Title: The effect of the internet on the margins of trade

Abstract

This paper investigates the effect of internet use on the extensive and intensive margins of trade, and assesses whether the internet bridges the cultural gap in trade. We find that an increase in internet users increases the extensive margin, and decreases the intensive margin. Splitting our sample into development levels, we find that increased internet use in lower-income countries facilitates trade displacement along the extensive margin. Lastly, an increase in the number of internet users decreases the effect of linguistic and religious distance on total exports and the extensive margin.

Key words

Internet, gravity model, international trade, margins of trade, linguistic distance, religious distance

JEL categories: F14; F19.

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1. Introduction

Researchers have shown considerable interest in the effects of the internet on different aspects of the economy such as economic growth, inflation, productivity, and trade (Choi, 2003; 2010). Development and increased use of the internet generally has a positive and significant effect on trade. A 10 per cent increase in the number of internet users in a country leads to a 2 per cent increase in FDI (Choi, 2003), while it results in a 0.2 to 0.4 per cent growth in exports (Freund & Weinhold, 2004; Bojnec & Ferto, 2009; Choi, 2010). Clarke and Wallsten (2006) add that an increase in internet development significantly increases developing countries' exports only to developed countries.

These studies are based on Freund and Weinhold's (2004) model in which the internet reduces the fixed costs of entry into a market by the reduction of search costs. Building on this model, Fink et al. (2005) show that communication affects fixed and variable costs of trade due to suppliers and consumers exchanging information after fixed costs are incurred. Lawless (2010) translates this into a heterogeneous firm productivity model wherein fixed and variable trade costs negatively affect the extensive margin and ambiguously affect the intensive margin. She finds that an increase in the number of internet users has a positive effect on the extensive margin, and a negative effect on the intensive margin. Here, lowering trade costs increases the sales of continuing exporters and introduces new marginal exporters with lower average sales.

Trade costs arise from differences in informal constraints such as socially shared rules, and in differences in formal constraints such as official rules and procedures (North, 1990). Trade costs thus stem in part from informal constraints relating to culture (North, 1990). As such, cultural differences are a source of communication costs and for this reason many international trade studies feature aspects of language (e.g. Melitz & Toubal, 2014; Egger & Lassmann, 2015), religion (e.g. Lewer & van den Berg, 2007), and broader indicators of shared cultural values such as Hofstede's (1980) dimensions of culture (e.g. Lankhuizen et al., 2011). The internet being a communication tool, it can be expected that it can alleviate communication barriers imposed by such cultural differences.

As outcomes of fixed and variable costs of trade[1], the extensive and intensive margins form the link between trade costs and the extent to which the internet fosters new trade rather than more trade in existing relationships. Within this context, research into how the internet increases trade along the extensive and intensive margins consists only of Lawless' (2010) cross-sectional study. Moreover, the margins of trade may clarify the source of trade displacement that Clarke and Wallsten (2006) speak of. Furthermore, while Freund and Weinhold (2004) and Bojnec and Ferto (2009) investigate the role of the internet with respect to the effect of distance on trade, an assessment of its effect on the costs of communication arising from cultural barriers remains absent. Using panel data, this study contributes

[1] Where the negative relationship between the extensive margin and fixed and variable trade costs is unambiguous in the Melitz (2003) model while this is not the case for the intensive margin (Dutt et al, 2013; Lawless, 2010)

to the existing literature by investigating the extent to which the trade increase from internet usage comes about from an increase in the extensive and intensive margins, and looking at whether internet use alleviates the negative effects of communication costs caused by cultural differences.

This paper is divided into four sections. In Section 2 we present our estimation methodology and data. Section 3 presents and discusses our results, and Section 4 concludes.

2. Methodology and data

To assess the effect of internet use on the margins of trade, we specify the following estimation model:

$$(1)\ \ln(X_{ij,k}) = \beta_0 + \beta_1 \ln(AvgInternet_{ij,t}) + \beta_2 LangDist_{ij,t} + \beta_3 RelDist_{ij,t} + \beta_4 \ln(GDP_{i,t} * GDP_{j,t}) + \beta_5 \ln(Dist_{ij,t}) + \boldsymbol{\beta_Z \cdot Z} + u_i + u_j + u_t + \varepsilon_{ij,t}$$

Here, i denotes the trade flow's origin country, j is its destination, and t is the subscript for time. The subscript k in our trade variable $X_{ij,k}$ differentiates between three trade flows: unidirectional total exports, the extensive margin, and the intensive margin. To construct these variables we use the UN Comtrade database. The data we use is 4-digit level SITC exports data comprising 786 product codes. Based on commonly used definitions (e.g. Dennis & Shepherd, 2011; Dutt et al, 2013) the extensive margin is a count of the number of product exported, and the intensive margin is the average value of exports per product.

With regard to our control variables, $AvgInternet_{ij,t}$ is the average number of internet users per 100 people between two countries, the data for which comes from the World Bank's World Development Index. To denote informal institutional differences between countries, we use two variables. First, $LangDist_{ij,t}$ is a measure of linguistic distance between two countries. To construct this variable we invert the aggregate common language variable from Melitz and Toubal (2014). Second, we invert Melitz and Toubal's (2014) religious proximity variable to create our measure of religious distance $RelDist_{ij,t}$[2]. The data for GDP and population-weighted distance $Dist_{ij,t}$ come from the CEPII database. This also applies to **Z**, which is a vector of dummy variables for contiguity, colonial relations, common coloniser, FTA membership, and common legal origin. This CEPII data is available until 2006; we extend and, where necessary, update the variables for 2007 and beyond.

Finally, the u-terms are fixed effects for exporter, importer, and year, which account for multilateral resistance terms (Anderson & van Wincoop, 2004) as well as cross-sectional and time-series correlation[3].

[2] The advantage of both of these variables over the use of more commonly used dummy variables lies in their continuous nature and in their specificity of measurement. We use these two variables to denote cultural distance and in doing so, we forego the use of broad cultural variables such as those developed by Hofstede (1980). Our motivation for this is that such broad indicators for culture are accompanied by conceptual and methodological criticism (e.g. McSweeney, 2002; Tung & Verbeke, 2010). Moreover, there is extensive empirical evidence regarding the role of linguistic and religious aspects in trade.

[3] We utilised time-varying country fixed effects as well and the results are highly similar.

With these three datasets we have information from 1998 to 2014 for 157 exporters and 171 importers. Table 1 displays the summary statistics.

Table 1
Summary statistics

	Obs	Mean	Std. Dev.	Min	Max
Total Exports	285890	5.82E+08	5.40E+09	0	3.97E+11
Total Exports (log)	240,983	15.555	3.714	0	26.707
Extensive Margin	285,890	99.254	158.435	0	763.000
Extensive Margin (log)	240,271	3.427	1.934	0	6.637
Intensive Margin	285,890	2.90E+06	11.50E+07	0	2.49E+10
Intensive Margin (log)	240,271	12.077	2.272	0	23.939
Internet use	285,890	28.791	21.418	0	97.230
Internet use (log)	285,890	2.869	1.275	-5.714	4.577
Linguistic Distance	285,890	0.859	0.174	0	1
Religious Distance	285,890	0.835	0.224	0	1
Geographic Distance (Log)	285,890	8.622	0.822	4.546	9.886
GDP (log)	273,371	21.580	3.019	9.563	32.767
Contiguity	285,890	0.024	0.152	0	1
Colony	285,890	0.019	0.136	0	1
Common Coloniser	285,890	0.090	0.286	0	1
Trade Agreement	285,890	0.114	0.318	0	1
Common Legal Origin	285,890	0.319	0.466	0	1

Equation (1) is shown in log-linear form and our main specification is thus based on OLS. In our dataset, zero trade flows comprise around 15 per cent of total trade flows and it is likely that these zero trade flows are the result of economically meaningful selection rather than them being too small to report (Anderson, 2010). We estimate equation (1) using Poisson Pseudo Maximum Likelihood (PPML) to allow for their incorporation into our estimation (Santos Silva & Tenreyro, 2006).

While our main results assess equation (1) for our entire dataset, later we extend our analysis to look at the potential heterogeneity that exists in trade among and between developing and developed countries. As such, where equation (1) will shed light on the effect of internet use on the extensive and intensive margins of trade and adds to Lawless' (2010) findings, the division into development levels will shed light on the trade displacement effect to which Clarke and Wallsten (2006) allude. To examine whether internet use decreases barriers of informal institutional differences, we follow Freund and Weinhold (2004) in specifying a dummy variable for 'high distance' and interacting it with our internet use variable, where this interaction term is added to equation (1). We do so for linguistic and religious differences separately, where 'high distance' is unity if the distance between two countries exceeds the average distance between all countries. In addition, we look at the continuous form of our linguistic and religious difference variables which allows for an assessment of the marginal effects of these distance variables on trade, conditional on our internet use variable.

3. Results

3.1. Main results

Table 2 shows the results for equation (1) for total exports in column (1), the extensive margin in column (2), and the intensive margin in column (3). Columns (4), (5) and (6) show the same for PPML. Our models fit the data well with the R-squared ranging from 0.556 to 0.9.

Our OLS specification shows that the average number of internet users across two countries is insignificant for total exports, positive and significant at the 1 per cent level with a coefficient of 0.051 for the extensive margin, and negative and significant at the 1 per cent level for the intensive margin with a coefficient of -0.049. This suggests that a 10 per cent increase in the number of internet users across two countries results in a 0.52 per cent increase in export diversification, and a 0.48 per cent decrease in average exports per product. These results confirm Lawless' (2010) cross-sectional findings, although in our panel data setting the magnitude of the effect is six times smaller for the extensive margin, and three times smaller for the intensive margin. In particular, the results indicate that increased internet use lowers trade costs such that it promotes an increase in exports of goods not previously traded. At the same time, this introduces new marginal exporters whose exports are relatively low resulting in a lower average volume of goods traded overall upon their entry into new markets.

Utilising a PPML specification alters the results found above. In column (4), the effect of the number of internet users on total exports is now significant at the 1 per cent level with a coefficient of 0.129, suggesting that a 10 per cent increase in the number of internet users increases total exports by 1.38 per cent. Moreover, column (5) indicates that the coefficient for the number of internet users on the extensive margin is now 0.084, suggesting an increase along that margin of 0.88 per cent with a 10 per cent increase in the number of internet users. In column (6), the effect on the intensive margin has become insignificant. Thus, the inclusion of zero trade flows, which arise from fixed costs of entry (Anderson, 2010), magnifies the role of the internet as an alleviator of these fixed costs as represented by the increase of the extensive margin relative to column (2). This aligns with Freund and Weinhold's (2004) model and further specifies the results from the OLS specification above and from Lawless (2010).

The behaviour and signs of our control variables in the OLS and PPML specifications are as expected (see e.g. Santos Silva et al., 2014). We draw attention to the religious distance variable, which is insignificant in our OLS specification in column (3) and positive and significant in our PPML specification in column (6), suggesting that an increase in religious distance increases the intensive margin of trade. A closer inspection of our data indicates that this is a result of country pairs in the highest regions of our intensive margin variable. As a robustness check, we exclude these top 2 per cent of observations and present the results in Table A1 in the Appendix. In this robustness check, religious distance becomes negative and significant for the intensive margin in the OLS specification (Table A1, column 3) where it was previously insignificant in its counterpart in Table 2, column (3). More

importantly, religious distance becomes negative and significant in the PPML estimation (Table A1, column 6) where it was previously positive and significant in Table 2, column (6). Lastly, in this robustness check, the effect of internet use on the intensive margin becomes negative and significant in the PPML specification (Table A1, column 6) where it was previously insignificant in Table 2, column (6). As such, this result strengthens our OLS results in Table 2 and highlights that outliers only have a major effect on religious distance, whereas the effect of outliers on internet use is in line with our main results.

Table 2
Main results

	OLS			PPML		
	(1)	(2)	(3)	(4)	(5)	(6)
	(Log of) Total Exports	(Log of) Extensive Margin	(Log of) Intensive Margin	Total Exports	Extensive Margin	Intensive Margin
Internet use (log)	-0.004	0.051***	-0.049***	0.129***	0.084***	-0.101
	(0.016)	(0.009)	(0.012)	(0.039)	(0.011)	(0.223)
Linguistic Distance	-1.371***	-1.024***	-0.338***	-0.285*	-0.599***	-1.816***
	(0.089)	(0.054)	(0.064)	(0.156)	(0.062)	(0.245)
Religious Distance	-0.303***	-0.259***	-0.040	-0.080	-0.138***	1.018***
	(0.059)	(0.032)	(0.043)	(0.104)	(0.037)	(0.216)
Geographic Distance (Log)	-1.595***	-0.938***	-0.630***	-0.725***	-0.537***	0.015
	(0.023)	(0.014)	(0.016)	(0.040)	(0.018)	(0.080)
GDP (log)	0.627***	0.179***	0.452***	0.590***	0.084***	0.549**
	(0.019)	(0.009)	(0.016)	(0.030)	(0.008)	(0.254)
Contiguity	0.504***	0.111	0.405***	0.401***	-0.198***	1.057***
	(0.097)	(0.074)	(0.053)	(0.064)	(0.053)	(0.136)
Colony	0.950***	0.589***	0.384***	0.112	0.378***	0.791***
	(0.086)	(0.064)	(0.053)	(0.089)	(0.049)	(0.142)
Common Coloniser	0.752***	0.550***	0.218***	0.341**	0.376***	0.048
	(0.055)	(0.029)	(0.040)	(0.144)	(0.036)	(0.274)
Trade Agreement	0.512***	0.132***	0.400***	0.611***	0.137***	1.329***
	(0.041)	(0.024)	(0.029)	(0.073)	(0.025)	(0.164)
Common Legal Origin	0.291***	0.169***	0.121***	0.161***	0.148***	-0.237*
	(0.028)	(0.015)	(0.020)	(0.048)	(0.018)	(0.133)
Observations	231,564	230,881	230,881	272,279	272,279	272,279
R-squared	0.756	0.785	0.556	0.900	0.710	0.538

Notes:
Robust standard errors (clustered on country pair) in parentheses.
Intercepts and fixed effects for origin, destination, and year omitted for brevity.
*** p<0.01, ** p<0.05, * p<0.1.

3.2. Accounting for development levels

Because the internet may have heterogeneous effects on countries with different development levels, we estimate equation (1) for four subsamples: among lower-income countries, among higher-income countries, and between lower- and higher-income countries (in both directions).

Table 3 presents the results for the effect of internet use on total exports, the extensive margin, and the intensive margin for our OLS and PPML specifications. This is an aggregate table, wherein each row contains only our variable of interest from one of four subsamples. In row (a) we investigate the effect of internet use on exports from low-income to other low-income countries. Row (b) contains results for the subsample where low-income countries export to high-income countries. Rows (c) and (d) contain results for exports from high-income countries to low-income and high-income countries, respectively. In these specifications our threshold for transitioning from low-income to high-income countries is a

static US$10,000 per capita. The results in Table 3 do not change when applying a dynamic threshold, nor do they change when adopting the differentiation between high- and low-income countries used by the World Bank.

The results for the subsample in row (a) suggest that increased internet use decreases the extensive margin of exports (column 2) from low-income to other low-income countries, and increases the intensive margin (column 3). When accounting for zero trade flows, the effect on the intensive margin becomes insignificant in column (6) and the effect on the extensive margin in column (5) remains negative and significant, but less so than in column (2). Looking at the effect of internet use on exports from low-income to high-income countries the extensive margin is strongly significant and positive in column (5). Combined with row (a), this suggests that an increase in the number of internet users in low-income countries allows exporters to make the switch from exporting in low-income countries to exporting in high-income countries.

In row (c), columns (2) and (5), a similar pattern emerges for high-income countries. The extensive margin for exports to low-income countries decreases with an increase in the number of internet users. As internet access increases, high-income countries prefer to trade with other high-income countries due to higher information availability. However, the effect of internet use on exports from high-income to other high-income countries in row (d) is always insignificant. This suggests that exports from high-income to other high-income countries are not affected by an increase in the number of internet users, which is due to information already being available to such an extent that a marginal increase in the number of internet users makes no difference[4].

Table 3
Effect of internet use on trade by development level

		OLS			PPML		
		(1) (Log of) Total Exports	(2) (Log of) Extensive Margin	(3) (Log of) Intensive Margin	(4) Total Exports	(5) Extensive Margin	(6) Intensive Margin
(a)	Internet use (log)	-0.019	-0.065***	0.057***	-0.135***	-0.041**	-0.177
	(Low-income to low-income)	(0.027)	(0.014)	(0.021)	(0.047)	(0.017)	(0.140)
(b)	Internet use (log)	0.067	0.030	0.046	0.120	0.097***	0.115
	(Low-income to high-income)	(0.056)	(0.025)	(0.049)	(0.092)	(0.019)	(0.548)
(c)	Internet use (log)	-0.141***	-0.099***	-0.021	-0.082	-0.086***	-0.596
	(High-income to low-income)	(0.038)	(0.019)	(0.031)	(0.074)	(0.015)	(0.570)
(d)	Internet use (log)	0.013	0.003	0.018	0.083	-0.003	0.435
	(High-income to high-income)	(0.091)	(0.046)	(0.073)	(0.075)	(0.022)	(0.383)

Notes:
Robust standard errors (clustered on country pair) in parentheses.
*** p<0.01, ** p<0.05, * p<0.1.
Estimations based on equation (1) for different levels of development. Rows (a) to (d) contain results for equation (1) and row-column intersects are coefficients for the variable of interest from individual regressions that include our control variables as before, as well as fixed effects for origin, destination, and year. The control variables and fixed effects are omitted for brevity.

[4] The results in Table 3 are robust to our earlier robustness check in which we remove the top 2 per cent of country pairs in terms of trade. Results are not reported in the interest of brevity, they are available upon request.

3.3. Internet use and the marginal effects of linguistic and religious distance

We assess whether internet use reduces the effect of linguistic and religious distance on trade in two ways. First, we add a dummy variable that denotes whether linguistic or religious distance between two countries is above the average for all countries and interact it with our internet use variable, adding this to equation (1). Second, we add the interaction between our internet use variable and the continuous linguistic and religious distance variables, which allows for an assessment of their marginal effects conditioned by the number of internet users.

Table 4 presents our results for the interaction between our internet use variable and the dummy variable for high linguistic and religious distance in columns (1) to (3) for total exports, the extensive margin, and the intensive margin. The effect of the interaction between internet use and linguistic distance is positive and significant for the extensive margin, and negative and significant for the intensive margin, suggesting that an increase in the number of internet users decreases the negative effect of high linguistic distance on the extensive margin, and increases the negative effect of high linguistic distance on the intensive margin. The interaction between internet use and the dummy variable for high religious distance indicates that an increase in the number of internet users decreases the negative effect of high religious distance on total exports and on the extensive margin, but does not significantly affect the effect of high religious distance on the intensive margin.

Table 4
Interaction of internet users and linguistic and religious distance

	(1) (Log of) Total Exports	(2) (Log of) Extensive Margin	(3) (Log of) Intensive Margin	(4) (Log of) Total Exports	(5) (Log of) Extensive Margin	(6) (Log of) Intensive Margin
Internet use (log)	-0.036*	-0.010	-0.018	-0.297***	-0.317***	0.031
	(0.019)	(0.010)	(0.014)	(0.038)	(0.025)	(0.026)
Linguistic Distance	-1.413***	-1.116***	-0.281***	-2.150***	-2.024***	-0.112
	(0.095)	(0.057)	(0.068)	(0.150)	(0.093)	(0.110)
Internet use (log) * High Linguistic Distance	0.012	0.026***	-0.016**			
	(0.010)	(0.005)	(0.007)			
Internet use (log) * Linguistic Distance				0.264***	0.339***	-0.077**
				(0.042)	(0.028)	(0.030)
Religious Distance	-0.469***	-0.540***	0.084	-0.480***	-0.456***	-0.009
	(0.079)	(0.045)	(0.058)	(0.107)	(0.056)	(0.082)
Internet (log) * High Religious Distance	0.034***	0.057***	-0.025***			
	(0.011)	(0.007)	(0.008)			
Internet (log) * Religious Distance				0.066**	0.073***	-0.012
				(0.031)	(0.017)	(0.023)
Geographic Distance (Log)	-1.597***	-0.942***	-0.628***	-1.590***	-0.932***	-0.631***
	(0.023)	(0.014)	(0.016)	(0.023)	(0.014)	(0.016)
GDP (log)	0.622***	0.171***	0.456***	0.615***	0.165***	0.455***
	(0.019)	(0.009)	(0.016)	(0.019)	(0.009)	(0.016)
Contiguity	0.497***	0.100	0.410***	0.494***	0.100	0.407***
	(0.097)	(0.073)	(0.053)	(0.096)	(0.072)	(0.053)
Colony	0.963***	0.611***	0.374***	0.971***	0.614***	0.379***
	(0.086)	(0.063)	(0.053)	(0.086)	(0.063)	(0.053)
Common Coloniser	0.754***	0.554***	0.215***	0.738***	0.532***	0.222***
	(0.055)	(0.029)	(0.040)	(0.055)	(0.029)	(0.040)
Trade Agreement	0.510***	0.129***	0.402***	0.518***	0.140***	0.398***
	(0.041)	(0.023)	(0.029)	(0.041)	(0.023)	(0.029)
Common Legal Origin	0.291***	0.168***	0.122***	0.292***	0.170***	0.121***
	(0.028)	(0.015)	(0.020)	(0.028)	(0.015)	(0.020)
Observations	231,564	230,881	230,881	231,564	230,881	230,881
R-squared	0.756	0.786	0.556	0.756	0.787	0.556

Notes:

Columns (1) to (3) add the interaction between internet users and a dummy variable for high linguistic distance to equation (1). Columns (4) to (6) interact our internet use variable with our continuous linguistic distance variable.
Robust standard errors (clustered on country pair) in parentheses.
Intercepts and fixed effects for origin, destination, and year omitted for brevity.
*** p<0.01, ** p<0.05, * p<0.1.

To investigate these results further, columns (4) to (6) include the interactions between our internet use variable and the continuous variables for linguistic and religious distance, which follow the same pattern as in columns (1) to (3). To fully understand these coefficients we include graphs of the marginal effects of linguistic and religious distance on total exports, the extensive margin, and the intensive margin in Figures 1, 2, and 3. Each of these figures juxtapose the marginal effects of linguistic and religious distance in two graphs, and each graph includes a horizontal line at zero and the 95 per cent confidence intervals.

Both Figure 1 and 2 underline results we found earlier in that an increase in the number of internet users decreases the negative effect of linguistic and religious distance on total exports and the extensive margin. With regards to total exports, as the number of internet users increases, the negative effect of religious distance on trade diminishes, and the same goes for the effect of linguistic distance on the extensive margin. As for the intensive margin, the marginal effect of religious distance is always insignificant, while the marginal effect of linguistic distance increases as the number of internet users does[5].

These results mean that an increase in the number of internet users works to affect fixed costs caused by communication barriers in such a way that an increase in the number of internet users strongly reduces these barriers to allow for more diversified exports. Meanwhile, the new exporters export relatively low volumes such that the overall average of export volume per good traded decreases. While the internet alleviates communication barriers for the extensive margin, it increases the effects of linguistic barriers on the intensive margin. One possible explanation is that more internet access makes it easier to export to linguistically proximate countries, which are often neighbouring countries as well. This explanation finds support in Table 3, row (a), where increased internet use in lower-income countries increases the intensive margin of their exports to other lower-income countries.

[5] The results in Table 4 and Figures 1, 2 and 3 are robust to our earlier robustness check in which we remove the top 2 per cent of country pairs in terms of trade. Results are not reported in the interest of brevity, they are available upon request.

Figure 1
Marginal effect of linguistic and religious distance on total exports (95% confidence interval)

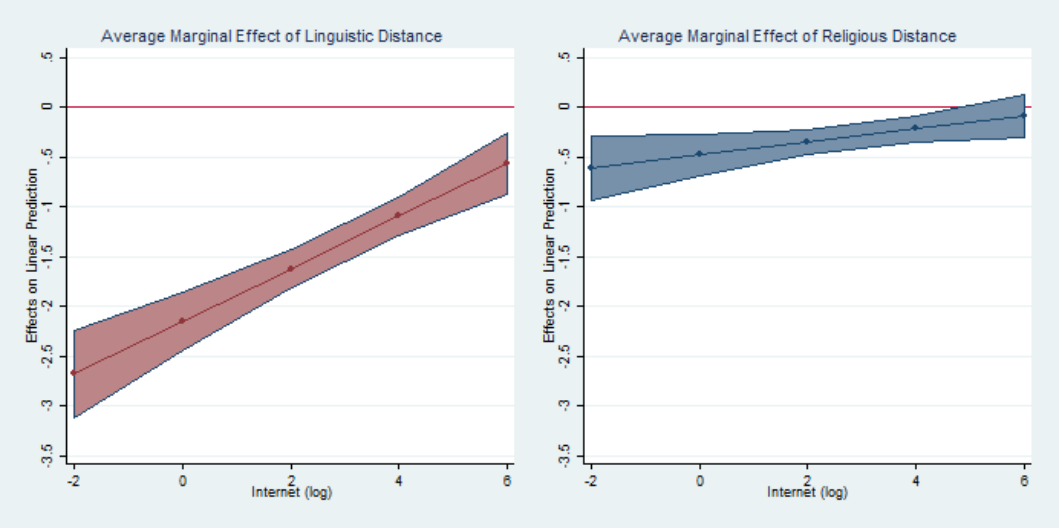


Figure 2
Marginal effect of linguistic and religious distance on the extensive margin (95% confidence interval)

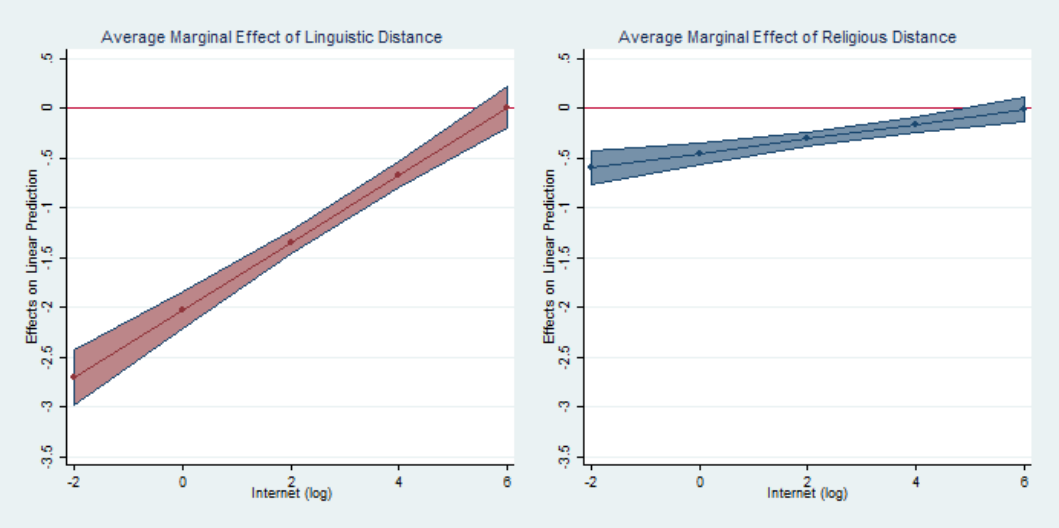
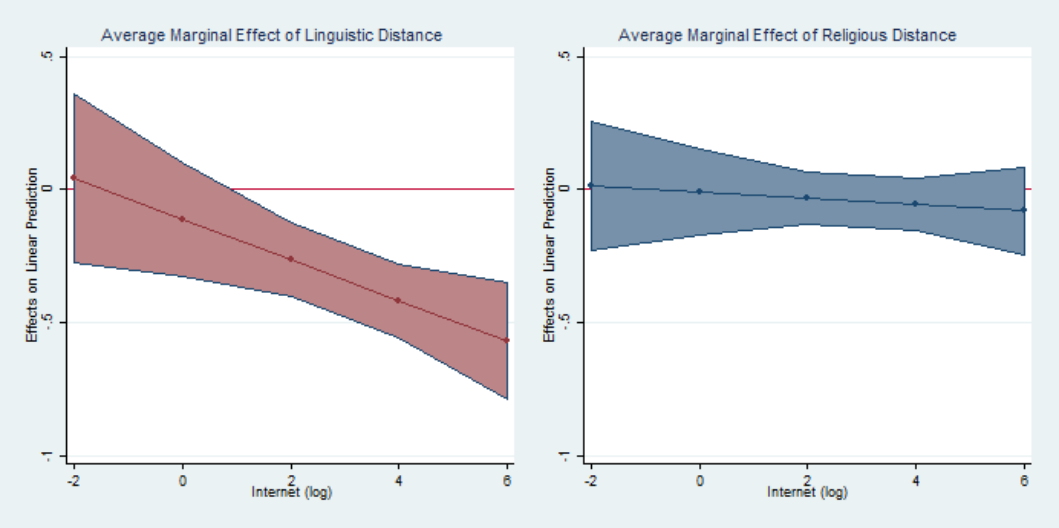


Figure 3
Marginal effect of linguistic and religious distance on the intensive margin (95% confidence interval)



4. Conclusion

We use panel data for 157 countries exporting to 171 destination from 1998 to 2014 to investigate the effect of internet use on the margins of trade, and to assess whether internet use bridges the cultural gap in trade. Using OLS and PPML with country and time fixed effects, we find that an increase in internet users stimulates export diversification, and decreases the average sales per good exported. Splitting our sample into development levels, we find that an increase in the number of internet users is especially beneficial to lower-income countries' exports to higher-income countries. More specifically, we find that increased internet use allows exporters from lower-income countries to make the switch from exporting in other lower-income countries to higher-income countries due to increased access to information. These results support Lawless' (2010) model of how communication costs affect the fixed costs of trade, and they specify the results in Clarke and Wallsten (2006) to identify the way in which trade displacement between lower and higher-income countries takes place along the extensive margin of trade. Moreover, we show that an increase in the number of internet users decreases the effect of linguistic and religious distance on total exports and on the extensive margin. While Freund and Weinhold (2004) find that the internet does not reduce geographical distance, our results differ in that we assess the internet as a communication tool to find that it alleviates fixed costs of trade that arise from barriers of communication.

Our results suggest that an investment in internet infrastructure has larger marginal benefits for lower-income countries than for higher-income countries and thus indicates a course of action that lower-income countries' policymakers may undertake to increase the competitiveness of their exporters. We also highlight how the internet bridges the cultural divide in trade and demonstrate that an increase in the number of internet users especially benefits exports from lower-income countries to higher-income countries. Moreover, increased internet use stimulates exports between culturally distant countries by lowering the fixed costs of entry that stem from communication barriers for exporters who may otherwise not have established export channels.

5. References

Anderson, J. E. (2010). The gravity model, National Bureau of Economic Research.

Anderson, J. E. and E. Van Wincoop (2004). Trade costs, National Bureau of Economic Research.

Bojnec, Š. and I. Fertö (2009). "Impact of the Internet on manufacturing trade." Journal of Computer Information Systems **50**(1): 124-132.

Choi, C. (2003). "Does the Internet stimulate inward foreign direct investment?" Journal of Policy Modeling **25**(4): 319-326.

Choi, C. (2010). "The effect of the Internet on service trade." Economics Letters **109**(2): 102-104.

Clarke, G. R. G. and S. J. Wallsten (2006). "Has the Internet Increased Trade? Developed and Developing Country Evidence." Economic Inquiry **44**(3): 465-484.

Dennis, A. and B. Shepherd (2011). "Trade facilitation and export diversification." The World Economy **34**(1): 101-122.

Dutt, P., et al. (2013). "The effect of WTO on the extensive and the intensive margins of trade." Journal of International Economics **91**(2): 204-219.

Egger, P. H. and A. Lassmann (2015). "The causal impact of common native language on international trade: Evidence from a spatial regression discontinuity design." The Economic Journal **125**(584): 699-745.

Fink, C., et al. (2005). "Assessing the impact of communication costs on international trade." Journal of International Economics **67**(2): 428-445.

Freund, C. L. and D. Weinhold (2004). "The effect of the Internet on international trade." Journal of International Economics **62**(1): 171-189.

Hofstede, G. (1980). "Culture and organizations." International Studies of Management & Organization **10**(4): 15-41.

Lankhuizen, M., et al. (2011). "The Trade-Off between Foreign Direct Investments and Exports: The Role of Multiple Dimensions of Distance." The World Economy **34**(8): 1395-1416.

Lawless, M. (2010). "Deconstructing gravity: trade costs and extensive and intensive margins" Canadian Journal of Economics **43**(4): 1149-1172.

Lewer, J. J. and H. Van den Berg (2007). "Estimating the Institutional and Network Effects of Religious Cultures on International Trade." Kyklos **60**(2): 255-277.

McSweeney, B. (2002). "Hofstede's model of national cultural differences and their consequences: A triumph of faith-a failure of analysis." Human relations **55**(1): 89-118.

Melitz, J. and F. Toubal (2014). "Native language, spoken language, translation and trade." Journal of International Economics **93**(2): 351-363.

North, D. C. (1990). Institutions, institutional change and economic performance, Cambridge university press.

Santos Silva, J. M. C., et al. (2014). "Estimating the extensive margin of trade." Journal of International Economics **93**(1): 67-75.

Santos Silva, J. M. C. and S. Tenreyro (2006). "The Log of Gravity." Review of Economics and Statistics **88**(4): 641-658.

Tung, R. L. and A. Verbeke (2010). "Beyond Hofstede and GLOBE: Improving the quality of cross-cultural research." Journal of International Business Studies **41**(8): 1259-1274.

6. Appendix

Table A1
Main results excluding outliers

	OLS			PPML		
	(1)	(2)	(3)	(4)	(5)	(6)
	(Log of) Total Exports	(Log of) Extensive Margin	(Log of) Intensive Margin	Total Exports	Extensive Margin	Intensive Margin
Internet use (log)	-0.019	0.028***	-0.043***	0.103***	0.056***	-0.103***
	(0.016)	(0.008)	(0.012)	(0.029)	(0.010)	(0.018)
Linguistic Distance	-1.446***	-1.072***	-0.368***	-0.670***	-0.686***	-0.147*
	(0.087)	(0.050)	(0.061)	(0.103)	(0.050)	(0.076)
Religious Distance	-0.327***	-0.239***	-0.088**	0.031	-0.073**	0.049
	(0.057)	(0.031)	(0.041)	(0.060)	(0.034)	(0.051)
Geographic Distance (Log)	-1.622***	-0.975***	-0.620***	-0.949***	-0.634***	-0.399***
	(0.022)	(0.013)	(0.015)	(0.028)	(0.013)	(0.018)
GDP (log)	0.608***	0.188***	0.423***	0.518***	0.093***	0.431***
	(0.019)	(0.009)	(0.016)	(0.027)	(0.009)	(0.019)
Contiguity	0.789***	0.421***	0.382***	0.315***	-0.115***	0.237***
	(0.094)	(0.061)	(0.052)	(0.058)	(0.044)	(0.048)
Colony	0.926***	0.558***	0.393***	0.520***	0.349***	0.257***
	(0.084)	(0.058)	(0.050)	(0.060)	(0.040)	(0.046)
Common Coloniser	0.779***	0.548***	0.248***	0.447***	0.369***	0.138**
	(0.054)	(0.029)	(0.038)	(0.079)	(0.035)	(0.056)
Trade Agreement	0.523***	0.146***	0.397***	0.329***	0.088***	0.297***
	(0.041)	(0.023)	(0.027)	(0.046)	(0.021)	(0.030)
Common Legal Origin	0.292***	0.175***	0.115***	0.279***	0.172***	0.090***
	(0.027)	(0.015)	(0.019)	(0.031)	(0.015)	(0.024)
Observations	225,959	225,276	225,276	266,674	266,674	266,674
R-squared	0.750	0.795	0.533	0.739	0.754	0.514

Notes:
Robust standard errors (clustered on country pair) in parentheses.
Intercepts and fixed effects for origin, destination, and year omitted for brevity.
*** p<0.01, ** p<0.05, * p<0.1.