Asymmetric Cultural Proximity and Green eld FDI*

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Abstract

This paper investigates the role of asymmetric cultural proximity (CP) on green eld foreign direct investment (FDI) from an origin to a destination country. We build a conceptual framework that explicitly accounts for cultural attractiveness as an asymmetric dimension within a broad notion of CP. We revisit the existing origin-side theories of bilateral FDI to derive a gravity equation suited for testing the impact of (i) the attractiveness of destination's culture for citizens in the origin country, and (ii) the attractiveness of origin's culture for individuals in the destination economy. While the role of the former direction of CP is well understood in the literature, we propose new mechanisms to rationalize that of the latter. We use exports and imports of cultural goods to proxy for the two directions of asymmetric and time-dependent CP in the same empirical speci cation. The econometric analysis con rms a positive role of asymmetric CP as a determinant of Green eld FDI. Moreover, it suggests a stronger investment e ect of the origin's culture attractiveness for the destination country. Finally, it provides support for the mechanisms proposed in the theoretical discussion.

Keywords: cultural proximity; green eld FDI; cultural trade; gravity model
JEL Classi cation: F14; F21; F23; Z10

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1 Introduction

The role of foreign direct investment (FDI) in generating net gains for both origin and destination countries is well documented. The growth-enhancing potential of FDI has spurred an in-depth analysis of its determinants. One of the most robust ndings pertains to the cultural relationships between the investing and the receiving country: investment from origin to destination is relatively higher if the two countries share similar cultural traits, such as those embedded in language, religion, ethnicity or genetics (see for instance Blonigen and Piger, 2014). However, economically relevant dimensions of cultural relationships go well beyond the symmetric (and largely time-invariant) nature of proxies capturing the extent to which individuals in two countries speak the same language or share similar genetic traits (Shenkar, 2001; Felbermayr and Toubal, 2010; Tung and Verbeke, 2010). This leads to the question of whether and how asymmetric (and time-dependent) cultural variables, such as preferences for cultural systems or bilateral trust, play out as determinants of investment patterns. The literature here o ers only half of the answer. While the seminal contribution by Guiso et al. (2009) has shown that investment increases if individuals in the investing country trust the citizens of the receiving economy, the potential role of the opposite direction of trust is left unexplored. More generally, we lack a comprehensive assessment of the asymmetric dimensions in bilateral cultural relationships as determinants of FDI. Given the premise that the cultural relationship between two countries, say Kenya and the UK, features an asymmetric element such as the appreciation of each other's cultural systems, it is obvious to anyone that the way individuals in Kenya appreciate British culture might be very di erent from how much Kenyan culture is attractive for the UK. It is equally straightforward that these patterns are likely to change over time. How do these two di erent and evolving forces a ect British FDI in Kenya? Is one more relevant than the other? These are questions that motivate this paper, which represents a rst attempt to assess the e ect of cultural proximity (CP) on FDI, explicitly accounting for the asymmetric and time-dependent dimensions of CP.

To this end we rst provide a simple conceptual framework for the notion of CP. By encompassing contributions from international business scholars and economists, we present a workable de nition of CP accounting for multiple dimensions of the cultural relationship between two countries. These include symmetric sharing of common cultural traits as well as asymmetric cultural attractiveness. The latter component is allowed to vary over time. In line with Disdier et al. (2010), we use bilateral trade in cultural goods as a proxy for asymmetric and time-dependent CP. Indeed, the value of imports of cultural goods re ects the attractiveness of the exporter's culture for the importer. Moreover, bilateral cultural trade is correlated with standard, symmetric and time-invariant measures of CP, showing the capacity of this proxy to capture all dimensions of CP. We provide some suggestive evidence of the asymmetry embedded in bilateral cultural relationships with a descriptive exercise, conducted on a broad sample of countries. The perspective on cultural asymmetry embedded in cultural trade data di ers from and complements the seminal work by Guiso et al. (2009), where data on bilateral trust are analyzed on a sample of European countries. The variation in cultural relationships that can be captured with trade in cultural goods covers both developed and developing countries, an advantage with respect to other asymmetric

the de nition of cultural trade.

Our ndings shed new light on the mechanisms linking asymmetric CP and green eld investment. In particular they suggest a stronger role of the `destination-side' mechanisms. We extend the core analysis of the paper by conducting an empirical test of `destination consumers demand' and the `destination political economy' channels and nd supportive evidence. We also investigate whether and how the e ect of the asymmetric and time-dependent dimension of CP varies at di erent levels of its symmetric and time-invariant components. We nd that time-contingent positive shocks in the asymmetric component of CP increase green eld FDI only at low levels of the time-invariant, symmetric dimension of CP. This is consistent with a relationship of substitutability between (i) time-contingent, asymmetric and (ii) time-invariant, symmetric dimensions of CP in triggering FDI, with the former operating as a bridgehead between otherwise culturally distant countries.

1.1 Related literature

Our paper speaks to the growing literature that considers culture as an important determinant of economic outcomes (see among others Guiso et al., 2006; Fernández, 2008, 2011; Alesina and Giuliano, 2015). We contribute in particular to the debate on whether and how the relationship between cultures a ects exchanges and investment patterns across countries (see for instance Head and Mayer, 2014; Giuliano et al., 2014).

the symmetric and time-invariant concept and measures of CP well before economists. We draw from the seminal work of Shenkar (2001) and propose a de nition of CP which accounts for many of the critiques emerging from that literature. From the same strand in international business we acknowledge the recent contribution by Li et al. (2017). These authors focus on role of

economic literature. Numerous studies including Shenkar (2001), Tung and Verbeke (2010) and

where f is an increasing function on the unspecified support between minimum and maximum CP. S

reports the products which are classi ed as cultural goods. The UNCTAD classi cation divides them into two categories, `core' and `optional' cultural goods, listed in the rst and second column of Table 1 respectively. Each category has two headings, arts and media within the `core' category and heritage and functional creation within the optional one. Core cultural goods generally embed a higher cultural content and they are listed across other available classi cation schemes such as the one developed by UNESCO.

Table 1: Categories of Goods with Cultural Content (UNCTAD, 2010)

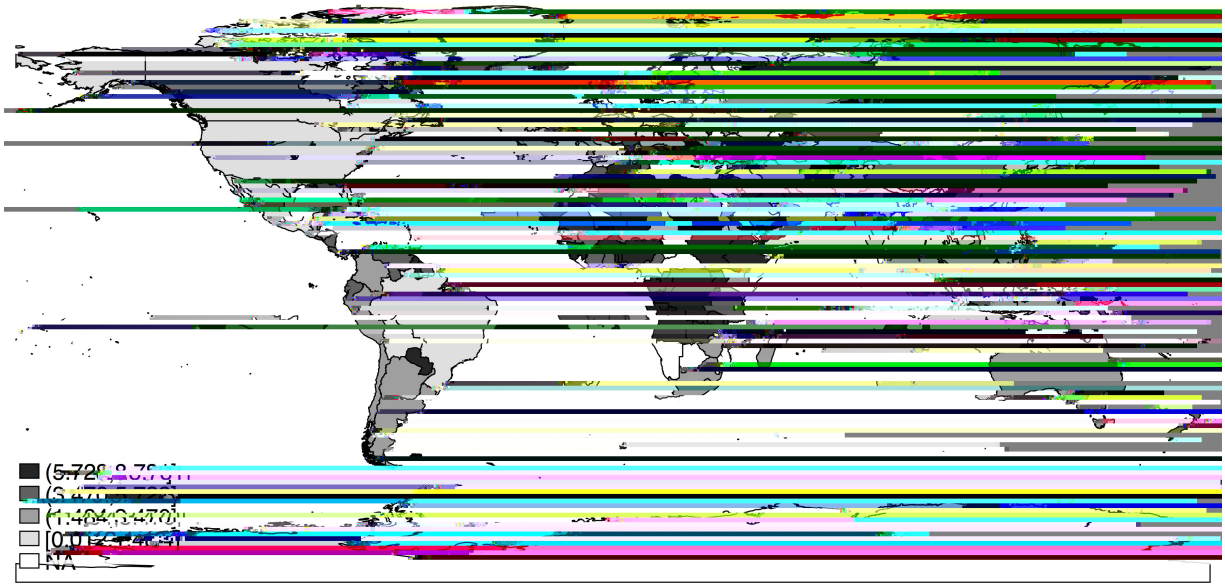
Core Cultural Goods	Optional Cultural Goods
Arts (Performing and Visual)	Heritage (Arts Crafts)
Music (CD, Tapes), Printed Music, Painting, Photography, Sculpture and Antiques	Carpets, Celebration, Paperware, Wickerware, Yarn and Other
Media (Publishing and Audio-Visual)	Functional Creations (Design and New-Media)
Books, Newspaper, Other Printed Matter, Film	Architecture, Fashion, Interior, Glassware, Jewellery, Toys, Recorded Media and Video Games

Notes: Further information on the classi cation can be found in UNCTAD (2010). This table replicates Table 4.2, p. 112 of UNCTAD (2010).

Before the merging with FDI and other data the cultural trade database has a coverage of 176 countries on the period 2003-2014. On average across countries and over time trade in cultural goods accounts for 2.7% of total trade in this sample. As noted in Disdier et al. (2010), cultural trade is highly concentrated. Summing cultural trade ows across importers and over time, the top ve exporters - China, Germany, USA, Italy and France - account for 55% of total cultural

of all potential combinations, these 4137 pairs account for 49.1% and 55.8% of total trade and total trade in cultural goods respectively. To illustrate the scope of the asymmetry embedded in cultural trade, Table 2 reports the country pairs with the highest and the lowest value of the asymmetry measure. For these two pairs we report the directed attractiveness premia and the resulting value of asymmetry implied by cultural trade.

Figure 1: Asymmetry in CP Between the UK and the Rest of the World



UK is apparent for many European countries (with the notable exception of Ireland); for many economies in the South-East Asia region; for Russia; for the North American countries; and for some Latin American ones. High asymmetry emerges between the UK and countries in the African continent (with few exceptions below the median level of asymmetry including Madagascar and South Africa); countries in the Central Asia region; and few countries in Latin America. Relatively low asymmetry in the cultural relationships with European countries highlights the capacity of our empirical framework and of its wide country coverage to complement previous studies on the role of asymmetric cultural variables for economic transactions with a focus on Eu-

A focus on such asymmetry is central to our main research question, which we now turn to address.

eral resistance component, capturing the attractiveness of alternative locations for investors in country i. M_n is a function of the destination/host country specific parameters, which include the total number of potential investment projects and the average contribution of Sup across projects. Finally, T_{ni} is the bilateral component, a function of both monitoring and transaction costs, but also of the vector of formal investment policies, geographic proximity and CP. Intuitively, the model specifies T_{ni} as a decreasing function of c and . The qualitative relationship between these costs and formal investment policies as well as geographical distance parameters is taken from Head and Ries (2008) and de Sousa and Lochard (2011). The existence of FTAs (Free Trade Agreements) or BITs (Bilateral Investment Treaties) between i and n can potentially reduce both monitoring and transaction costs, which are also assumed to decrease with geographical proximity.

The way c and depend upon the symmetric component of CP is not new to the FDI gravity literature in economics: higher similarity between the two cultures implies lower monitoring as well as lower transaction costs. What has not been discussed is how monitoring and transaction costs react to the asymmetric component of CP. In what follows we address this in a broader discussion on how greenfield FDI from origin i to destination n depends upon both $CP_{ni;t}$ and $CP_{in;t}$.

Higher $CP_{ni;t}$ reduces the costs that the parent MNE has to pay to monitor the activities of its foreign subsidiary. This is intuitive if higher $CP_{ni;t}$ reflects higher S_{ni}. Indeed, for many symmetric dimensions of CP (common language, similar legal practices and contracting behaviour) clearly facilitate monitoring activities. However, $A_{ni;t}$, the degree of attractiveness for individuals in the origin country i of the ideas and practices which are prevalent among individuals in destination n, is also a determinant of lower monitoring costs. It minimizes assessment errors and facilitate the assessment processes themselves by making easier for individuals (that have to evaluate the effort exerted by the subsidiary located in i) to establish an effective interaction with n agents, beyond a common language b-377(if91 Tf 273(Hng)-359(8ie)-332uI)-360(3 [(C)-72c7-1a2q-32

view of the subsidiary personnel in the destination country n, the attractiveness of i's culture for them results in a good attitude toward interactions with the parent's personnel. Smoother interactions reduce inspection as well as transaction costs for the MNE. But $A_{in;t}$ can be relevant for i's investment in n beyond its effect on i's MNE monitoring and transaction costs. First, in so far as the n subsidiary is intended to serve the n market, the value that consumers in n put on the output of i's MNE increases the average payoff from a greenfield investment in country n. This preference value is likely to be a positive function of how much individuals (consumers) in n are attracted by i's culture ($A_{in;t}$), also relatively to the cultures of other

and destination ($\ln dist_{ni}$); (ii) a dummy for geographical contiguity ($contig_{ni}$) as proxies for transportation costs; (iii) the number of FTAs and BITs involving i and n which are in force at time (t - $FTA_{ni;t}$ and $BIT_{ni;t}$) as measures of formal investment policy. Finally, the elements of $T_{ni;t}$ which pertain to CP are proxied with both directions of cultural trade between i and n, ($CulIMP_{ni;t}$ and $CulEXP_{ni;t}$). In order to identify the specific role of the asymmetric component of CP ($A_{ni;t}$ and $A_{in;t}$) we control for its symmetric component (S_{ni} S_{in}) by adding to

Table 3: Summary Statistics from Baseline Estimation Sample

Variable	Mean	Median	sd	Min	Max
$C_{ni;t}$	1.551	0	8.897	0	400
$\ln dist_{ni}$	8.482	8.747	0.910	4.107	9.892
$colony_{ni}$	0.032	0	0.177	0	1
$lang_{ni}$	0.157	0	0.364	0	1
$comrelig_{ni}$	0.173	0.033	0.266	0	0.989
$contig_{ni}$	0.038	0	0.190	0	1
$comleg_{ni}$	0.293	0	0.455	0	1
$FTA_{ni;t}$	0.269	0	0.444	0	1
$BIT_{ni;t}$	0.393	0	0.488	0	1
$\ln CultIMP_{ni;t}$	-0.454	-0.429	3.273	-6.908	10.644
$\ln CultEXP_{ni;t}$	-0.145	-0.086	3.114	-6.908	10.644

Notes: This table reports summary statistics for the variables used in the baseline estimation exercise (see Table 4). The related estimation sample consists of 87,448 observations.

4 Results

In this section we present the results of the empirical analysis. We discuss the baseline estimation results in Section 4.1 and then the main robustness tests in Section 4.2. Further extensions to the core analysis of the paper are discussed separately in Section 5.

4.1 Baseline results

Table 4 below presents the main results of our empirical exercise. The positive and statistically signi cant coe cient of $\ln CultIMP_{ni;t}$ in column (1) shows that the attractiveness of the n's culture for individuals in country i ($A_{ni;t}$) is a determinant of the number of green eld FDI projects from i to n. In particular, the number of investments from an origin country to a destination economy increases with $A_{ni;t}$ as captured by the value of i's cultural imports from n. Analogously, the estimated coe cient of $\ln CultEXP_{ni;t}$ in column (2) is positive and statistically signi cant, showing that the number of green eld FDI projects from origin i to destination n is higher for stronger attractiveness of thei ($A_{ni;t}$

(see Section 3.1) suggests that this too can be due to the MNE manager's expectations of lower monitoring and transaction costs (because of smoother interaction with agents that appreciate the culture represented by the MNE) but also to destination-speci c channels. These are a higher propensity of the individuals in the destination country to buy the output of the MNE a liate in their country (`destination consumers demand' channel) as well as to approve political (and economic) support toward the FDI project by their government (`destination political economy' channel). Both channels increase the pro tability of the FDI project and therefore stimulate green eld investment.[15]

4.2 Robustness checks

In this section we test the robustness of our results. The main econometric concern in our benchmark estimates is the potential endogeneity of our proxy for CP - i.e. trade in cultural goods - which may derive from multiple sources: for instance because of the omission of dyadic speci c unobserved factors that might be correlated both with the error term (hence with FDI) and with CP. In particular, as noted by Felbermayr and Toubal (2010) and Disdier et al. (2010) these unobserved elements are often related to initial conditions, since the mutual learning due to strong pre-existing ties may favor convergence of cultural characteristics which in turn can trigger even more intense FDI ows. Furthermore, the link between CP and FDI may be subject to reverse causality as there might be determinants of FDI that drive both economic outcomes as well as cultural attractiveness, making it di cult to establish a clear direction of causation (see Felbermayr and Toubal, 2010; Guiso et al., 2009). Indeed, positive FDI shocks may increase the interactions with foreign partners which in turn could lead to mutual learning and further cultural convergence and appreciation. Finally, measurement error can bias the estimated impact of our parameters of interest. In particular, the data on Green eld FDI from the FT dataset include estimates for capital investment (derived from algorithms) when a company does not release the information (see Desbordes and Wei, 2017; Lee and Ries, 2016). As for CP, the cultural content embodied in di erent categories of cultural goods may re ect di erent degrees of bilateral CP. We deal with the rst two sources of endogeneity - namely omitted variable bias and reverse causality - through the inclusion of dyadic xed e ects and by adopting an instrumental variable (IV) approach, respectively.[16] We address the measurement error concerns by rst testing our benchmark speci cation on di erent measures of the bilateral volume of FDI andolumed6(di repli56(sS4 rW8o4

variability in our sample, so that the impact of CP depends solely upon time contingent cultural factors. To allow for comparison of the results, the sample size is identical in all columns as we maintain the same sample for the fully speci ed model across all speci cations. The models with country year xed e ects (columns 1-3) deliver roughly the same results as Table4, so the reduction of the sample size does not signi cantly alter our benchmark estimates. On the other hand, similarly to Felbermayr and Toubal (2010) and Disdier et al. (2010), the inclusion of dyadic xed e ects in column (4) substantially a ects our parameters of interest. Trade in cultural goods retains a positive impact on FDI, but the magnitude of both the elasticities of cultural imports and exports is much lower with respect to the benchmark equation, indicating that CP is largely captured by an unobservable time invariant component. In addition, only the impact of exports remain statistically signi cant: this nding suggests that only the time variation of attractiveness of the origin's culture for the individuals in the destination economy plays a role in the MNE decision to invest.

We now move to the issue of reverse causality. In the literature the simultaneity problem has been commonly addressed with an IV strategy where current levels of CP are instrumented with their past values (see for instance Felbermayr and Toubal (2010)). This strategy hinges on the assumptions that (i) lagged bilateral values CP predict their current levels su ciently well and

Table 5: Impact of Cultural Proximity on Green eld FDI: Adding Country Pair FE

Dep. Var.	Count C

creases in magnitude. Hence, once we control for reverse causality, we nd that only the cultural attractiveness of the origin country for potential destinations have an impact on green eld investment. Furthermore, the instrumented exports' elasticity is more than twice as large, suggesting a downward bias in the impact of exports of cultural goods. However, the resulting downward bias is substantially smaller compared to the estimates emerging from previous studies on the impact of CP on economic exchanges, suggesting that our gravity speci cation su ers relatively less from endogeneity compared to other proxies used so far in the literature[18].

4.2.2 FDI count versus value

Table 7 replicates the same speci cation of Table 4 using the total value of bilateral investments ($V_{ni;t}$) rather than their number.

The focus on the number of projects (count) as opposed to their total or average value has the advantage of minimizing the potential distortions induced by the imputation techniques used in the construction of the value-related variables,[19] but has its own limitations: for instance it is equivalent to imposing to all projects the same weight in terms of economic relevance, without discriminating them for their actual size. For instance, an investment in a legal consultant office (the business sector with the lowest average capital investment in our sample) is implicitly evaluated as an investment in a plant for oil re nery, which is roughly 257 times larger (5.344 millions US$ against more than 1.372 billions US$ on average for the two types of investments respectively). Beyond these measurement related considerations, the size of bilateral FDI and

Table 6: Impact of Instrumented Cultural Proximity on Green eld FDI

Dep. Var.	Count $C_{ni;t}$			
	2 year lag	5 year lag	Baseline	IV
	(1)	(2)	(3)	(4)
ln CultIMP $_{ni;t}$			0.0658**	0.0736
			(2.96)	(1.35)
ln CultEXP $_{ni;t}$			0.247***	0.619***
			(9.43)	(6.54)
ln lagged CultIMP$_{ni;t\ \ 2}$	0.0740***			
	(6.32)			
ln lagged CultEXP$_{ni;t\ \ 2}$	0.296***			
	(21.27)			
ln lagged CultIMP$_{ni;t\ \ 5}$		0.0784***		
		(6.59)		
ln lagged CultEXP$_{ni;t\ \ 5}$		0.286***		
		(19.51)		
ln dist$_{ni}$	0.179***	0.182***	0.806***	0.350**

Table 7: Impact of Cultural Proximity on the Total Value of Green eld FDI

Dep. Var.	Value $V_{ni;t}$		
	(1)	(2)	(3)
ln CultIMP $_{ni;t}$	0.0984***		0.0221
	(4.82)		(1.07)
ln CultEXP $_{ni;t}$		0.277***	0.269***
		(13.28)	(11.44)
ln $dist_{ni}$	-0.469***	-0.248***	-0.237***
	(-9.64)	(-4.58)	(-4.44)
$colony_{ni}$	0.507***	0.370***	0.364***
	(6.02)	(4.85)	(4.76)
$lang_{ni}$	0.180	0.115	0.109
	(1.84)	(1.26)	(1.20)
$comrelig_{ni}$	1.370***	1.217***	1.210***
	(9.02)	(8.46)	(8.42)
$contig_{ni}$	-0.150	-0.0863	-0.0952
	(-1.43)	(-0.86)	(-0.94)
$comleg_{ni}$	0.142*	0.0775	0.0724
	(2.41)	(1.37)	(1.28)
FTA $_{ni;t}$	0.302***	0.265***	0.260***
	(3.96)	(3.60)	(3.52)
BIT $_{ni;t}$	-0.0289	-0.0441	-0.0443
	(-0.45)	(-0.73)	(-0.74)
Imp Year FE	o	o	o
Exp Year FE	o	o	o
Obs	87448	87448	87448
% Zeros	0.749	0.749	0.749
R^2	0.9056	0.9216	0.9221
Estimator	PPML	PPML	PPML

Notes: * p @0:05, ** p @0:01, *** p @0:001. z-statistics in parentheses. Standard errors are clustered by trading-pair. The dependent variable Value C $_{ni;t}$ is the value of the aggregated bilateral ow of green eld investments from country i to country n, including zero ows. The estimates are obtained with PPML using the PPML panel sg command written by Thomas Zylkin which simultaneously allows to absorb pair-wise as well as origin-by-time and destination-by-time FEs. The model includes origin time and destination time FEs. The sample size in this table is invariant to the number of covariates included and refers to the regression which features both imports and exports of cultural goods. The information which belong to groups with all zeros or missing values are automatically dropped by the estimator as FEs cannot be computed. fDIMarket database provides information on the value of each green eld. When no o - cial gures are provided by the parent company, the value is estimated by FDIIntelligence unit. Information about the estimation algorithm can be found on fDIMarket website.

the cultural content embodied in these types of products: hence, it is reasonable to expect the impact of CP as mostly driven by the trade (in either direction) of core cultural goods as they are likely to better capture proximity in cultural tastes.However, optional cultural goods represent the lion share of cultural trade from and between developing countries: failing to account for these ows would exclude many South countries from the analysis, limiting the impact of CP on speci c FDI channels (especially North-North). As shown in Table 9, the pattern of results is stable across di erent measures of cultural trade, showing the capacity of both types of cultural goods to re ect the same underlying forces.

The exercise proposed in Table 9 serve the additional purpose of minimizing potential concerns regarding the measurement error introduced by the gross nature of cultural trade used in the

Table 8: Impact of Cultural Proximity on Intensive Margin of Investment

Dep. Var.	Average Value $V_{ni;t}$		
	(1)	(2)	(3)
ln CultIMP $_{ni;t}$	0.0705***		0.0390*
	(3.96)		(2.11)
ln CultEXP $_{ni;t}$		0.147***	0.137***
		(6.99)	(6.11)
ln $dist_{ni}$	-0.308***	-0.194***	-0.166**
	(-6.48)	(-3.72)	(-3.20)
$colony_{ni}$	0.155	0.0529	0.0290
	(1.29)	(0.45)	(0.25)
$lang_{ni}$	0.0701	0.0399	0.0222
	(0.74)	(0.43)	(0.24)
$comrelig_{ni}$	0.825***	0.773***	0.750***
	(5.79)	(5.16)	(5.09)
$contig_{ni}$	0.0805	0.0998	0.0874
	(0.60)	(0.74)	(0.66)
$comleg_{ni}$	0.0513	0.0325	0.0215
	(0.76)	(0.49)	(0.32)
F 0.031			

Table 9: Di erent Measures of CP: Core VS Optional Cultural Trade

Dep. Var.	Count $C_{ni;t}$		
	Total cultural trade	Core cultural trade	Optional cultural trade
	(1)	(2)	(3)
ln CultIMP $_{ni;t}$	0.0690***	0.0925***	0.0525***
	(5.90)	(8.22)	(4.34)
ln CultEXP $_{ni;t}$	0.305***	0.285***	0.249***
	(21.91)	(20.18)	(19.43)
FTA $_{ni;t}$	0.118*	0.0990	0.110
	(2.19)	(1.89)	(1.93)
BIT $_{ni;t}$	0.0115	0.0329	-0.0174
	(0.29)	(0.83)	(-0.41)
ln $dist_{ni}$	-0.179***	-0.198***	-0.225***
	(-5.13)	(-5.75)	(-6.38)
$colony_{ni}$	0.366***	0.244***	0.488***
	(6.85)	(4.49)	(8.65)
$lang_{ni}$	0.181**	0.161**	0.216***
	(3.53)	(3.1*4y771	

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5 Extensions

This section proposes the two extensions to the analysis conducted so far. First we propose two empirical tests of the `destination-side' mechanisms as introduced in the conceptual framework

Table 10: Destination Consumers Demand Channel

Dep. Var.	Count $C_{ni;t}$	
FDI targeting consumers in n	More likely	Less likely
	(1)	(2)
ln CultIMP $_{ni;t}$	0.0768***	0.0731***

contingent shocks in terms of cultural attractiveness of the origin country for the destination seem to trigger investments. However, it seems that those results are mainly driven by pairs

explaining patterns of FDI should be attributed to the cultural preferences of the individuals in the destination country, both as consumers potentially buying the outcome produced by

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Appendices

A Data: sources and general features

The data used throughout both the descriptive and the analytical parts of the paper come from a variety of sources. Table A-1 displays the major sources and related links where additional information on the di erent databases used to create our nal dataset: most of the other data come from sources that are well known in empirical gravity literature.

The focus of the analysis is on testing the role and the extent of the non-reciprocal component of CP on international economic ows, with the speci c focus on green eld FDI. For this reason we aggregate the projects according to the country of origin, destination and year in which the investment has been made. Then, we label missing dyadic ows at this stage as null investment channels, to obtain a square bilateral FDI matrix accounting for 184 185 countries of origin and destination. Cultural Trade data are then merged accordingly. Given that some territorial units in fDIMarket are not matched in BACI, some countries are dropped throughout the empirical analysis (see Table F-1 in Appendix B with the complete list of unmatched and excluded countries). In this respect, our strategy is similar to the one adopted by Aubry et al. (2014), Desbordes and Wei (2017), and Lee and Ries (2016) among the others. As a consequence, our FDI data reveals a pattern that is consistent with the ndings from the recent theoretical and empirical literature in international economics (see for instance Mayer and Ottaviano, 2008), i.e. that only few rms are able to undertake FDI as a form of internationalization. [24]

Table A-1: Main Sources of Data used in the Empirical Section

Variables	Dataset / Source / Website / Reference and Accessibility
FDI Variables	FDIMarket / FDI Intelligence Unit, The Financial Times / http://www.fdiintelligence.com/ / FDI Market License
Trade Variables	BACI / CEPII / http://www.cepii.fr/CEPII/en/bdd_modele/presentation.asp?id=1 / UN COMTRADE access required
Gravity Variables	Gravdata / CEPII / http://www.cepii.fr/CEPII/en/bdd_modele/presentation.asp?id=8 / Free
Bilateral Distance	Geodist / CEPII / http://www.cepii.fr/CEPII/en/bdd_modele/presentation.asp?id=6 / Free
Migrant Stock	WB Global Bilateral Migration Dataset / The World Bank / http://data.worldbank.org/data-catalog/global-bilateral-migration-database / Artuç et al. (2015) / Free
Language I	Lingweb / CEPII /

the remaining of this section, we explore the main issues related to cultural trade (that constitute our main variable of interest) and green eld FDI respectively.

Data on trade in cultural goods Trade data come from the BACI dataset by CEPII[25], a proper workhorse in empirical gravity analysis in international trade. It is not the purpose of this appendix to describe the features of the BACI dataset as it is, for which we suggest the interested reader to check directly on the web link provided in Table A-1 above. Much more interesting for the purpose of this paper is to de ne what can be labelled as Cultural Good and what classi cation scheme is batter able to t to the purpose of this paper that is, to investigate the role of imperfect reciprocity in cultural proximity in international economic ows.

Many countries and international organizations developed their own classi cation scheme, based on precise principles and content of the single class of product: for this reason, identifying the most suitable scheme for the sample considered in this paper is not an easy task. Yet, the choice of the classi cation is particularly sensible. Given the world coverage of our analysis, we restricted our search to two alternative classi cations for cultural goods promoted by United Nations agencies, the UNESCO and the UNCTAD,[26] each of them based on di erent criteria and di erent categories of goods to be included in the count. Disdier et al. (2010) classi ed cultural goods using the de nition proposed by UNESCO. Despite we build upon their seminal work, we depart from that approach and adopt the scheme proposed by UNCTAD (2010). There exist two main reasons for this choice: (i) a technicality related to the time coverage of the data, and (ii) a more substantial issue concerning the sample selection.

As for time coverage, the decision to prefer the UNCTAD classi cation leans on the di erent coding system adopted by the two di erent classi cations. With respect to this point, UNESCO adopts the 2007 Harmonized Commodity Description and Coding System (HS 2007), that would call for the adoption of a conversion table to arrange the data along our time period. Conversely, UNCTAD (2010) adopts the HS 2002 coding system, that is more suitable for the time period at stake, as it allows not to convert the trade ows prior of 2007.[27] The conversion may distort the data, since the way they are collected is not always consistent across di erent coding systems: for this reason, the adoption of the UNCTAD (2010) classi cation could turn out to be not only less burdensome from a computational point of view, but also less prone to distortions.

Much more relevant for the choice of the classi cation scheme is the the sample coverage issue. The dataset used throughout this paper has global coverage,[28] with a large number of developing and transition economies in addition to developed ones. Conversely, Disdier et al. (2010) con ne their analysis to a much more homogeneous group of OECD countries. This could not seem a major concern, but it is important to acknowledge that cultural goods are neither homogeneous nor equally produced worldwide. Both UNESCO and UNCTAD classi cations uphold this fact by splitting cultural goods into core and optional cultural goods, with the former generally dominated by developed economies. By construction, in both classi cations optional cultural goods encompass a wide range of products that are more likely to be produced in, and traded by developing countries too.[29]

[25] http://www.cepii.fr/cepii/en/bdd_modele/presentation.asp?id=1

[26] Other criteria can be found in the classi cation schemes developed by national and smaller international institutions (see UNCTAD, 2010, for a review).

[27] Nonetheless, as we adopted lag values of cultural trade as instruments in our IV analysis, we could not eventually avoid the burden of converting trade data prior to 2003n(ro1 Tf 136s 834 u1hon,)-22(to)-4.2./F98 8.9664 Tf 7.803 -3.976

A potential drawback of the wider conception of what can be considered as cultural good is that the UNCTAD classi cation has a much more diluted cultural content when compared to the UNESCO's. In fact, despite the latter encompasses a narrower set of traded goods, they are the ones with the larger cultural content. Nonetheless, given the world coverage of our sample, developed countries account for less than 30% of the whole set of countries included. For this reason, in order to balance the cultural composition of trade ows, and to construct a comparable measure of cultural trade across di erent development stages, the classi cation that is able to guarantee a relatively higher weight to those goods more evenly distributed across developed, developing and least developed economies should be preferred. This problem was not relevant in Disdier et al. (2010) because of the relative homogeneity of the sampled

Table A-2: Percentage of Zeroes by Year

Year	Null	Non-Null	Total	Incidence
2003	32,453	1,587	34,040	95.34%
2004	32,442	1,598	34,040	95.31%
2005	32,405	1,635	34,040	95.20%
2006	32,289	1,751	34,040	94.86%
2007	32,151	1,889	34,040	94.45%
2008	31,751	2,289	34,040	93.28%
2009	31,960	2,080	34,040	93.89%
2010	31,931	2,109	34,040	93.80%
2011	31,833	2,207	34,040	93.52%
2012	31,916	2,124	34,040	93.76%
2013	31,756	2,284	34,040	93.29%
2014	31,901	2,139	34,040	93.72%
Total	384,788	23,692	408,480	94.20%

Notes: This table breaks down the incidence of null ows by year. It becomes apparent that the issue of null ows is pervasive in the FDIMarket dataset as we constructed it. The high incidence of zeroes and the data over-dispersion in

Table A-3: Percentage of Imputed Values by Year

Year	Imputed	Real Value	Observations	Incidence
2003	6,325	3,182	9,507	67%
2004	7,270	3,143	10,413	70%
2005	7,849	2,883	10,732	73%
2006	9,534	3,301	12,835	74%
2007	8,968	4,006	12,974	69%
2008	13,416	3,794	17,210	78%
2009	12,063	2,723	14,786	82%
2010	12,843	2,629	15,472	83%
2011	14,101	2,757	16,858	84%
2012	13,088	2,181	15,269	86%
2013	14,319	2,399	16,718	86%
2014	13,044	2,344	15,388	85%
Total	132,820	35,342	168,162	79%

Notes: The table report the percentage of estimated capital investment. The number of observations refers to the number of single projects collected by FDIMarket for the period 2003-2014. The large incidence of estimated values makes the estimates obtained using values as dependent variables not fully reliable: as a matter of facts, in addition to the lack of clarity in the imputation technique, imputation brings in a component of uncertainty per se.

B Cultural trade as a proxy of the symmetric component of CP

Building upon Disdier et al. (2010), we identi ed the exchange of cultural goods as classi ed by UNCTAD (2010) as a good proxy of CP. In this Appendix we show how trade in cultural goods strongly relates to the symmetric component of CP as de ned in Section 2. In other words, we provide a rough indication of the dependency of cultural attractiveness on cultural similarities. To that end we regress cultural trade on various conventional symmetric (and time invariant) proxies

Table B-1: Testing the Validity of Cultural Trade as a Proxy of CP

Dep. Var.	ln CultIMP $_{ni;t}$	ln CultIMP $_{ni;t}$	ln CultIMP $_{ni;t}$
	(1)	(2)	(3)
ln mig$_{ni;t}$	0.115***	0.0761***	0.0880**
	(20.83)	(4.30)	(2.89)
ln dist$_{ni}$	-1.225***	-0.695***	-0.921***
	(-49.15)	(-10.61)	(-6.77)
contig$_{ni}$	0.317***	0.260**	0.440*
	(3.74)	(2.86)	(2.34)
FTA $_{ni;t}$	0.266***	0.0807	0.683**
	(6.24)	(0.77)	(2.96)
comrelig$_{ni}$	0.236***	0.440*	0.235
	(3.55)	(2.28)	(1.26)
comleg$_{ni}$	0.281***	0.303***	0.411**
	(8.66)	(4.43)	(2.68)
colony$_{ni}$	0.500***	0.383***	0.763***
	(5.67)	(3.65)	(3.45)
COL$_{ni}$	0.374***	0.0786	-0.0000199
	(6.13)	(0.55)	(-0.00)
CSL$_{ni}$	0.683***	-0.350	-0.394
	(6.52)	(-1.45)	(-0.74)
CNL $_{ni}$	0.0691	0.209	-0.402
	(0.48)	(0.71)	(-0.92)
Hofstede$_{ni}$			-1.034***
			(-4.01)
Imp Year FE	o	o	o
Exp year FE	o	o	o
Sample	Full	Full	Reduced
Obs	24620	54525	684
% Zeros	-	0.5485	-
R^2	0.7476	0.8993	0.9118
Estimator	OLS	PPML	OLS

Notes: * p @0:05, ** p @0:01, *** p @0:001. t (z) -statistics in parentheses. Standard errors are clustered by trading-pair. The dependent variable wo(tig)]TJ/F21 7.93TJ/Ft9@ren3r0(t82Cf 4.2342 5 Td)]T.

Table B-2: Testing Validity of Cultural Trade as a Proxy of CP - Correlations

Correlation with:	cult.trade $T_{ni;t}$	
	Baseline Covariates Set	Linguistic and CP proxies
	(1)	(2)
$\ln mig_{ni}$	0.0955*	0.0955*
	(0.0000)	(0.0000)
$\ln dist_{ni}$	-0.0218*	-0.0218*
	(0.0000)	(0.0000)
$contig_{ni}$	0.0771*	0.0771*
	(0.0000)	(0.0000)
$FTA_{ni;t}$	0.0363*	0.0363*
	(0.0000)	(0.0000)
$comrelig_{ni}$	-0.0049	-0.0049
	(0.2433)	(0.2433)
$comleg_{ni}$	-0.0037	-0.0037
	(0.3691)	(0.3691)
$colony_{ni}$	0.0265*	0.0265*
	(0.0000)	(0.0000)
$lang_{ni}$	0.0130*	
	(0.0018)	
COL_{ni}		0.0101*
		(0.015)
CSL_{ni}		0.0359*
		(0.0000)
CNL_{ni}		0.0275*
		(0.0000)
$Hofstede_{ni}$		-0.2507*
		(0.0000)
Obs	57672	703

Notes: * p @0:01. SE in parentheses are clustered by trading-pair. The table show pairwise correlation coe cients between trade in cultural goods and all standard coe cients of proximity. Coe cients in the rst column refers to the whole sample for which all variables are available. This means that it is limited to just year 2010 and year 2013 because of bilateral stock of migrants availability. Coe cients in the second column refers instead to the reduced sample for which the Hofstede index is available.

C Extensions to the detour on asymmetry

Asymmetry in CP and export capacity This Appendix investigates the correlation between the degree of asymmetry in CP and the relative cultural export capacity between trading partners. This is done by dividing the set of countries which appear in at least one pair for which a value of asymmetry is available into four classes, depending on the value of their exports of cultural good with respect to the 3 quartiles of the distribution of cultural exports. The first class consists of countries below the first quartile of cultural exports, the second class of those between the first and the second quartile, the third class of those between the second and third quartile, and finally the fourth class of those countries above the third quartile of the distribution. The set of country pairs are then partitioned according to all possible combinations of two elements with repetitions from the four classes defined above. One pair could be classified either as containing two first class countries (both at the bottom of the cultural export distribution), one first and one fourth class country (the former at the bottom and the latter at the top of the cultural trade distribution) and so on and so forth for all 10 possible combinations. Finally, the value of asymmetry is regressed on the ten dummies identifying the elements of this partition (First-First, Second-Second, . . . , First-Second, . . .), taking those pairs with two bottom cultural exporters (First-First) as the base group. Results are reported in Table C-1.

Looking at the first column of Table C-1, we notice that on average across all pairs including two bottom cultural exporters the value of asymmetry is equal to 2.078, below both the mean and median values of asymmetry, equal to 2.932 and 2.614 respectively. Less asymmetry appears to be present in the CP between countries with a similar but higher value of cultural exports, and also between a country in the fourth class (top cultural exporter) and one in the third (quasi-top cultural exporter). Higher levels of asymmetry in CP instead are expected among countries which are relatively more heterogeneous in terms on cultural export capacity. Higher asymmetry in bilateral CP is associated with wider heterogeneity in export capacity and, to a lesser extent, with average export capacity within the pair. These patters are generally confirmed when restricting the analysis to bilateral cultural relationships characterized by attractiveness

Table C-1: Asymmetry Across Different Types of Cultural Traders

Dep. Var.	Asymmetry $S_{ni} \hat{}_{in} S$			
Attractiveness premia	All types	Both positive	Both negative	Opposite sign
	(1)	(2)	(3)	(4)
Second-Second	-0.400**	-0.279	-0.0767	-0.561**
	(-3.13)	(-1.35)	(-0.54)	(-2.75)
Third-Third	-0.610***	-0.143	-0.946***	-0.399
	(-4.90)	(-0.74)	(-5.45)	(-1.60)
Fourth-Fourth	-0.828***	-0.172	-	-
	(-5.59)	(-0.82)	-	-
First-Second	1.048***	1.104***	0.299*	1.532***
	(6.77)	(3.96)	(2.10)	(7.12)
Second-Third	0.188	0.00573	0.110	-0.00420
	(1.56)	(0.03)	(0.79)	(-0.02)
Third-Fourth	-0.586***	0.0328	-	0.973
	(-4.75)	(0.17)	-	(1.18)
First-Third	1.682***	1.380***	0.889***	1.721***
	(12.21)	(4.79)	(6.50)	(9.06)
Second-Fourth	0.779***	0.607**	1.093	0.889***
	(5.97)	(3.07)	(1.12)	(4.61)
First-Fourth	2.690***	1.270***	1.651***	2.043***
	(21.84)	(5.07)	(10.23)	(11.96)
Constant (First-First)	2.078***	1.423***	1.392***	3.194***
	(19.70)	(7.76)	(12.86)	(20.20)
Obs	4137	1486	793	1858
R^2	0.3424	0.1274	0.2285	0.2421
Estimator	OLS	OLS	OLS	OLS

Notes: * p @0:05, ** p @0:01, *** p @0:001. z-statistics in parentheses. Standard errors are clustered by trading-pair. In this table the proxy for asymmetry ($S_{ni} \hat{}_{in} S$) is regressed on a constant and 9 dummies. As an illustration, the dummy Fourth-Fourth takes value one for those country pairs where both countries have a value of cultural exports above the third quartile of the distribution of cultural exports. As a further illustration the dummy First-Fourth takes value one for those country pairs where one country is a bottom exporter of cultural goods (below the first quartile of the cultural exports distribution) and the other is a top cultural exporter (above the third quartile). When point estimates and t statistics are not reported it is because the respective dummy coefficient has no variability (always equal to 0) in the corresponding estimation sample. The case in which both countries in the pair are bottom exporters (below the first quartile of the cultural exports distribution) is set as base level and the related dummy variable is omitted from the regression.

and equal to 0.17. The first sign below the asymmetry score indicates that the attractiveness premium that France exerts on the UK with respect to the average country is positive. The same is true the other way round, as indicated by the second sign. When computed on a smaller sample featuring only European countries, the value of asymmetry increases by more than 180% and becomes equal to 0.48 (still relatively small compared to the average asymmetry over the whole sample).

The last column of the table shows the extent of the bias induced by considering only a subsample of (relatively) homogenous countries: a negative sign in the difference between $S_{ni} \hat{}_{in} S^{full}$ and $S^{f}_{ni}{}^{ull} \hat{}_{in} S^{T}$ means that the degree of asymmetry in the country pair under consideration decreases when other, more heterogeneous countries are considered. Failing to consider the role of the rest of the world within the system of cultural affinity could result in a severe bias in cultural relationship between countries.

Beyond the few examples reported in Table C-2, Figure gives a sense of the sign of the bias on

Table C-2: Asymmetry Across Di erent Samples

Country n	Country i	Asymmetry - full $S_{ni} \hat{}_{in} S^{full}$	Asymmetry - FT $S_{ni} \hat{}_{in} S^{FT}$	Di erential $S_{ni} \hat{}_{in} S^{full}$	$S_{ni} \hat{}_{in} S^{FT}$
Finland	Italy	1.16	2.35	-1.19	
		+ +	+ +		
United Kingdom	France	0.17	0.48	-0.31	
		+ +	+ +		
Russian	United Kingdom	0.95	1.60	-0.65	
		+ +	+ +		
Germany	Turkey	0.33	1.46	-1.13	
		+ +	+ +		
Spain	Russian	2.19	2.20	-0.01	
		+ +	- +		
Norway	Sweden	1.49	1.95	-0.46	
		+ +	+ +		
Croatia	Sweden	0.31	1.89	-1.58	
		+ +	+ -		
Belgium	Malta	2.88	5.02	-2.14	
		+ +	+ -		
Ireland	United Kingdom	2.70	3.32	-0.62	
		+ +	+ +		
Ukraine	Ireland	3.04	3.45	-0.41	
		+ -	- -		

Notes: The table lists a selection of country pairs and shows the extent of the bias in the empirical assessment of asymmetry due to adopting a sample of relatively homogeneous countries. A positive (negative) value of the di erential across the full sample and the restricted one implies that the restriction is actually over-(under-) estimating the true extent of CP. The sample of countries used in Felbermayr and Toubal (2010), which only includes European countries is taken as the restricted set of relatively homogeneous countries. The and signs below the two columns of symmetry report the sign of the attractiveness premium exerted by country i and country n on each other.

all the country pairs generated from the restricted sample for which both measures of asymmetry are estimated. This is done by plotting, for each pair the value of asymmetry coming from the full sample (on the vertical axis) against the value of the asymmetry generated from the restricted sample (on the horizontal axis). With the bulk of the observations below the 45 degree line, especially moving away from the origin, we conclude that the overestimation of asymmetry in CP implied by an empirical framework with limited country coverage can be highly widespread.

Figure C-1: Asymmetry Full Sample VS Asymmetry Felbermayr and Toubal (2010) Sample

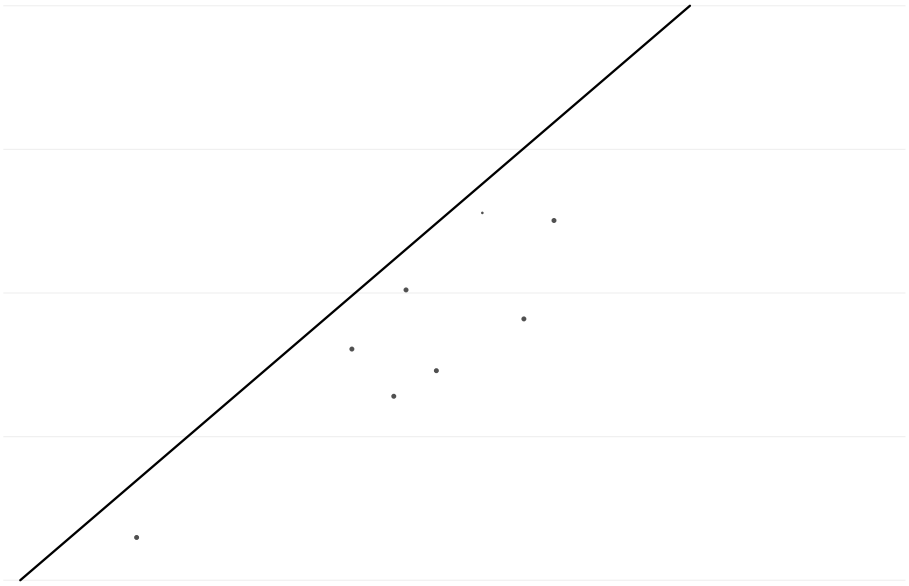

Table D-1: Addressing Omitted Variable Bias: Including Migration

Dep. Var.	Count $C_{ni;t}$		
	(1)	(2)	(3)
ln migstock$_{ni;t}$	0.0810***		0.0579**
	(5.13)		(2.63)
ln migstock$_{in;t}$		0.0788***	0.0293
		(4.29)	(1.33)
ln CultIMP $_{ni;t}$	0.0507**	0.0368	0.0204
	(3.27)	(1.90)	(0.93)
ln CultEXP $_{ni;t}$	0.290***	0.296***	0.290***
	(15.12)	(12.94)	(11.37)
ln dist$_{ni}$	-0.0566	-0.0693	-0.0574
	(-1.25)	(-1.46)	(-1.13)
colony$_{ni}$	0.283***	0.308***	0.292***
	(4.26)	(4.41)	(3.87)
lang$_{ni}$	0.117*	0.0704	0.0725
	(2.01)	(1.11)	(1.08)
comrelig$_{ni}$	0.930***	0.910***	0.960***
	(7.48)	(7.04)	(6.82)
contig$_{ni}$	-0.0391	-0.0447	-0.0140
	(-0.55)	(-0.60)	(-0-18)
comleg$_{ni}$	0.156***	0.189***	0.187***
	(3.45)	(3.84)	(3.61)
FTA $_{ni;t}$	0.129	0.144*	0.138
	(1.94)	(2.10)	(1.84)
BIT $_{ni;t}$	0.0277	-0.0154	-0.0315
	(0.51)	(-0.26)	(-0.93)
Imp Year FE	o	o	o
Exp year FE	o	o	o
Obs	9619	8756	5853
% Zeros	67%	67%	60%
R^2		0.92	
Estimator	PPML	PPML	PPML

Notes: * p @0:05, ** p @0:01, *** p @0:001. z-statistics in parentheses. Standard errors are clustered by trading-pair. The dependent variable Count C $_{ni;t}$ is the bilateral number of Green eld FDI projects from country i to country n. It includes the zero ows. This table replicates the baseline speci cation adding the bilateral stock of migrants from n to i as additional regressors. The reduced number of observations is due to the availability of the migration data, that allow to use only two point in time (2010 and 2013) for the period covered in the analysis (Source: The World Bank).

E Relevance of the instruments

Table E-1 below mimics a first stage regression for the IV analysis, by showing the relevance of the instruments in explaining the endogenous variables to our analysis. Since the ivPPML command does not compute first stage regression, we regressed the endogenous variables on all the instruments as well as on the covariates of the second stage.

Table E-1: Relevance of the Instrument: First Stage Endogenous Variables on Instruments

Dep. Var.	Cult.Import $_{ni;t}$	Cult.Export $_{ni;t}$
	(1)	(2)
ln CultIMP $_{ni;t-8}$	0.560***	
	(14.73)	
ln CultEXP $_{ni;-8}$		0.560***
		(14.74)
ln $dist_{ni}$	-0.664***	-0.663***
	(-9.15)	(-9.14)
$colony_{ni}$	-0.116	-0.116
	(-1.37)	(-1.37)
$lang_{ni}$	0.123	0.124
	(0.90)	(0.91)
$comrelig_{ni}$	0.0534	0.0539
	(0.44)	(0.44)
$contig_{ni}$	0.0773	0.0776
	(1.13)	(1.14)
$comleg_{ni}$	0.0481	0.0479
	(0.78)	(0.78)
FTA $_{ni;t}$	0.324**	0.325**
	(2.94)	(2.95)
BIT $_{ni;t}$	0.0485	0.0484
	(0.59)	(0.58)
Imp Year FE	o	o
Exp Year FE	o	o
Obs	11117	11117
% Zeros	12.2%	12.2%
R^2	0.9502	0.9502
Estimator	PPML	PPML

Notes: * p @0:05, ** p @0:01, *** p @0:001. z-statistics in parentheses. Standard errors are clustered by trading-pair. This table shows the relevance of the selected instruments on the endogenous variables. The decision to adopt lagged values of the endogenous variables builds on Card (2001).
The estimates are obtained with PPML using the PPML command by Santos Silva and Tenreyro (2006) and Santos Silva and Tenreyro (2011) which perfectly deals with the reduced set of FE we are going to include in the instrumental analysis. Column (1) shows the correlation of the lagged value of import in cultural goods on current imports. Column (2) performs the same exercise on export. The sample is reduced in this speci cation, because of data availability for the lagged instruments. Time coverage: 2007-2014

F Country excluded from the dataset

Table F-1: List of Countries Excluded from the Analysis

In both direction: no ows of green eld FDI (in or out) over the entire period
Anguilla, Netherland Antilles, Cocos and Keeling Islands, Cook Islands, Christmas Islands, Western Sahara, Falkland Islands, Faeroe Islands, Gibraltar, French Guiana, Kiribati, Marshall Islands, Northern Mariana Islands, Montserrat, Norfolk Islands, Niue, Nauru, Pitcairn, Palau, Saint Helena and Tristan da Cunha, San Marino, Saint Pierre et Miquelon, Tokelau, Tonga, Tuvalu, British Virgin Islands, Vanuatu, Wallis and Futuna
No outward ows over the whole period (excluded as source countries)
Aruba, Benin, Bhutan, Cape Verde, Central African Republic, Chad, Comoros, Republic of the Congo, Dominica, Eritrea, Grenada, Guinea, Guinea-Bissau, PRD Korea, Liberia, Maldives, Mauritania, New Caledonia, Niger, Paraguay, Sao Tome and Principe, Seychelles, Sierra Leone, Somalia, Saint Kitts and Nevis, Sain Lucia, Saint Vincent and the Grenadines, Suriname, Timor Leste, Turkmenistan
Countries excluded or aggregated for inconsistencies between CEPII and fDIMarket
Serbia and Montenegro (both excluded) Belgium and Luxembourg (both excluded) Sudan and Sud Sudan (South Sudan is Excluded) Switzerland and Liechtenstein (Aggregated) France and Monaco (Aggregated)

Notes: The result of the exclusion of these countries is a rectangular dataset of n m countries. In addition to these countries - excluded for data inconsistencies - other dyadic ows are excluded when no investment occurs between two countries during the period analyzed. This explains the discrepancy between the size of the dataset and the number of observations used in the estimation