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Association for Comparative Economic Studies

Poster Session II

Chair: Daniel Berkowitz, University of Pittsburgh

Atlanta, GA, Jan. 4, 2019

Rivers and Trade

Jarko Fidrmuc [a,c] and Richard Frensch [a,b,c]

a: IOS Regensburg; b: University of Regensburg; c: Zeppelin University Friedrichshafen

Landshuter Str. 4, 93947 Regensburg
Email: frensch@ios-regensburg.de

Rivers and Trade

What this is about

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While rivers both impede and facilitate trade, the dual role of rivers has so far not been explicitly considered.

We expand the existing bilateral geographical CEPII database by adding detailed information on bilateral river borders and indirect river linkages for 36 European countries, i.e., 1,260 (630 bidirectional) country pairs.

Within a gravity framework, we assess the impact of international rivers on trade, using disaggregate trade data, both on trade flows and along the margins of trade.

Results

- River linkages are trade creating, working predominantly through the extensive margin.
- Substantial river borders, working predominantly through the intensive margin, are detrimental to trade.
- Our counterfactuals show that international rivers have a modest positive net impact on European trade.
- Preliminary results suggest:
  - what matters for trade are river basins rather than rivers.
  - The positive net impact of international rivers on European trade includes historical legacy of geographical impact on economic activity.

Rivers and Trade
What this is about

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- Geography and economic activity
- Contribution
- Data
- Gravity specification
- Results
- Counterfactuals
- Robustness
- Further questions
    - Rivers or river basins?
    - Contemporaneous trade costs or historical legacy?
- Conclusions

Rivers and Trade

Geography and economic activity

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There is a huge literature on geography and economic activity.

> Allen and Arkolakis (2014) develop a general equilibrium framework to determine the spatial distribution of economic activity. Combining the gravity structure of trade with labor mobility, they find that geographic location accounts for at least twenty percent of the spatial variation in U.S. income.
>
> > They also calculate that the construction of the interstate highway system increased welfare by 1.1 to 1.4 percent, which is substantially larger than its cost.

Two things to notice in that literature

(1) Geography is as a rule seen as a barrier to economic activity.

> Exemplified in (traditional) gravity specifications using CEPII's geographical measures to proxy trade costs by geographical variable.

(2) A rather abstract view of "nature"

> We argue that what we thus add in terms of trade cost structure upon the seamless world qualitatively fits European realities: rather than assuming that countries are ordered like pearls on a thread, we see many small countries encircled by all the other equidistant small countries. In this set-up, foreign distance need not matter more for international trade than distance at home. In consequence, distance effects are of second order as compared to border effects … (Frensch et al., 2015).

Rivers and Trade

Geography and economic activity

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However, geography is about rugged terrain, mountains and rivers. On these real nature phenomena as determinants of variation in economic activity, literature is sparse.

Giuliano et al. (2014) argue that geographic factors that shaped genetic patterns in the past are relevant for persistent border effects today and can account for the correlation between trade flows and genetic distance.

> In response to Schulze and Wolf's (2009) point that ethno-linguistic network effects determine persistent border costs across integrating Europe.

Redding and Venables (2004) refer to sub-Saharan Africa, "where a recent literature has emphasized the importance of physical geography and infrastructure in explaining trade and development," quoting Amjadi, Reincke, and Yeats (1996); Gallup, Sachs, and Mellinger (1998); Limao and Venables, (2001).

> Africa has few east-west navigable rivers to facilitate water-borne trade within the continent… (p. 110). Export performance also depends on internal geography, which is measured in this paper by the proportion of the population close to the coast or navigable rivers (p. 119).

Bleakley and Lin (2012) observe that many cities in North America formed at obstacles to water navigation, where continued transport required overland hauling or "portage." Although original advantages have long since become obsolete, they document continuing importance of historical portage sites and interpret this as path dependence.

Rivers and Trade
Contribution

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While rivers both impede and facilitate trade, the dual role of rivers has so far, to the best of our knowledge, not been explicitly considered.

Why should it matter?

Topographical variability is relevant in the determination of transportation costs (Giuliano et al., 2014) and affects the construction and maintenance costs of surface transport networks, as well as the costs to users of those networks.

We expand the bilateral geographical CEPII-database by adding information on bilateral river borders and river linkages for 1,260 (630 bidirectional) European country pairs.

Using highly disaggregate trade data in a gravity framework, we assess the impact of international rivers on European trade, both on flows and along the margins of trade.

Rivers and Trade
Data

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Bilateral trade flows

We use CEPII's 1995–2013 BACI trade data-set, derived from UN-Comtrade: bilateral trade flows in HS Code 92, i.e., at the 6-digit level (5,017 goods), for different levels of aggregation for 36 European countries:

ALB, ARM, AUT, AZE, BEL, BGR, BLR, CHE, CZE, DNK, ESP, EST, FIN, FRA, GBR, GEO, GER, GRC, HRV, HUN, IRL, ITA, LTU, LVA, MDA, MKD, NLD, NOR, POL, PRT, ROM, SVK, SVN, SWE, TUR, UKR

Rudimentary trade margin measurement:

Extensive margin (export variety): number of goods in a bilateral export relationship, based on 6-digit level data

Intensive margin (export intensity): trade flow divided by extensive margin.

GDP at current prices: WDI

Trade policies and institutions

Trade policy (WTO, FTA's, EU, EMU, OECD membership) is from CEPII, as is country-pair information on common religion, language and colonial experience (*comrelig, cl, colony, sibling*).

Common country-pair pre- and post-transition *legal systems* (separately for common law, French, German, Scandinavian, and socialist) is from La Porta et al. (1998 and 2008).

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Uni- and bilateral proxies for geographical trade costs other than rivers

We use CEPII data on *area*, *landlocked* status, *distance* and *contiguity*.

Ruggedness

As Giuliano et al. (2014) report having done previously for a much smaller sample of European countries, we use country-level data on terrain ruggedness provided in Nunn and Puga (2012), to construct a variable measuring ruggedness of terrain in between any of our trading country pairs.

(1) With CEPII's main cities distance information, we implement a shortest route algorithm to determine the countries that lie between any two trading partners.

(2) Then, using Nunn and Puga's (2012) Standard Ruggedness (Terrain Ruggedness Index, 100 m.), we construct a weighted ruggedness indicator, *rugla*, with areas of countries in between, including the two trading partners, as weights.

(3) In our regressions, we use the log of *rugla*.

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Bilateral proxies for river trade (developed by research assistants, Philipp Stelzer and Florian Wittmann)

- River names
- River border dummy (*Rbord*)
- Length of (river) border
- River border as share of border (*Rshare*)
- Dummy for river connection between non-contiguous countries (*Rlong*)
- Dummy for downstream river connection between non-contiguous countries (*Rdown*)

Data sources

Length of border: CIA World Factbook

Total river length: CIA World Factbook and Wikipedia (double-ckeck on language versions)

Length of river borde, river connections etc.: Using freeware ArcGis(http://www.esri.de/produkte) for measuring mapped distances (crosschecked with Google Earth satellite images to exclude minor flows < 5 m wide)

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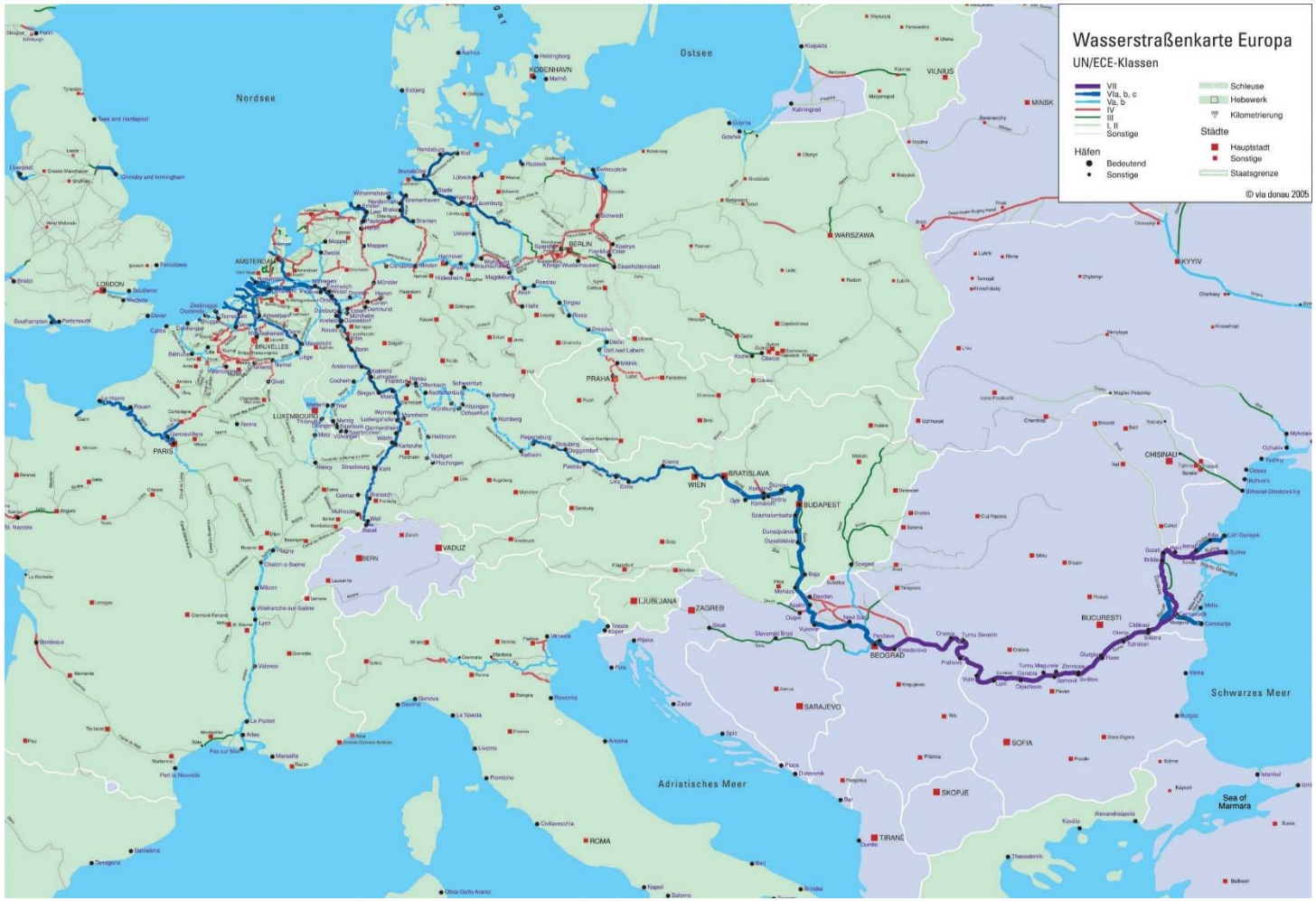

Rivers across Europe
http://www.portofdortmund.com/fileadmin/img/englische_Fassung/73_europa__ische_wasserstrassenkarte.jpg

Rivers and Trade
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What is a river? In the original research assistant assignment, a river was meant to be "every flow of water that has to be tunneled under or bridged over to be crossed" (excluding explicity minor flows of less than 5 m wide).

Sadoff and Grey (2002), on terminology: "… freshwater flows (whether surface water or groundwater), and the lakes and wetlands which some of these flows may pass through, derive from or terminate within, are described, very loosely and evocatively, as 'rivers'. The term 'international rivers' is used in this text to refer to freshwaters whose basins are situated within the borders of more than one state. "

Following this, we exclude saltwater flows tunneled under or bridged over, as., e.g., the Eurotunnel (1994) and the Oresund bridge (2000).

We concentrate on "nature," i.e., we exclude canals, such as the Rhein-Main-Donaukanal opened in 1992 and connecting the Rhine and the Danube river basins.

Rivers and Trade
Data

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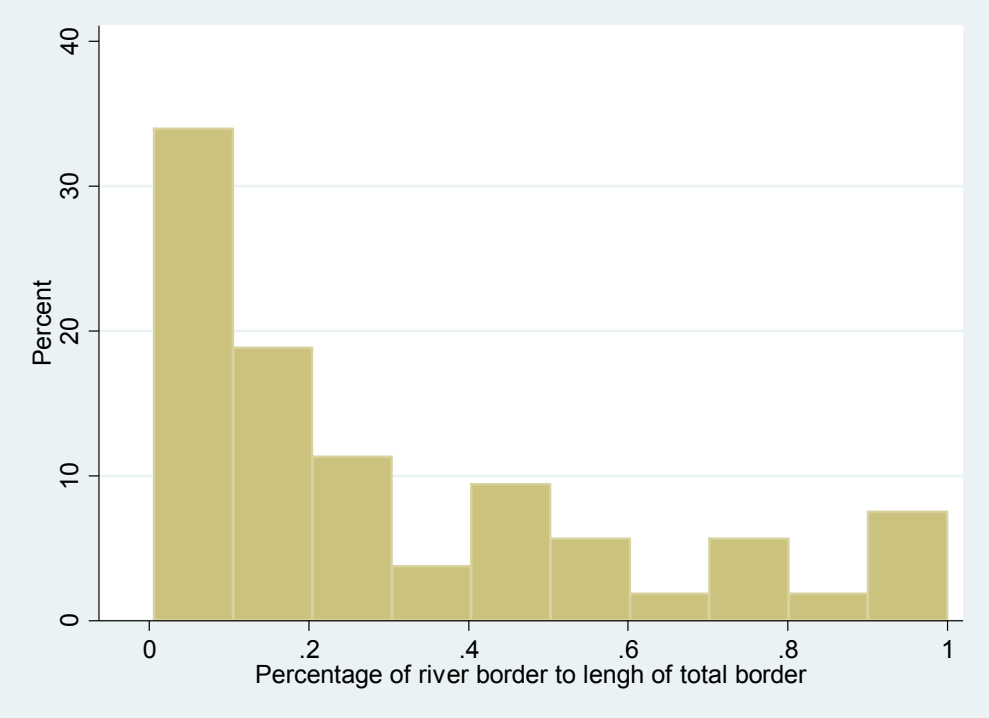
We have 1,260 unidirectional (i.e., 630 unique bidirectional) country pairs. After excluding bidirectional FRA-GBR, DNK-SWE, and ARM-AZE:

1,134 *contig* = 0 81 *Rlong* = 1

120 *contig* = 1 106 *Rbord* = 1

Rshare if *Rbord* = 1:



Rivers and Trade

Gravity and choice of estimator

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The gravity equation relates trade between two economies *o* and *d* (origin and destination, respectively) to their sizes, Y_o, Y_d, (+), other trade incentives (+), and trade barriers (–), in a multiplicative form.

Traditional gravity equations are often eclectic combinations of explanatory variables taken from different trade theories, combined with any conceivable trade barrier.

Trends in the gravity literature (see, e.g.., Yotov et al, 2016):

- Identification and decomposition of trade costs within structural gravity approaches, compatible with new and new new theories of trade
- Control for multilateral trade resistance (MTR)
  Intuitively: the higher the trade barriers of a country with the world for fixed trade barriers with a specific country, the more the country will be driven to trade with this specific country (Anderson and van Wincoop, 2003).
- Account for zero trade flows and heteroscedasticity of trade data by estimating gravity equations using the Poisson Pseudo-Maximum-Likelihood Estimator (PPML, see Santos Silva and Tenreyro, 2006).

Rivers and Trade

Gravity and choice of estimator

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Baldwin and Taglioni (2006) recommend making use of the panel structure of available trade data when controlling for MTR, and specifically doing so by subsuming MTR under

- separate time-variant exporter- and importer-specific fixed effects, and
- time-invariant country-pair specific fixed effects,
  that are of particular relevance for identifying average treatment effects of time-varying bilateral policy variables, such as regional trade agreements, on trade. If some pairs are more likely to select into agreements, not including country-pair fixed effects would produce bias.

Estimating with PPML with fixed effects is consistent with MTR indices as in Anderson and van Wincoop (2003), see Fally (2015).

MTR with geographical data

- We cannot control for time-invariant country-pair effects. However, we are not interested in average treatment effects of time-varying bilateral policy variables but rather in the average treatment effect of time-nonvarying, exogenous geographical variables.
- Bilateral geography accounts for almost all time-invariant country-pair variation (Melitz, 2007; in the European context, Hanousek and Kočenda, 2014)
- Together with time varying exporter and importer fixed effects, we are able to control for multilateral trade resistance.

Rivers and Trade
Gravity specification

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$$Exp_{od,t} = \exp[\beta_1 \log Y_{o,t} + \beta_2 \log Y_{d,t} + \sum_i \beta_i \text{ TradeAgreement}_{i,\,od,\,t}$$
$$+ \sum_j \beta_j \text{ Institututional Arrangement}_{j,\,od.}$$
$$+ \sum_h \beta_h \text{ Geographical Variable}_{h,\,od}$$
$$+ \sum_k \beta_k \text{ River Variable}_{k,\,od}$$
$$+ \log c_{o,t} + \log c_{d,t}] + \varepsilon_{ij,t} \qquad (1)$$

with $c_{o,t}$ and $c_{d,t}$ as origin-time and destination-time fixed effects, respectively, to ensure the theoretical restrictions implied by structural gravity are satisfied.

We estimate (1) with PPML in stata, employing the user-defined `ppml_panel_sg` command, to enable faster estimation of Poisson gravity models with high-dimensional fixed effects. For more on `ppml_panel_sg`, see Larch et al. (forthcoming).

We also decompose the influences specified in (1) along the two margins of trade, i.e., along *extensive* (number of exported goods) *versus intensive* export margins (average volumes per exported good), based on the highly disaggregated nature of our original trade data (as in Bista and Tomasik, 2016).

Rivers and Trade

Results: Nominal bilateral exports

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	1	2	3	4		5
	Total exports					Exports by BEC
WTO	0.079	0.196	0.131	0.114		0.382***
OECD	0.269***	0.422**	0.450***	0.417***		0.397***
FTA	0.201***	0.408***	0.373***	0.323***		0.469***
EU	0.123**	0.026	0.047	0.234**		0.319***
EU2003				-0.321***		-0.246***
EMU	-0.023	-0.007	-0.013	0.045		0.060
lDistance		-0.457***	-0.431***	-0.444***		-0.438***
lRuggedness		-0.142	-0.198	-0.192		-0.130*
Contig		0.294***	0.254***	0.254***		0.270***
Rbord			**0.238*****	**0.218*****		**0.220*****
Rshare			**-0.481****	**-0.489****		**-0.507*****
Rlong			**0.217****	**0.198****		**0.182*****
Institutional variables		Yes	Yes	Yes		Yes
Geographical variables		Yes	Yes	Yes		Yes
Origin-(BEC-)time and destination-(BEC-)time FE	Yes	Yes	Yes	Yes		Yes
Country pair FE	Yes	No	No	No		No
Observations	23,825	23,825	23,825	23,825		403,083
Adj. R^2	0.99	0.94	0.95	0.95		0.92

Rivers and Trade

Results

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Notes: All estimations are with `ppml_panel_sg`. Standard errors are clustered on country pairs. In column (4), standard errors are clustered on country pairs and BEC.

In columns 1–4 (total trade), 240 (1 per cent) trade flows are zero.

In column 5 (trade by BEC), 77,134 (19 per cent) trade flows are zero.

Institutional variables control for country-pair common pre- and post-transition *legal systems* (separately for common law, French, German, Scandinavian, and socialist).

l*Distance* is distance between countries' main cities, and *Contig* is country pair contiguity. Other uni- and bilateral proxies for geographical trade costs other than rivers control for *country area* and (separately for uni- and bilateral) *landlocked* status.

l*Ruggedness* is the log of our weighted ruggedness indicator, with areas of countries in between, including the two trading partners, as weights.

In case of collinearity problems, `ppml_panel_sg` drops covariates rather than fixed effects. This regularly eliminates the following variables from the list: l*gdp_o*, l*gdp_d*, l*gdpcap_o*, l*gdpcap_d*, l*area_o*, l*area_d*. However, we always keep all observations perfectly predicted by excluded regressors.

The table below introduces the Broad Economic Categories (BEC) classification.

1 Food and beverages	4 Capital goods (except transport equipment) and parts and accessories thereof
11 Primary	41 Capital goods (except transport equipment)
111 Mainly for industry	42 Parts and accessories
112 Mainly for household consumption	5 Transport equipment and parts and accessories thereof
12 Processed	51 Passenger motor cars
121 Mainly for industry	52 Other
122 Mainly for household consumption	521 Industrial
2 Industrial supplies not elsewhere specified	522 Non-industrial
21 Primary	53 Parts and accessories
22 Processed	6 Consumer goods not elsewhere specified
3 Fuels and lubricants	61 Durable
31 Primary	62 Semi-durable
32 Processed	63 Non-durable
321 Motor spirit	7 Goods not elsewhere specified
322 Other	

Broad Economic Categories (BEC)

The United Nations Statistics Division's Classification by BEC (Broad Economic Categories, available online at http://unstats.un.org/unsd/cr/family2.asp?Cl=10) allows for headings of the SITC, Rev.3 to be grouped into 19 activities covering primary and processed foods and beverages, industrial supplies, fuels and lubricants, capital goods and transport equipment, and consumer goods according to their durability. The BEC also provides for the rearrangement of these 19 activities (on the basis of SITC categories' main end-use) to approximate the basic System of National Accounts (SNA) activities, namely, primary goods, intermediate goods, capital goods, and consumer goods

Rivers and Trade

Results: Exports margins by BEC

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	5	6	7
	Exports	Extensive margin	Intensive margin
WTO	0.382***	0.388***	0.106
OECD	0.397***	-0.048	0.857***
FTA	0.469***	0.332***	0.161
EU	0.319***	0.108***	-0.006
EU2003	-0.246***	-0.165***	-0.219
EMU	0.060	-0.056***	0.121
lDistance	-0.438***	-0.298***	-0.658***
lRuggedness	-0.131*	-0.124***	-0.195
Contig	0.270***	-0.017	0.037
Rbord	**0.220****	**0.170****	**0.185**
Rshare	**-0.507****	**-0.192****	**-0.589****
Rlong	**0.182****	**0.131****	**0.065**
Institutional variables	Yes	Yes	Yes
Geographical variables	Yes	Yes	Yes
Origin-BEC-time and destination-BEC-time FE	Yes	Yes	Yes
Observations	403,083	403,083	403,083
Adj. R^2	0.92	0.93	0.83

Notes: Standard errors are clustered by country pair and BEC. As PPML is not a linear operator, estimated margin coefficients do not sum up to respective trade flow coefficients.

Rivers and Trade
Counterfactuals

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Predicted river effects on the basis of specification 4			
	Predicted values (including river variables)	Predicted values (with river variables, Rbord, Rshare, Rlong all set to zero)	River impact = Predicted values (including river variables) / Predicted values (with zero river variables)
Nominal exports	Mean: 2,106,496	Mean: 2,026,538	**Mean: 1.021** Std. Dev.: .071 Min: .763 Max: 1.240
Extensive margin	Mean: 1159.561	Mean: 1126.005	**Mean: 1.019** Std. Dev.: .050 Min: .980 Max: 1.185
Intensive margin	Mean: 975.412	Mean: 1016.182	**Mean: .999** Std. Dev.: .085 Min: .451 Max: 1.188
23,825 obs.			

Note: River impact is on total European trade.

Rivers and Trade
Counterfactuals

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Predicted river effects on exports on the basis of specification 4, by country			
ALB	1.012	HRV	1.048
ARM	1.002	HUN	1.032
AUT	1.043	IRL	1.005
AZE	0.993	ITA	1.013
BEL	1.017	LTU	1.016
BGR	1.060	LVA	1.015
BLR	1.017	MDA	1.046
CHE	1.037	MKD	1.005
CZE	1.059	NLD	1.024
DNK	1.000	NOR	1.008
ESP	1.006	POL	1.012
EST	1.006	PRT	1.000
FIN	0.994	ROM	1.032
FRA	1.023	SVK	1.052
GBR	1.005	SVN	1.056
GEO	1.011	SWE	1.000
GER	1.059	TUR	0.991
GRC	1.005	UKR	1.050

Rivers and Trade

Rivers or river basins?

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As argued above, we follow Sadoff and Grey's (2002) terminology, defining 'international rivers' to refer to freshwaters whose basins are situated within the borders of more than one state." Accordingly:

(1) we exclude saltwater flows tunneled under or bridged over, as., e.g., the Eurotunnel (1994) and the Oresund bridge (2000).

(2) We concentrate on "nature," i.e., we exclude the Rhein-Main-Donaukanal (1992).

This raises the question whether our results are due to effects exerted by rivers in the narrow sense, or by river basins, i.e., independent from modes of transport.

Rivers and Trade

Rivers or river basins?

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Jonkeren et al (2011) study the effect of an imbalance in trade flows on transport prices using micro-data on trips made by carriers in the inland waterway network in North West Europe and find that imbalances in trade flows have substantial effects on transport prices.

The authors estimate that a one standard deviation increase in the region's trade imbalance (the ratio of export and import cargo flows) increases the transport price per ton of trips departing from this region by about 7%.

Accordingly, in our context, if our river effects are due to the use of river transport in a narrow sense, we should find a significant effect from the direction of river linkages (downstream or upstream) on trade.

However, as the following tables shows, this is not the case; furthermore, our benchmark results remain stable.

From that we conclude that our results are due to the existence of river basins, i.e., they are independent from specific modes of transport chosen along or across river basins.

Rivers and Trade

Rivers or river basins?

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	8		9	10	11
	Total exports		Exports by BEC		
	Flows		Flows	Externsive margin	Intensive margin
WTO	0.112		0.381***	0.388***	0.097
OECD	0.417***		0.396***	-0.051	0.857***
FTA	0.325***		0.469***	0.332***	0.162
EU	0.235**		0.320***	0.109***	-0.006
EU2003	-0.323***		-0.247***	-0.167***	-0.220
EMU	0.046		0.061	-0.055***	0.123
lDistance	-0.444**		-0.438***	-0.298***	-0.657***
lRuggedness	-0.191		-0.129*	-0.123***	-0.191
Contig	0.255***		0.270***	-0.017	0.042
Rbord	**0.217****		**0.218****	**0.169****	**0.182**
Rshare	**-0.489****		**-0.506****	**-0.190****	**-0.591****
Rlong	**0.160**		**0.146****	**0.104****	**-0.023**
Rdown	**0.091**		**0.086**	**0.052**	**0.237**
Institutional and geographical variables	Yes		Yes	Yes	Yes
Origin-(BEC-)time and destination-(BEC-)time FE	Yes		Yes	Yes	Yes
Observations	23,825		403,083	403,083	403,083
Adj. R^2	0.95		0.92	0.93	0.83

Notes: All estimations are done with `ppml_panel_sg`. In column (8), standard errors are clustered on country pairs. In columns (9–11), standard errors are clustered on country pairs and BEC.

Rivers and Trade

Contemporaneous trade costs or historical legacy?

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Again, according to Sadoff and Grey (2002), international rivers can elicit cooperation or conflict, i.e., they can impose potentially persistent trade barriers over and above the contemporaneous trade costs of topographical variability cited in Giuliano et al. (2014).

This raises the question whether the effects of river borders and river linkages found in our benchmark results represent contemporaneous trade costs or rather some historical legacy.

- A dynamic gravity approach might answer this question, including the lagged dependent (trade) variable among the explanatory variables, encompassing "the entire history of the right-hand-side variables, so that any measured influence is conditional on this history; in this case, any impact of (the independent variables) … represents the effect of new information." Greene (2008, p. 469).
- Another approach would try to find transmission channels among the covariates, which would, however, render the benchmark model underspecified.

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However,

- by including the lagged dependent (trade) variable among the explanatory variables error terms from one year to the next will be correlated, and
- controlling for country-specific effects is problematic in the context of a dynamic specification in which the unobserved effect is part of the composed error term and thus – by construction– correlated with the lagged dependent variable.

The simplest way to go is estimating gravity using a cross-section instead of as a panel, to avoid the problem of correlated standard errors from one year to the next completely (see Campbell, 2010).

However, we also produce preliminary evidence by dividing our sample into two sub-samples, performing regressions on the more recent sample, using the less recent sample only to provide lagged trade variables, with resulting lags between 10 and 13 years.
This may not help if past trade costs evolve very slowly.

Both regression specifications show strong attenuation of all geographical effects (including those of rivers) over time, once we control for lagged trade.

Rivers and Trade

Contemporaneous trade costs or historical legacy?

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Dep. Variable: Exports by BEC in 2013	12	13	14	15	16	17
OECD	0.127	0.268***	0.090	-0.077	-0.214***	-0.079*
FTA	0.261	0.920***	0.106	0.009	-0.133	0.019
EU	0.835***	0.744***	0.607**	0.593***	0.361*	0.275*
EU2003	-0.245***	-0.205***	-0.056	-0.105**	-0.056	-0.012
EMU	0.009	-0.005	0.007	-0.027	0.048	0.006
lDistance	-0.449***	-0.392***	-0.259***	-0.163***	-0.091***	-0.072***
lRuggedness	-0.110*	-0.075	-0.029	0.066*	0.011	0.010
Contig	0.297***	0.272***	0.205***	0.142***	0.057*	0.054***
Rbord	**0.240*** **	**0.193*** **	**0.142*** **	**0.097** **	**0.078** **	**0.022**
Rshare	**-0.471*** **	**-0.417*** **	**-0.223*** **	**-0.107*** **	**-0.158*** **	**-0.076*** **
Rlong	**0.199*** **	**0.159*** **	**0.104** **	**0.037**	**0.064** **	**0.034**
Log(lagged exports)		0.118***	0.386***	0.574***	0.767***	0.836***
Lag in years		18	13	8	3	1
Institutional and geographical variables	Yes	Yes	Yes	Yes	Yes	Yes
Origin-BEC and destination-BEC FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	21,318	21,318	21,318	21,318	21,318	21,318
Adj. R^2	0.91	0.93	0.95	0.97	0.97	0.99

Notes: All estimations are done with `ppml_panel_sg`. Standard errors are clustered on country pairs and BEC. WTO always dropped due to convergence problems.

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Contemporaneous trade costs or historical legacy?

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Dep. Variable: Exports by BEC	18	19	20	21	22	23
OECD	0.369***	0.426***	0.431***	0.299***	0.341***	0.324***
FTA	0.398***	0.430***	0.505***	0.320***	0.309***	0.340***
EU	0.693***	0.650***	0.593***	0.537***	0.489***	0.403***
EU2003	-0.274***	-0.277***	-0.266***	-0.128**	-0.125**	-0.101*
EMU	0.042	0.060	0.069	0.015	0.029	0.038
lDistance	-0.445***	-0.448***	-0.450***	-0.307***	-0.297***	-0.289***
lRuggedness	-0.114	-0.118	-0.124	-0.043	-0.049	-0.056
Contig	0.291***	0.284***	0.279***	0.217***	0.204***	0.191***
Rbord	**0.241*** **	**0.233*** **	**0.221*** **	**0.146*** **	**0.133*** **	**0.116*** **
Rshare	**-0.475*** **	**-0.479*** **	**-0.488*** **	**-0.285*** **	**-0.270*** **	**-0.258*** **
Rlong	**0.202*** **	**0.201*** **	**0.198*** **	**0.106*** **	**0.102*** **	**0.096*** **
Log(lagged exports)				0.310***	0.336***	0.364***
Lag in years				13	12	11
Institutional and geographical variables	Yes	Yes	Yes	Yes	Yes	Yes
Origin-BEC-time and destination-BEC-time FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	127,668	127,634	127,600	127,668	127,634	127,600
Sample period	2008–13	2007–12	2006–11	2008–13	2007–12	2006–11
Adj. R^2	0.83	0.93	0.92	0.95	0.95	0.95

Notes: All estimations are done with `ppml_panel_sg`. Standard errors are clustered on country pairs and BEC. WTO always dropped due to convergence problems.

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Conclusions

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We expand the existing bilateral geographical CEPII-database by adding detailed information on bilateral river borders and indirect river linkages for 1,260 (630 bidirectional) European country pairs.

Within a gravity framework, we assess the impact of international rivers on European trade, using disaggregate trade data, both on trade flows and along the margins of trade.

First, we confirm previous results on trade arrangement effects.

- Our results confirm Dutt et al. (2013) that positive trade effects from WTO membership are realized predominantly along the extensive margin.
- We confirm the doubts concerning trade effects from EMU membership raised in Baldwin and Taglioni (2006).

Second, while confirming the importance of geography for trade, we qualify the importance of contiguity.

- Among geographical variables, river variables appear to be as important as contiguity.
- Some of the trade effects so far attributed to contiguity (see, e.g., Frankel and Romer, 1999) appear to operate through river variables.

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Third, the gross effects of international rivers on trade are substantial.

- Substantial river borders can erase the positive trade effects of contiguity.
  By working predominantly through the intensive margin, the effect is more skewed than that of contiguity.
- Depending on specification, an international river link may create up to four fifths as much trade as does contiguity.
  The share of the extensive margin in this positive effect is more pronounced than in the detrimental river border effect.

Fourth, the net effects of river variables on European trade appear to be modest.

- River borders and river linkages are comparatively rare phenomena among European country pairs.
- Peliminary counterfactuals reveal a net river impact of 2 per cent on total European trade flows, realized entirely along the extensive margin.
- There is substantial country-specific variation.

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Preliminary additional conclusions

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Preliminary additional results suggest:

- what matters for trade are river basins rather than rivers; i.e., our results are independent from specific modes of transport chosen along or across river basins.

- The positive net impact of international rivers on European trade represents much historical legacy of geographical impact on economic activity, rather than exclusively contemporaneous trade costs.
  This appears comparable to other geographical effects.

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