The Trade Effects of Border Controls: Evidence from the European Schengen Agreement

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Abstract

The Schengen agreement has guaranteed unchecked travel across internal EU borders since 1995. Has it also facilitated trade flows? Our econometric analysis suggests that Schengen has boosted trade by 3% on average (equivalent to a drop in tariffs by 0.7 percentage points). Goods trade is more robustly affected than services, and peripheral countries benefit more than central ones.

Keywords: Trade Integration, Schengen Agreement, Gravity
JEL: F10, F15, N74, N94

1. Introduction

The Schengen Agreement, first enforced in 1995 by a group of countries, has abolished identity checks at internal EU borders. Today, the agreement covers 26 countries, 4.2 million km^2, and about 400 million citizens.

By eliminating waiting times at borders, Schengen facilitates the free movement of people and goods, thereby complementing the EU single market. In the current refugee crisis, Aussilloux and Le Hir (2016) and Boehmer et al. (2016) warn about high economic costs of suspending Schengen. They assume that identity checks at borders are equivalent to introducing an *ad valorem* tariff of 3%.

The few existing econometric studies of the Schengen agreement, such as Davis and Gift (2014) or Chen and Novy (2011), ignore that Schengen membership treats different country pairs differently, depending on the number of internal borders to be crossed. Moreover, existing studies do not always live up to state-of-the-art gravity modeling. E.g., they exclude services and domestic trade flows or fail to minimize omitted variable bias. We deal with these problems by (i) using a more accurate definition of treatment, (ii) employing the most recent and most adequate data, and (iii) making full use of newest methodological advances.

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2. Empirical Model

We start with the general structural gravity equation $X^s_{ij,t} = \frac{Y^s_{i,t}E^s_{j,t}}{Y^s_t} \cdot \left(\frac{\phi^s_{ij,t}}{\Omega^s_{i,t}\Phi^s_{i,t}}\right)^{-\epsilon}$, where $X^s_{ij,t}$ is the value of exports of country i to country j in sector s at time t, $Y^s_{i,t}$ is country i's value of production in sector s, $E^s_{j,t}$ is country j's expenditure in sector s, Y^s_t is the value of global output, $\phi^s_{ij,t}$ measures bilateral trade costs, and $\Omega^s_{i,t}$ and $\Phi^s_{i,t}$ are "multilateral resistance" terms; see Head and Mayer (2015). ϵ is the trade elasticity.

We assume that $\phi^s_{ij,t}$ is an exponential function of our Schengen measure and of indicator variables measuring whether i and j are both members of the EU, the Eurozone, or any other regional trade agreement (RTA). This implies the following empirical gravity model

$$\begin{aligned} X^s_{ij,t} =& exp\left[\beta^s \text{Schengen}_{ij,t} + \gamma^s_1 \ln Y^s_{i,t} + \gamma^s_2 \ln E^s_{j,t} + \boldsymbol{\alpha^s Z}^s_{ij,t} + \boldsymbol{\mu^s_5 MR}^s_{ij,t}\right. \\ &\left. + \nu^s_{ij} + \nu^s_t\right] + \varepsilon^s_{ij,t}, \end{aligned} \tag{1}$$

where ν^s_{ij} and ν^s_t are country-pair and year fixed effects.

We are interested in unbiased estimates of the treatment effects β^s. Contrary to the literature, we do *not* define $\text{Schengen}_{ij,t}$ as a binary variable taking value 1 if country i and country j have both ratified the Schengen agreement. Such a definition mismeasures the treatment. A land-borne trade flow in Europe from i to j may cross up to 8 internal Schengen borders.[1] Moreover, the pair ij may benefit from lower transit costs, even if i and/or j are outsiders to Schengen. Therefore, we use a count variable $\text{Schengen}_{ij,t} = \{1, \ldots, 8\}$ registering the number of Schengen border crossings that land-borne trade between i and j involves.

Selection into Schengen may not be random. The estimate of β^s would be upward biased if trade shocks $\varepsilon^s_{ij,t} > 0$ increase the odds of i and j being affected by Schengen. However, joining Schengen is not a bilateral decision, and transportation costs between countries i and j depend on the Schengen status of transit countries. Thus, reverse causation may not be a major issue. Nonetheless, we introduce country-pair fixed effects to account for all time-invariant determinants that might jointly affect $\text{Schengen}_{ij,t}$ and $X^s_{ij,t}$. This also addresses omitted variable bias and the endogeneity of other policy variables.

We follow Baier and Bergstrand (2009) in dealing with unobserved multilateral resistance terms.[2] Finally, we include domestic trade ($i = j$). Dai et al. (2014) show that this is important conceptually and quantitatively for the *ex post* evaluation of trade policy.

We estimate (1) by Poisson Pseudo Maximum Likelihood (PPML) methods as recommended by Santos Silva and Tenreyro (2006).[3] Identification relies

[1] Evidence from France suggests that about three quarters of intra-European trade is land-borne; see `www.statistiques.developpementdurable.gouv.frntransportsn873.html`.

[2] The vector $\mathbf{MR}^s_{ij,t}$ includes first-order approximations of the terms $\Omega^s_{i,t}$ and $\Phi^s_{i,t}$ for all types of trade costs. For any trade cost proxy C_{ij} we have $MR\_C^s_{ij,t} = \left[\left(\sum_{k=1}^C \lambda^s_{k,t}C_{ik}\right) + \left(\sum_{m=1}^C \delta^s_{m,t}C_{mj}\right) - \left(\sum_{k=1}^C \sum_{m=1}^C \lambda^s_{k,t}\delta^s_{m,t}C_{km}\right)\right]$, where $\delta^s_{m,t}$ is country m's share in total world supply $S^s_{m,t}/S^s_t$ in sector s, and $\lambda^s_{k,t}$ is an analogously defined sectoral demand share.

[3] Standard errors allow for clustering at the country-pair-sector level.

on the time variance within country pairs with different exposure to Schengen borders relative to the total number of borders crossed (captured by the bilateral fixed effect ν_{ij}^{s}).

3. Data

We use yearly bilateral data on goods and services trade flows between and within countries, and sectoral output and expenditure data from the World Input-Output Database (WIOD) for 40 countries and the years 1995 to 2011. Geographical and historical variables stem from CEPII. Information on RTAs comes from the WTO.[4]

Data on the successive accession of countries to the Schengen Agreement stem from the European Commission.[5] We combine GIS data with information from Google Maps to count the number of Schengen borders to be crossed by truck (and ferry) moving from economic centers of i to j in year t. In 2011, a share of 35% of goods trade of EU countries crosses 1 Schengen border. The share is 17%, 7%, and 3% for 2, 3 or more than 3 borders, respectively. For services trade the shares are 21%, 13%, 7%, and 3%, respectively. The residual originates from outside the EU-27. Air-borne trade is unlikely to benefit from the Schengen agreement; sea-borne trade, however, may well benefit, as goods are shipped from major seaports to consumers (see robustness checks).

4. Benchmark results

Table 1 provides results for total, goods, and services trade. Even-numbered columns show that the effect of a *single* Schengen border between a country pair leads to an increase in goods trade of about 3.8% and of services trade of 3.5%.[6] Assuming a trade elasticity $\epsilon = 5$, estimates imply *ad valorem* tariff equivalents (AVTEs) of 0.74% in goods trade, and of 0.68% in services trade.[7] Failing to account for regional integration, as in the odd-numbered columns, leads to omitted variable bias and drastically inflates the Schengen effect.

Country pairs differ in the number of internal Schengen borders crossed by bilateral land-borne trade. When two internal borders are involved, the AVTE for goods amounts to 1.5%;[8] with three border crossings we get 2.2%, and so forth; analogously for services trade. Accounting for the different trade structures of all EU-27 country pairs, the total average trade creating effect of Schengen is 3.29%, i.e., an AVTE of 0.67% (applying $\epsilon = 5$).[9]

[4] See Appendix Tables A.1 to A.3 for sample details.

[5] Starting with 7 countries in 1995, the agreement was joined by Italy and Austria in 1997, Greece in 2000, Denmark, Finland, and Sweden in 2001, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Slovakia, and Slovenia in 2007. The EU members Bulgaria, Croatia, Ireland, Romania and the United Kingdom do not participate in Schengen while the non-EU countries Iceland, Norway, and Switzerland do.

[6] The latter effect is borderline significant. Estimated coefficients are translated by calculating $100\% \times [e^{\beta} - 1]$.

[7] We calculate AVTEs as $100\% \times [(e^{\beta})^{(1/\epsilon)} - 1]$.

[8] $[(e^{2 \cdot \beta})^{(1/\epsilon)} - 1] \times 100\%$.

[9] We believe that an average Schengen AVTE of below 1% is entirely plausible. Schengen does speed up the flow of traffic, but effects should not be overstated. Evidence from the US-Canadian border suggests that waiting times for trucks are about 20 minutes on average (see Web Appendix, Table A.4).

Table 1
The Impact of Schengen on Bilateral Exports (1995 - 2011)

Dep. var.:	Bilateral Exports					
	Total Trade		Goods		Services	
	(1)	(2)	(3)	(4)	(5)	(6)
Schengen$_{ij,t}$	0.060***	0.004	0.118***	0.037***	0.060***	0.034
	(0.01)	(0.01)	(0.02)	(0.01)	(0.02)	(0.02)
Both EU$_{ij,t}$		0.651***		0.820***		0.330***
		(0.09)		(0.09)		(0.09)
Both Euro$_{ij,t}$		0.029		0.123***		0.079*
		(0.03)		(0.03)		(0.05)
Other RTA$_{ij,t}$		0.276***		0.324***		0.168**
		(0.08)		(0.08)		(0.08)
ln Supply$_{i,t}$	0.651***	0.649***	0.741***	0.737***	0.555***	0.550***
	(0.07)	(0.07)	(0.07)	(0.07)	(0.09)	(0.09)
ln Demand$_{j,t}$	0.438***	0.438***	0.399***	0.394***	0.445***	0.453***
	(0.07)	(0.07)	(0.07)	(0.07)	(0.09)	(0.09)
Loglikelihood	-2.06e+06	-1.97e+06	-1.48e+06	-1.39e+06	-1.57e+06	-1.56e+06
Chi^2	50116.256	58571.098	62478.267	85772.771	51653.521	68971.997

Note: ***, **, * denote significance at the 1%, 5%, 10% levels, respectively. Robust standard errors (in parentheses) allow for clustering at the country-pair level. Pair and time fixed effects as well as separate multilateral resistance terms for all trade costs proxies (distance, contiguity, and all trade policy indicators) included but not reported. Number of observations: 27,200.

Depending on their geographical location, Schengen affects countries differently. Calculating average AVTEs by EU member states,[10] we find that peripheral countries such as Finland, Estonia, and Latvia display the highest AVTEs (1.19%, 1.13%, and 1.07%, respectively (see Web Appendix, Table A.14). These countries typically trade across several internal EU borders. At the lower end, central economies such as Germany or France display smaller AVTEs (0.54% and 0.51%, respectively). Ireland features the lowest AVTE, 0.23%, as it trades a lot with non-Schengen countries. Non-EU countries such as Russia and Turkey also benefit. The respective AVTEs are 0.45% and 0.72%.

5. Robustness Analysis

Each cell in Table 2 reports the Schengen effect obtained from alternative regressions. First, we vary the sample (panel A). In the benchmark model, we have excluded products transported by pipeline or ship (gas, petrol, mining & quarrying products). Considering them, the effect of a Schengen border on bilateral goods exports amounts to an AVTE of 0.80%; see line [1].[11]

In line [2], we exclude the three most important trade partners of each country from the sample, as they could have driven the decision to join Schengen. This is supposed to reduce endogeneity concerns. The results support our previous findings. Line [3] focuses on *intra*continental European trade only (treating Turkey and Russia as Europe). Results remain very similar to our benchmark results. The effect on services trade is now more accurately measured.

[10] We average across goods and services, and trade partners.
[11] Assuming $\epsilon = 5$.

Table 2
Robustness: Schengen Effects in Alternative Models

Dep. var.: Bilateral Exports

	Total Trade	Goods	Services
	(1)	(2)	(3)
PANEL A: Alternative Sample Composition			
[1] Including mining, gas, petrol	0.012	0.040***	0.034
	(0.01)	(0.01)	(0.02)
[2] Excluding main bilateral trade partners	0.003	0.039***	0.040*
	(0.01)	(0.01)	(0.02)
[3] Intracontinental trade only (European Sample)	0.004	0.037***	0.037*
	(0.01)	(0.01)	(0.02)
PANEL B: Alternative Measurement of Treatment			
[4] Treating intercontinental trade flows	0.024**	0.051***	0.070***
	(0.01)	(0.01)	(0.03)
[5] Schengen as binary variable [0;1]	0.039**	0.087***	0.073
	(0.02)	(0.02)	(0.05)
[6] Chen and Novy (2011) indicator [0;0.5;1]	0.160***	0.229***	0.317***
	(0.03)	(0.03)	(0.07)
PANEL C: Alternative Econometric Choices			
[7] GDP instead of supply and demand	0.006	0.050***	0.036
	(0.01)	(0.02)	(0.02)
[8] Pooled over sectors	0.019***	0.030***	-0.002
	(0.01)	(0.01)	(0.02)
[9] No bilateral fixed effects	-0.120	-0.066	-0.143
	(0.08)	(0.07)	(0.09)

Note: ***, **, * denote significance at the 1%, 5%, 10% level, respectively. Robust clustered standard errors reported in parentheses. For details see Tables A.5-A.13 in the Web Appendix.

Panel B looks at alternative measurements of treatment. In line [4], we assume that *inter*continental trade with Schengen members crosses one internal Schengen border on average (e.g., as goods move from seaports to the interior of the continent). This increases estimates, leading to AVTEs of 0.48% for total trade, 1.02% for goods, and 1.4% for services. Line [5] (wrongly) employs a binary Schengen indicator as in Davis and Gift (2014), or Aussilloux and Le Hir (2016). This more than doubles the Schengen effect. Similarly, coding whether both, one or none of the trade partners are Schengen members ($Schengen = 0, 0.5, 1$), as in Chen and Novy (2011), strongly inflates the estimates (line [6]).

Panel C varies econometric choices. Line [7] uses importer and exporter GDP instead of sectoral supply and expenditure. This slightly increases the effects, suggesting AVTEs of 1% for goods and 0.72% for services trade. If we pool over all 35 sub-sectors instead of aggregating trade, we find a statistically significant effect on total and goods trade, but the effect on services vanishes (line [8]). Replacing bilateral fixed effects by explicit trade cost proxies, such as bilateral distance, adjacency and common language, leads to implausible effects not only on Schengen membership, but also on the other trade policy variables (see Web Appendix, Table A.13), a result reminiscent of Baier and Bergstrand (2007).

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Table A.1
Summary Statistics

variable	N	mean	sd	max	min
$\text{Exports}_{ij,t}$	27,200	20386.46	272131.3	1.24e+07	0
$\text{Schengen}_{ij,t}$	27,200	0.795	1.310	8	0
$\text{Schengen}_{ij,t}$ (S = 1)	27,200	0.988	1.251	8	0
$\text{Schengen}_{ij,t}$ [0;1]	27,200	0.134	0.340	1	0
$\text{Schengen}_{ij,t}$ [0;0.5;1]	27,200	0.343	0.347	1	0
ln $\text{Supply}_{i,t}$	27,200	13.032	1.819	17.063	8.777
ln $\text{Demand}_{j,t}$	27,200	12.331	1.819	16.543	8.264
ln $\text{GDP}_{i,t}$	26,520	26.240	1.848	30.373	22.004
ln $\text{GDP}_{j,t}$	26,520	26.240	1.848	30.373	22.004
Both $\text{EU}_{ij,t}$	27,200	0.265	0.441	1	0
Both $\text{Euro}_{ij,t}$	27,200	0.078	0.269	1	0
Other $\text{RTA}_{ij,t}$	27,200	0.232	0.422	1	0
ln Distance_{ij}	27,200	8.029	1.142	9.812	2.134
Adjacency_{ij}	27,200	0.056	0.230	1	0
$\text{Common Language}_{ij}$	27,200	0.049	0.215	1	0
MR $\text{Schengen}_{ij,t}$	27,200	0.019	0.013	0.088	-6.36e-06
MR $\text{Schengen}_{ij,t}$ (S = 1)	27,200	0.033	0.020	0.118	0.003
MR $\text{Schengen}_{ij,t}$ [0;1]	27,200	0.004	0.004	0.013	-1.78e-06
MR $\text{Schengen}_{ij,t}$ [0;0.5;1]	27,200	0.014	0.008	0.031	.005
MR Both $\text{EU}_{ij,t}$	27,200	0.007	0.005	0.017	-2.75e-06
MR Both $\text{Euro}_{ij,t}$	27,200	0.003	0.003	0.012	-1.38e-06
MR Other $\text{RTA}_{ij,t}$	27,200	0.006	0.006	0.042	-2.94e-06
MR Adjacency_{ij}	27,200	0.003	0.003	0.018	-1.73e-06
MR $\text{Common Language}_{ij}$	27,200	0.004	0.005	0.025	-2.99e-06
MR ln Distance_{ij}	27,200	0.415	0.011	0.465	0.392

Note: Summary statistics for the complete sample and total trade.

Table A.2
WIOD Country List

ISO Code	Country
AUS	Australia
AUT	Austria
BEL	Belgium
BGR	Bulgaria
BRA	Brazil
CAN	Canada
CHN	China, People's Rep. of
CYP	Cyprus
CZE	Czech Republic
DEU	Germany
DNK	Denmark
ESP	Spain
EST	Estonia
FIN	Finland
FRA	France
GBR	United Kingdom
GRC	Greece
HUN	Hungary
IDN	Indonesia
IND	India
IRL	Ireland
ITA	Italy
JPN	Japan
KOR	Korea
LTU	Lithuania
LUX	Luxembourg
LVA	Latvia
MEX	Mexico
MLT	Malta
NLD	Netherlands
POL	Poland
PRT	Portugal
ROM	Romania
RUS	Russia
SVK	Slovak Republic
SVN	Slovenia
SWE	Sweden
TUR	Turkey
TWN	Taiwan
USA	United States

Table A.3
WIOD Sector List

Sector	ISIC rev.3	Description
C01	AtB	Agriculture, Hunting, Forestry and Fishing
C02	C	Mining and Quarrying
C03	15t16	Food, Beverages and Tobacco
C04	17t18	Textiles and Textile Products
C05	19	Leather, Leather and Footwear
C06	20	Wood and Products of Wood and Cork
C07	21t22	Pulp, Paper, Paper , Printing and Publishing
C08	23	Coke, Refined Petroleum and Nuclear Fuel
C09	24	Chemicals and Chemical Products
C10	25	Rubber and Plastics
C11	26	Other Non-Metallic Mineral
C12	27t28	Basic Metals and Fabricated Metal
C13	29	Machinery, Nec
C14	30t33	Electrical and Optical Equipment
C15	34t35	Transport Equipment
C16	36t37	Manufacturing, Nec; Recycling
C17	E	Electricity, Gas and Water Supply
C18	F	Construction
C19	50	Sale, Maintenance and Repair of Motor Vehicles and Motorcycles; Retail Sale of Fuel
C20	51	Wholesale Trade and Commission Trade, Except of Motor Vehicles and Motorcycles
C21	52	Retail Trade, Except of Motor Vehicles and Motorcycles; Repair of Household Goods
C22	H	Hotels and Restaurants
C23	60	Inland Transport
C24	61	Water Transport
C25	62	Air Transport
C26	63	Other Supporting and Auxiliary Transport Activities; Activities of Travel Agencies
C27	64	Post and Telecommunications
C28	J	Financial Intermediation
C29	70	Real Estate Activities
C30	71t74	Renting of M&Eq and Other Business Activities
C31	L	Public Admin and Defense; Compulsory Social Security
C32	M	Education
C33	N	Health and Social Work
C34	O	Other Community, Social and Personal Services
C35	P	Private Households with Employed Persons

Table A.4
Waiting time for commercial vehicles and traffic volume at US–Canadian border checkpoints, 2014

	Waiting time (minutes)				
Border Station	mean	min	max	# vehicles	Station share
ME: Calais	0	0	0	62,352	1.1%
ME: Houlton	1	0	6	84,043	1.4%
ME: Jackman	0	0	0	84,755	1.5%
ME: Madawaska	3	0	15	19,238	0.3%
MI: Detroit	20	10	30	1,600,000	27.6%
MI: Port Huron	7	0	37	778,268	13.4%
MI: Sault Ste. Marie	5	0	15	38,932	0.7%
MN: Intertiol Falls	0	0	0	16,528	0.3%
MT: Sweetgrass	20	10	45	145,803	2.5%
ND: Pembi	18	12	36	229,079	3.9%
NY: Alexandria Bay	15	NA	NA	192,551	3.3%
NY: Buff.-Niagara Falls	24	11	36	962,076	16.6%
NY: Champ.-Rouses Pt.	45	NA	NA	285,195	4.9%
NY: Massena	0	0	0	23,188	0.4%
NY: Ogdensburg	10	NA	NA	37,726	0.7%
VT: Derby Line	20	NA	NA	97,836	1.7%
VT: Highgate Springs	15	NA	NA	93,914	1.6%
VT: Norton	0	0	0	11,161	0.2%
WA: Blaine	8	0	0	367,994	6.3%
WA: Lynden	10	NA	NA	41,580	0.7%
WA: Point Roberts	10	NA	NA	18,121	0.3%
WA: Sumas	25	10	100	149,361	2.6%
Other	NA	NA	NA	462,508	8.0%
Weighted Mean / Sum	18			5,802,209	100%

Table A.5
The Impact of Schengen on Bilateral Exports (1995 - 2011)

Dep. var.:	Bilateral Exports					
	Total Trade		Goods		Services	
	(1)	(2)	(3)	(4)	(5)	(6)
Schengen$_{ij,t}$	0.066***	0.012	0.116***	0.040***	0.060***	0.034
	(0.01)	(0.01)	(0.02)	(0.01)	(0.02)	(0.02)
Both EU$_{ij,t}$		0.614***		0.753***		0.330***
		(0.08)		(0.09)		(0.09)
Both Euro$_{ij,t}$		0.053*		0.142***		0.079*
		(0.03)		(0.03)		(0.05)
Other RTA$_{ij,t}$		0.251***		0.279***		0.168**
		(0.08)		(0.08)		(0.08)
ln Supply$_{i,t}$	0.650***	0.650***	0.736***	0.734***	0.555***	0.550***
	(0.06)	(0.06)	(0.06)	(0.06)	(0.09)	(0.09)
ln Demand$_{j,t}$	0.439***	0.438***	0.396***	0.393***	0.445***	0.453***
	(0.06)	(0.06)	(0.07)	(0.07)	(0.09)	(0.09)
Loglikelihood	-2.25e+06	-2.17e+06	-1.67e+06	-1.58e+06	-1.57e+06	-1.56e+06
Chi^2	45113.504	56925.728	56312.327	76454.872	51653.521	68971.997

Note: ***, **, * denote significance at the 1%, 5%, 10% level, respectively. Robust clustered standard errors reported in parentheses. Pair and time fixed effects included but not reported. All specifications include multilateral resistance terms for all trade costs. Number of observations: 27,200.

Table A.6
Endogeneity of Schengen and Bilateral Exports, excluding Gas, Fuel, Coke, Mining & Quarrying and the (1995 - 2011)

Dep. var.:	Bilateral Exports					
	Total Trade		Goods		Services	
	(1)	(2)	(3)	(4)	(5)	(6)
Schengen$_{ij,t}$	0.067***	0.003	0.122***	0.039***	0.076***	0.040*
	(0.01)	(0.01)	(0.02)	(0.01)	(0.02)	(0.02)
Both EU$_{ij,t}$		0.659***		0.857***		0.358***
		(0.07)		(0.08)		(0.08)
Both Euro$_{ij,t}$		0.044		0.080**		0.122**
		(0.03)		(0.04)		(0.05)
Other RTA$_{ij,t}$		0.236***		0.306***		0.147**
		(0.06)		(0.07)		(0.07)
ln Supply$_{i,t}$	0.767***	0.785***	0.903***	0.916***	0.632***	0.637***
	(0.06)	(0.06)	(0.06)	(0.06)	(0.08)	(0.07)
ln Demand$_{j,t}$	0.307***	0.289***	0.253***	0.235***	0.379***	0.379***
	(0.06)	(0.06)	(0.07)	(0.07)	(0.08)	(0.07)
Loglikelihood	-1.40e+06	-1.34e+06	-9.72e+05	-8.99e+05	-1.03e+06	-1.02e+06
Chi^2	1.04e+05	1.32e+05	67919.163	89270.864	1.47e+05	1.82e+05

Note: ***, **, * denote significance at the 1%, 5%, 10% level, respectively. Robust clustered standard errors reported in parentheses. Pair and time fixed effects included but not reported. All specifications include multilateral resistance terms for all trade costs. All specifications exclude the 3 most important trade partners of each country. Number of observations: 25,150.

Table A.7

The Impact of Schengen on Bilateral Exports, excluding Gas, Fuel, Coke, Mining & Quarrying, European Sample (1995 - 2011)

Dep. var.:	Bilateral Exports					
	Total Trade		Goods		Services	
	(1)	(2)	(3)	(4)	(5)	(6)
Schengen$_{ij,t}$	0.062***	0.004	0.121***	0.037***	0.066***	0.037*
	(0.01)	(0.01)	(0.02)	(0.01)	(0.02)	(0.02)
Both EU$_{ij,t}$		1.007***		1.400***		0.481***
		(0.11)		(0.10)		(0.17)
Both Euro$_{ij,t}$		0.034		0.137***		0.086*
		(0.03)		(0.03)		(0.04)
Other RTA$_{ij,t}$		0.632***		0.883***		0.321*
		(0.10)		(0.10)		(0.16)
ln Supply$_{i,t}$	0.611***	0.576***	0.743***	0.720***	0.523***	0.518***
	(0.06)	(0.05)	(0.08)	(0.06)	(0.10)	(0.10)
ln Demand$_{j,t}$	0.418***	0.399***	0.417***	0.413***	0.456***	0.454***
	(0.06)	(0.05)	(0.08)	(0.06)	(0.10)	(0.10)
Loglikelihood	-5.93e+05	-5.33e+05	-4.34e+05	-3.52e+05	-5.76e+05	-5.70e+05
Chi^2	62097.003	69811.617	15871.899	22316.468	98296.483	1.05e+05

Note: ***, **, * denote significance at the 1%, 5%, 10% level, respectively. Robust clustered standard errors reported in parentheses. Pair and time fixed effects included but not reported. All specifications include multilateral resistance terms for all trade costs. Number of observations: 14,297.

Table A.8

The Impact of Schengen on Bilateral Exports, excluding Gas, Fuel, Coke, Mining & Quarrying, Intercontinental Trade with one Schengen Border (1995 - 2011)

Dep. var.:	Bilateral Exports					
	Total Trade		Goods		Services	
	(1)	(2)	(3)	(4)	(5)	(6)
Schengen$_{ij,t}$	0.074***	0.024**	0.123***	0.051***	0.089***	0.070***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.03)
Both EU$_{ij,t}$		0.630***		0.808***		0.288***
		(0.09)		(0.09)		(0.09)
Both Euro$_{ij,t}$		0.023		0.121***		0.068
		(0.03)		(0.03)		(0.05)
Other RTA$_{ij,t}$		0.275***		0.323***		0.165**
		(0.08)		(0.08)		(0.08)
ln Supply$_{i,t}$	0.651***	0.650***	0.745***	0.741***	0.552***	0.547***
	(0.07)	(0.07)	(0.07)	(0.07)	(0.09)	(0.09)
ln Demand$_{j,t}$	0.438***	0.438***	0.391***	0.389***	0.446***	0.455***
	(0.07)	(0.07)	(0.07)	(0.07)	(0.09)	(0.09)
Loglikelihood	-2.05e+06	-1.97e+06	-1.48e+06	-1.39e+06	-1.56e+06	-1.56e+06
Chi^2	50586.561	56258.018	66397.315	91842.524	51453.920	68565.280

Note: ***, **, * denote significance at the 1%, 5%, 10% level, respectively. Robust clustered standard errors reported in parentheses. Pair and time fixed effects included but not reported. All specifications include multilateral resistance terms for all trade costs. Number of observations: 27,200.

Table A.9

The Impact of Schengen on Bilateral Exports, excluding Gas, Fuel, Coke, Mining & Quarrying, Dummy (1995 - 2011)

Dep. var.:	Bilateral Exports					
	Total Trade		Goods		Services	
	(1)	(2)	(3)	(4)	(5)	(6)
Schengen [0;1]	0.158***	0.039**	0.269***	0.087***	0.139***	0.073
	(0.02)	(0.02)	(0.03)	(0.02)	(0.04)	(0.05)
Both EU$_{ij,t}$		0.632***		0.808***		0.329***
		(0.09)		(0.09)		(0.09)
Both Euro$_{ij,t}$		0.022		0.116***		0.076
		(0.03)		(0.03)		(0.05)
Other RTA$_{ij,t}$		0.275***		0.324***		0.169**
		(0.08)		(0.08)		(0.08)
ln Supply$_{i,t}$	0.651***	0.650***	0.742***	0.740***	0.559***	0.552***
	(0.07)	(0.07)	(0.07)	(0.07)	(0.09)	(0.09)
ln Demand$_{j,t}$	0.439***	0.438***	0.393***	0.389***	0.444***	0.452***
	(0.07)	(0.07)	(0.07)	(0.07)	(0.09)	(0.09)
Loglikelihood	-2.05e+06	-1.97e+06	-1.48e+06	-1.39e+06	-1.57e+06	-1.56e+06
Chi^2	50154.363	55240.969	67862.869	92824.498	51240.148	65530.836

Note: ***, **, * denote significance at the 1%, 5%, 10% level, respectively. Robust clustered standard errors reported in parentheses. Pair and time fixed effects included but not reported. All specifications include multilateral resistance terms for all trade costs. Number of observations: 27,200.

Table A.10

The Impact of Schengen on Bilateral Exports, excluding Gas, Fuel, Coke, Mining & Quarrying, Indicator (1995 - 2011)

Dep. var.:	Bilateral Exports					
	Total Trade		Goods		Services	
	(1)	(2)	(3)	(4)	(5)	(6)
Schengen [0;0.5;1]	0.308***	0.160***	0.464***	0.229***	0.359***	0.317***
	(0.04)	(0.03)	(0.04)	(0.03)	(0.06)	(0.07)
Both EU$_{ij,t}$		0.594***		0.773***		0.241***
		(0.09)		(0.09)		(0.09)
Both Euro$_{ij,t}$		0.013		0.112***		0.056
		(0.03)		(0.03)		(0.05)
Other RTA$_{ij,t}$		0.273***		0.321***		0.159**
		(0.08)		(0.09)		(0.08)
ln Supply$_{i,t}$	0.651***	0.650***	0.742***	0.741***	0.557***	0.551***
	(0.07)	(0.07)	(0.07)	(0.07)	(0.09)	(0.09)
ln Demand$_{j,t}$	0.438***	0.438***	0.389***	0.388***	0.441***	0.452***
	(0.07)	(0.07)	(0.07)	(0.07)	(0.09)	(0.09)
Loglikelihood	-2.03e+06	-1.97e+06	-1.47e+06	-1.38e+06	-1.56e+06	-1.55e+06
Chi^2	52576.137	56754.353	68566.711	94428.832	54075.249	73759.910

Note: ***, **, * denote significance at the 1%, 5%, 10% level, respectively. Robust clustered standard errors reported in parentheses. Pair and time fixed effects included but not reported. All specifications include multilateral resistance terms for all trade costs. Number of observations: 27,200.

Table A.11
The Impact of Schengen on Bilateral Exports, excluding Gas, Fuel, Coke, Mining & Quarrying (1995 - 2011)

Dep. var.:	Bilateral Exports					
	Total Trade		Goods		Services	
	(1)	(2)	(3)	(4)	(5)	(6)
Schengen$_{ij,t}$	0.062***	0.006	0.131***	0.050***	0.065***	0.036
	(0.01)	(0.01)	(0.02)	(0.02)	(0.02)	(0.02)
Both EU$_{ij,t}$		0.656***		0.841***		0.355***
		(0.09)		(0.12)		(0.09)
Both Euro$_{ij,t}$		0.029		0.118***		0.092**
		(0.03)		(0.04)		(0.05)
Other RTA$_{ij,t}$		0.277***		0.337***		0.180**
		(0.09)		(0.11)		(0.08)
ln GDP$_{i,t}$	0.549***	0.554***	0.594***	0.606***	0.491***	0.491***
	(0.08)	(0.08)	(0.10)	(0.10)	(0.10)	(0.10)
ln GDP$_{j,t}$	0.557***	0.552***	0.604***	0.599***	0.566***	0.567***
	(0.08)	(0.08)	(0.10)	(0.10)	(0.11)	(0.11)
Loglikelihood	-2.25e+06	-2.15e+06	-2.24e+06	-2.11e+06	-1.59e+06	-1.58e+06
Chi^2	28369.799	40205.748	29958.568	50374.317	56140.795	65459.896

Note: ***, **, * denote significance at the 1%, 5%, 10% level, respectively. Robust clustered standard errors reported in parentheses. Pair and time fixed effects included but not reported. All specifications include multilateral resistance terms for all trade costs. Number of observations: 25,857.

Table A.12
The Impact of Schengen on Bilateral Exports, excluding Gas, Fuel, Coke, Mining & Quarrying, Pooled over Sectors (1995 - 2011)

Dep. var.:	Bilateral Exports					
	Total Trade		Goods		Services	
	(1)	(2)	(3)	(4)	(5)	(6)
Schengen$_{ij,t}$	0.072***	0.019***	0.089***	0.030***	0.028	-0.002
	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.02)
Both EU$_{ij,t}$		0.639***		0.678***		0.326***
		(0.08)		(0.09)		(0.08)
Both Euro$_{ij,t}$		0.048***		0.074***		0.082*
		(0.01)		(0.02)		(0.04)
Other RTA$_{ij,t}$		0.300***		0.300***		0.141*
		(0.08)		(0.09)		(0.07)
ln Supply$_{i,t}$	0.982***	0.981***	0.951***	0.948***	1.143***	1.143***
	(0.03)	(0.03)	(0.04)	(0.04)	(0.04)	(0.04)
ln Demand$_{j,t}$	0.098***	0.096***	0.205***	0.199***	-0.122***	-0.121***
	(0.03)	(0.03)	(0.06)	(0.06)	(0.04)	(0.04)
Observations	829,480	829,480	379,881	379,881	449,599	449,599
Loglikelihood	-8.72e+06	-8.65e+06	-4.04e+06	-3.97e+06	-4.50e+06	-4.49e+06
Chi^2	41539.646	44494.024	23639.866	25889.461	46167.965	47137.939

Note: ***, **, * denote significance at the 1%, 5%, 10% level, respectively. Robust clustered standard errors reported in parentheses. Pair and time fixed effects included but not reported. All specifications include multilateral resistance terms for all trade costs.

Table A.13

The Impact of Schengen on Bilateral Exports, excluding Gas, Fuel, Coke, Mining & Quarrying, Pooled PPML with fixed effects (1995 - 2011)

Dep. var.:	Bilateral Exports					
	Total Trade		Goods		Services	
	(1)	(2)	(3)	(4)	(5)	(6)
Schengen$_{ij,t}$	-0.436***	-0.120	-0.185***	-0.066	-0.670***	-0.143
	(0.06)	(0.08)	(0.05)	(0.07)	(0.09)	(0.09)
ln Distance$_{ij}$	-2.323***	-2.227***	-2.035***	-1.979***	-2.709***	-2.544***
	(0.06)	(0.06)	(0.06)	(0.06)	(0.08)	(0.06)
Adjacency$_{ij}$	-1.681***	-0.874***	-0.932***	-0.486***	-3.193***	-1.581***
	(0.12)	(0.15)	(0.10)	(0.15)	(0.31)	(0.19)
Common Language$_{ij}$	0.003	0.201	0.061	0.214	0.513	0.586**
	(0.23)	(0.17)	(0.20)	(0.15)	(0.32)	(0.25)
Both EU$_{ij,t}$		-1.099***		-0.512***		-1.666***
		(0.19)		(0.16)		(0.22)
Both Euro$_{ij,t}$		0.289**		0.206**		0.245
		(0.11)		(0.09)		(0.19)
Other RTA$_{ij,t}$		-1.402***		-0.983***		-2.364***
		(0.15)		(0.15)		(0.20)
Loglikelihood	-4.53e+07	-3.65e+07	-2.37e+07	-2.09e+07	-2.52e+07	-1.90e+07

Note: ***, **, * denote significance at the 1%, 5%, 10% level, respectively. Robust clustered standard errors reported in parentheses. Country × time fixed effects included but not reported. Number of observations: 27,200.

Table A.14
Average Tariff Equivalents due to Schengen, by Country

Country	Average Tariff Equivalents ($\epsilon = 5$)			Share of Schengen Trade in Total Trade		
	Goods	Services	Total	Goods	Services	Total
AUT	0.73%	0.52%	0.65%	72.71%	50.68%	64.16%
BEL	0.87%	0.68%	0.79%	74.40%	59.89%	68.12%
BGR	0.70%	0.54%	0.63%	47.00%	37.70%	42.83%
CYP	0.71%	0.44%	0.51%	44.87%	28.53%	32.81%
CZE	0.80%	0.64%	0.76%	75.69%	60.18%	72.01%
DEU	0.59%	0.36%	0.54%	60.02%	42.55%	55.85%
DNK	0.88%	0.47%	0.62%	69.89%	38.09%	50.05%
ESP	0.93%	0.79%	0.87%	67.12%	58.03%	63.36%
EST	1.24%	1.02%	1.13%	68.87%	52.50%	61.04%
FIN	1.31%	0.95%	1.19%	52.29%	43.26%	49.35%
FRA	0.58%	0.37%	0.51%	58.87%	39.88%	52.89%
GBR	0.59%	0.49%	0.53%	45.58%	38.03%	41.22%
GRC	0.71%	0.41%	0.48%	45.04%	28.27%	32.67%
HUN	1.19%	0.87%	1.09%	73.13%	55.39%	67.53%
IRL	0.28%	0.19%	0.23%	23.79%	15.96%	19.62%
ITA	0.86%	0.71%	0.81%	60.68%	48.83%	56.53%
LTU	1.14%	0.37%	0.63%	78.92%	28.26%	45.45%
LUX	0.92%	0.51%	0.55%	86.06%	42.98%	47.30%
LVA	1.27%	0.93%	1.07%	67.76%	50.20%	57.51%
MLT	0.83%	0.97%	0.92%	51.16%	59.95%	56.52%
NLD	0.93%	0.59%	0.77%	72.05%	45.39%	59.77%
POL	0.93%	0.65%	0.84%	72.23%	49.66%	64.60%
PRT	1.27%	0.82%	1.07%	79.40%	58.41%	70.27%
ROM	0.96%	0.67%	0.82%	57.13%	42.77%	50.03%
RUS	0.40%	0.48%	0.45%	30.71%	33.99%	32.68%
SVK	1.06%	0.81%	0.99%	79.37%	69.53%	76.60%
SVN	1.00%	0.66%	0.89%	73.98%	53.29%	67.00%
SWE	1.15%	0.62%	0.92%	60.83%	36.08%	50.36%
TUR	0.64%	0.91%	0.72%	40.60%	59.00%	46.10%
EU 27 Mean	0.90%	0.63%	0.79%	63.66%	45.71%	56.52%
EU 27 Median	0.92%	0.64%	0.77%	67.76%	45.39%	54.65%
EU 27	0.76%	0.54%	0.67%	62.03%	43.92%	54.96%

Note: AVTEs have been calculated dependent on each country's trade volumes of goods and services trade across the number of Schengen borders. The counterfactual trade volumes have been calculated respective of estimated Schengen effects from the gravity estimation. AVTEs result from the difference in counterfactual (cf) to observed (obs) trade, assuming $\epsilon = 5$: $(X^{cf}/X^{obs})^{(1/\epsilon)} - 1$.

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