
Cumulative[a]					-0.831	
					(-1.535)	
N	2411		2411		2411	
Adjusted R^2	0.933		0.933		0.933	

Note: See Table 4.

5 Sensitivity Analysis – Quantile Regression

The previous results may be sensitive to outliers. For example, there may be pairs of countries that have particularly high bilateral trade and relatively high communicative probability in English or another language so that the estimated gain from foreign languages is overestimated. Or, on the contrary, we may have pairs of countries with relatively low bilateral trade despite high communicative probability, resulting in underestimated effect of languages. We analyze these factors in this section by means of median and quantile regression. The median regression is frequently used when standard OLS regression may be biased by outliers. While the least squares regression estimates the sum of the squared residuals, which gives much weight to outliers, the median regression finds the regression line that equates the number of positive and negative residuals. This property makes the median regression more robust to influential observations. Koenker and Bassett (1978) generalized this concept to quantile regression, in which selected quantiles of the conditional distribution of the dependent variable are expressed as functions of observed explanatory variables. Koenker and Hallock (2000) argue that inference in quantile regression is more robust than in ordinary regression. While this concept is now frequently used in economics, especially in labor and family economics (see literature survey by Koenkeer and Hallock, 2001), it has found little application in trade analysis so far (see Wagner, 2006).

For simplicity, we use a parsimonious version of our gravity model for EU15, which is specified only with linear communicative probability in English as well as a dummy for English official language. We thus estimate the following linear model for the τ^{th} conditional quantile, Q, of bilateral trade volume, T,

$$Q_{\tau}\left(T_{ijt}\right) = \alpha_{\tau} + \theta_{\pi t} + \beta_{\tau 1}\left(Y_{it} + Y_{jt}\right) + \beta_{\tau 2} D_{ij} + \beta_{\tau 3} B_{ij} + \delta_{\tau} L_{eng,ij} + \delta_{\tau} P_{eng,ij} + \varepsilon_{ijt} . \qquad (3)$$

Table 7 reports the results for the 10^{th}, 25^{th}, 75^{th} and 90^{th} percentiles in addition to the median regression. The standard errors are simulated in a bootstrap procedure with 1000 repetitions. We can see that the effects of all gravity variables differ significantly between the individual percentiles. The income elasticity declines as bilateral trade increases. In turn, the transport (distance) elasticity increases slightly in absolute terms with trade volume, while the effect of contiguity tends rather to decrease with trade

volume. The test of equal coefficients for the first to third quartiles (see the last column) clearly rejects the null at the standard significance levels for all explanatory variables.

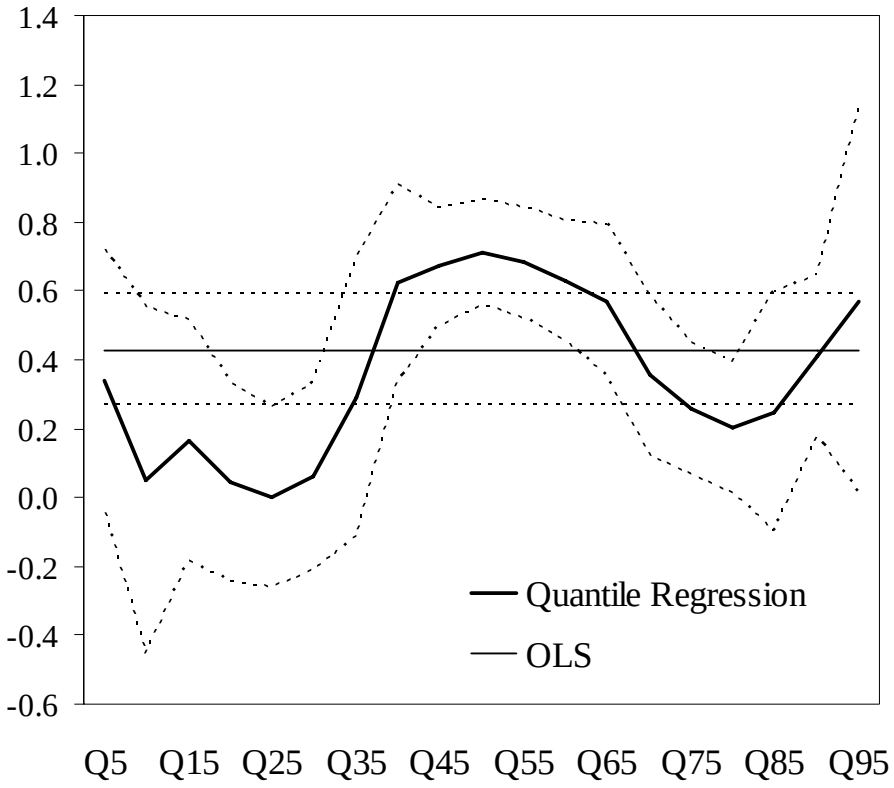
The effects of proficiency in English show an interesting non-monotonic behavior. We find that the effect is the highest in the median regression. This confirms that our previous findings are not due to outliers. There is also slight asymmetry in the coefficients showing that trade gains are higher for countries with higher trade intensity (compare the 25th and 75th percentile). The estimated coefficients are also significant only for the second and third quartiles and the tenth percentile. More detailed analysis in Figure 5 conducted for each fifth percentile confirms this pattern. Figure 5 shows that increasing language proficiency has significant effects at the very beginning of the scale. However, the effects are more or less negligible then. Only after the median is achieved, the effects of improved language proficiency increase again.

Table 7: Trade Effects of Proficiency in English, Quantile Regression, EU Trade

	OLS	**Q10**	**Q25**	**Q50**	**Q75**	**Q90**	**Test[a]**
Income	0.899***	0.966***	0.916***	0.881***	0.883***	0.809***	6.15
	(99.889)	(53.667)	(83.273)	(97.889)	(67.923)	(62.231)	[0.002]
Distance	-0.798***	-0.727***	-0.881***	-0.766***	-0.921***	-0.758***	10.46
	(-26.600)	(-9.088)	(-14.932)	(-34.818)	(-19.596)	(-14.037)	[0.000]
Contiguity	0.707***	0.632***	0.494***	0.780***	0.654***	0.551***	10.72
	(14.729)	(5.180)	(8.982)	(13.684)	(7.880)	(6.122)	[0.000]
Official lang.	0.205*	0.756***	0.567***	-0.063	0.226*	-0.006	4.22
(English)	(1.783)	(3.073)	(2.793)	(-0.257)	(1.687)	(-0.041)	[0.015]
Proficiency	0.430***	0.051	0.002	0.709***	0.257***	0.412***	27.72
(English)	(5.181)	(0.199)	(0.015)	(9.090)	(2.622)	(3.433)	[0.000]
Intercept	16.465***	14.668***	16.640***	16.379***	17.903***	17.996***	9.39
	(67.757)	(27.113)	(33.481)	(79.126)	(40.689)	(47.989)	[0.000]
N	1470	1470	1470	1470	1470	1470	
Pseudo R^2	0.913	0.7241	0.7301	0.7148	0.7028	0.6821	

Note: Time dummies are not reported. *t*-statistics (in parentheses) are computed using bootstrap standard errors with 1000 replications. ***, **, and * denote significance at 1 per cent, 5 per cent, and 10 per cent, respectively. a – Test of equal coefficients for the first to third quartiles. *p*-values in brackets.

Figure 5: OLS and Quantile Regression Estimates for Proficiency in English



Note: For quantile regression estimates, the 95% confidence bands are computes on the base of bootstrap standard errors with 1000 replications. Heteroscedasticity robust standard errors are used for the OLS estimates.

6 Conclusions

We find that languages have strong effects on trade. Besides confirming that countries that share the same official language tends to trade significantly more with each other, we are, to the best of our knowledge, the first to also consider the effect of foreign languages (i.e. languages that people do not speak because they are native speakers but because they have learned them). English plays a particularly important role: it is the most widely spoken foreign language and, unlike the other languages, its effect appears robust to alternative regression specifications (and, importantly, to inclusion of other languages in the analysis). Our results thus illustrate the predominance of English as, effectively, the lingua franca in Europe. While individuals may derive private benefits

from learning marginal languages, countries only benefit inasmuch as the same language is learned also by other individuals in other countries. English, at present, is the only language spoken by enough people to have an economically significant effect on trade flows. Nevertheless, our findings also suggest that the effect of English and other languages on trade flows may be non-linear, displaying diminishing returns: the return is particularly high for countries with relatively low level of proficiency in English (and other languages).

Nevertheless, the gains from foreign languages are not uniform across countries: our analysis suggests that the effect is different in the EU15 compared to the new member states and candidate countries. This heterogeneity is likely due to the different history of integration and different economic, political and linguistic legacies in the two sets of countries. Further research will show to what extent we can find evidence of convergence or divergence in the effect of languages.

In the past decade or two, trade has become a powerful argument in favor of deepening European integration, including introducing the common currency, the euro. Our findings suggest that gains of similar magnitude could be realized by improving linguistic skills, especially in English. Crucially, while adopting a common currency is costly because a country must give up its national currency and autonomy over monetary policy, improving linguistic skills in English does not require abandoning national languages. Substantial gains are available at relatively little cost: encouraging the learning of English could well, metaphorically, allow countries to pick up $100 bills lying on the sidewalk.

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