International Transport costs:
New Findings from modeling additive costs

Online Appendix (Not for Publication)

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A. Three models: Comparison

The paper compares the empirical performances of two models: one with only ad-valorem costs (Model (A)) and one with where both ad-valorem and additive costs (Model (B)). In the interest of comprehensiveness, we also estimate the model with only additive costs (Model (C)), in which case the estimated equation is:

$$\ln\left(\frac{p_{ik}}{\widetilde{p}_{ik}} - 1\right) = \ln\left(\frac{t_i + t_{s(k)}}{\widetilde{p}_{ik}}\right) + \epsilon_{ik}^{add}$$

This section is devoted to presenting the results. Precisely, we first compare the estimates of the transport costs components under the three models. In a second step, we report quality of fit tests for the three models.

A.1. Estimation results

In this section, we report the estimation results of the three models: Model (A) (with only ad-valorem costs), Model (B) (with both additive and ad-valorem) and Model (C) (with only additive costs). Table A.1 reports the results for air transport, Table A.2 for vessel transport.

Table A.1: Estimation results of the three models (Air, products at 5-digit level, sectors at 3-digit level)

	1974	1980	1990	2000	2010	2019
Data						
# obs.	14,955	16,118	24,958	35,027	40,284	44,133
# sectors	203	204	212	218	216	218
# origin countries	152	165	181	208	210	213
Observed transport costs						
Mean (in %)	5.3	4.0	4.1	2.8	3.1	2.3
Median (in %)	3.3	1.6	1.9	1.4	1.9	1.6
Std. dev.	6.7	6.4	6.0	4.8	5.2	3.6
Model (A)						
Multiplicative term ($\widehat{\tau}^{ice} - 1$)						
Mean (in %)	6.9	5.4	5.0	3.6	4.2	3.0
Median (in %)	5.4	3.8	4.4	2.5	3.4	2.6
Std. dev.	5.2	4.9	3.9	3.3	3.7	2.3
Model (B)						
Multiplicative term ($\widehat{\tau}^{adv} - 1$)						
Mean (in %)	3.6	2.3	2.4	1.7	2.6	2.0
Median (in %)	2.7	1.6	1.6	1.2	2.2	1.8
Std. dev.	3.2	2.5	2.1	1.6	2.3	1.5
Additive term ($\widehat{t}/\widetilde{p}$)						
Mean (in %)	2.6	2.0	1.8	1.3	1.1	0.6
Median (in %)	1.1	0.5	0.8	0.5	0.4	0.3
Std. dev.	4.0	4.1	3.3	2.8	2.4	1.7
Share of additive costs ($\widehat{\beta}$)						
Mean (in %)	0.34	0.33	0.33	0.31	0.21	0.19
Median (in %)	0.30	0.28	0.29	0.30	0.18	0.13
Std. dev.	0.24	0.23	0.21	0.20	0.18	0.19
Model (C)						
Additive term ($\widehat{t}^{add}/\widetilde{p}$)						
Mean (in %)	6.9	4.8	4.4	3.1	4.4	2.9
Median (in %)	4.4	1.8	2.3	1.4	2.7	1.6
Std. dev.	9.4	8.3	10.0	5.5	7.4	5.6

Statistics are weighted by value
Model (A): Iceberg transport costs only
Model (B): With additive and ad-valorem transport costs
Model (C): With additive transport costs only

Table A.2: Estimation results of the three models (Vessel, products at 5-digit level, sectors at 3-digit level)

	1974	1980	1990	2000	2010	2019
Data						
# obs.	19,007	17,356	28,383	36,093	37,748	41,137
# sectors	239	232	232	230	226	223
# origin countries	154	163	179	206	198	212
Observed transport costs						
Mean (in %)	8.9	6.2	5.4	5.3	4.2	4.1
Median (in %)	7.3	4.9	4.1	4.3	3.2	3.0
Std. dev.	6.7	5.0	4.8	4.7	3.6	3.5
Model (A)						
Multiplicative term ($\widehat{\tau}^{ice} - 1$)						
Mean (in %)	9.8	6.5	5.7	5.1	4.0	3.9
Median (in %)	9.6	5.5	4.6	4.8	3.5	3.8
Std. dev.	5.3	4.0	3.2	2.8	2.0	1.7
Model (B)						
Multiplicative term ($\widehat{\tau}^{adv} - 1$)						
Mean (in %)	5.4	3.1	3.3	2.5	1.9	2.0
Median (in %)	4.9	2.4	2.8	2.1	1.8	1.7
Std. dev.	4.1	2.3	2.2	2.1	1.7	1.4
Additive term ($\widehat{t}/\widetilde{p}$)						
Mean (in %)	5.1	3.4	2.8	2.8	2.5	2.2
Median (in %)	2.9	2.3	1.7	2.2	1.9	1.8
Std. dev.	8.5	4.6	4.1	4.3	2.5	2.3
Share of additive costs ($\widehat{\beta}$)						
Mean (in %)	0.41	0.50	0.39	0.51	0.54	0.50
Median (in %)	0.38	0.51	0.38	0.48	0.53	0.47
Std. dev.	0.30	0.25	0.21	0.28	0.30	0.25
Model (C)						
Additive term ($\widehat{t^{add}}/\widetilde{p}$)						
Mean (in %)	14.4	10.0	10.2	8.0	6.3	5.9
Median (in %)	9.5	6.7	6.3	4.9	4.6	4.3
Std. dev.	25.2	17.0	17.6	15.9	9.8	13.7

Statistics are weighted by value
Model (A): Iceberg transport costs only
Model (B): With additive and ad-valorem transport costs
Model (C): With additive transport costs only

Results for Models (A) and (B) are identical to those reported in the paper. Unsurprisingly, the estimated size of overall transport costs under Model (C) is of same order of magnitude as in Models (A) and (B). We also observe a downward trend of transport costs over time, in particular since 1980.

A.2. Quality of fit diagnostic tests

To go further into the comparison of the empirical relevance of our three empirical models (A), (B) and (C), we compare quality of fit diagnostic tests in this section. Table A.3 reports the results for air transport, and Table A.4 those for vessel transport. In both tables, we report the values of the R^2, the Standard Error of Regression (SER), the AIC criterion and the log-likelihood (LL) value. We also report the value of the log-likelihood ratio that tests the quality of fit of the global model (Model (B)) compared to the other two models.

Table A.3: Quality-of-fit diagnostic tests, Air, 3-digit level

	1974	1980	1990	2000	2010	2019
R^2						
Model (A)	0.44	0.48	0.46	0.47	0.42	0.28
Model (B)	0.59	0.65	0.63	0.64	0.51	0.37
Model (C)	0.49	0.54	0.52	0.52	0.34	0.26
SER (in %)						
Model (A)	4.7	4.5	4.1	3.4	3.7	2.9
Model (B)	3.8	3.2	3.0	2.1	2.7	2.3
Model (C)	6.8	5.2	8.1	2.7	4.7	4.3
AIC criteria						
Model (A)	35,672	41,166	60,718	87,494	102,297	123,708
Model (B)	31,386	35,740	52,099	74,955	95,887	118,554
Model (C)	40,795	45,149	69,448	100,126	129,293	148,246
Log-likelihood						
Model (A)	-17,498	-20,265	-29,976	-43,341	-50,747	-61,500
Model (B)	-15,114	-17,264	-25,393	-36,788	-47,278	-58,607
Model (C)	-20,055	-22,216	-34,349	-49,694	-64,251	-73,728
Test LL						
Stat LL ratio (B vs A)	4,768	6,001	9,166	13,105	6,938	5,787
# of restrictions (B vs A)	355	369	393	426	426	431
p-value (B vs A)	0.00	0.00	0.00	0.00	0.00	0.00
Stat LL ratio (B vs C)	9,882	9,905	17,911	25,811	33,948	30,242
# of restrictions (B vs C)	355	369	393	426	426	431
p-value (B vs C)	0.00	0.00	0.00	0.00	0.00	0.00

SER are weighted by value
Model (A): Iceberg transport costs only
Model (B): With additive and ad-valorem transport costs
Model (C): With additive transport costs only

For all years and whatever the transport mode considered, the model with additive costs only (Model (C)) is consistently dominated (in terms of quality of fit properties) by the model with multiplicative costs only (Model (A)), which is itself consistently dominated by the complete model (Model (B)), whatever the type of diagnostic test considered. That justifies our choice to disregard Model (C) in the main text.

B. Estimation at the 4-digit level

XXX UPDATE XXX : Est-ce fait? In this section, we report the estimation results when we retain the 4-digit classification level (s=4-digit).

Table A.4: Quality-of-fit diagnostic tests, Vessel, 3-digit level

	1974	1980	1990	2000	2010	2019
***R*²**						
Model (A)	0.45	0.41	0.46	0.40	0.35	0.31
Model (B)	0.61	0.58	0.59	0.57	0.49	0.45
Model (C)	0.42	0.40	0.44	0.43	0.37	0.33
SER (in %)						
Model (A)	5.5	4.3	3.5	3.4	2.6	2.8
Model (B)	6.5	3.4	3.8	3.3	2.1	2.3
Model (C)	22.5	15.3	16.3	13.8	8.9	12.9
AIC criteria						
Model (A)	33,322	33,016	51,143	71,370	84,780	98,016
Model (B)	27,332	28,068	43,676	60,437	76,161	89,292
Model (C)	46,075	44,374	69,427	88,750	100,272	114,008
Log-likelihood						
Model (A)	-16,288	-16,129	-25,169	-35,264	-41,995	-48,600
Model (B)	-12,986	-13,356	-21,178	-29,480	-37,419	-43,967
Model (C)	-22,689	-21,814	-34,350	-43,963	-49,744	-56,616
Test LL						
Stat LL ratio (B vs A)	6,605	5,546	7,983	11,567	9,153	9,266
# of restrictions (B vs A)	393	395	411	436	424	435
p-value (B vs A)	0.00	0.00	0.00	0.00	0.00	0.00
Stat LL ratio (B vs C)	19,406	16,915	26,344	28,965	24,651	25,298
# of restrictions (B vs C)	393	395	411	436	424	435
p-value (B vs C)	0.00	0.00	0.00	0.00	0.00	0.00

SER are weighted by value
Model (A): Iceberg transport costs only
Model (B): With additive and ad-valorem transport costs
Model (C): With additive transport costs only

B.1. Transport cost estimates

Tables A.5 and A.6 report the estimates of both models (with and without additive costs) in air and ocean transport respectively.

B.2. Goodness-of-fit tests at the 4-digit level

We now report the goodness-of-fit exercise (conducted by transport mode) at the 4-digit product classification level (for the selected years). The results are reported in Tables A.7 (for air) and A.8 (for vessel).

If anything, the quality of fit appears slightly higher when estimations are based on the 4-digit classification. This is especially true for the model restricting transport cost to their ad-valorem dimension, whatever the transport mode considered. When the additive part is taken into account however, the difference in goodness of fit between the 3- and the 4-digit classification level becomes very small, whatever the considered criterion. In other words, if using a more disaggregated classification unsurprisingly adds some statistical precision, this is not to an extent that would disqualify the use of slightly more aggregated data. Further, the same conclusion established at the 3-digit level regarding the significant role of the additive component in fitting international transport costs emerges at the 4-digit level.

Table A.5: Air: Transport costs estimates, selected years, 4-digit level

Year	1974	1981	1989	2001	2009	2013
Model (A) - With only Ad-Valorem TC ($\widehat{\tau}^{ice} - 1$, in %)						
Mean	6.6	5.8	5.2	3.3	3.7	3.2
Median	5.2	4.4	4.1	2.1	2.7	2.6
Model (B) - With Additive & Ad-Valorem TC						
Ad-valorem term ($\widehat{\tau}^{adv} - 1$, in %)						
Mean	3.5	2.6	3.1	1.5	2.1	1.6
Median	2.5	1.7	1.9	1.0	1.7	1.4
Additive term ($\widehat{t/\widetilde{p}}$), in %						
Mean	2.6	2.1	1.7	1.2	1.2	1.0
Median	1.2	0.6	0.6	0.5	0.4	0.4
# observations	14944	16844	25307	35005	38475	39460

Notes: TC = Transport Costs. Statistics are obtained weighting each observation by its share in trade (mode-dependent). Additive term expressed in fraction of fas price.

Table A.6: Vessel: Transport costs estimates, selected years, 4-digit level

Year	1974	1981	1989	2001	2009	2013
Model (a) - With only Ad-Valorem TC ($\widehat{\tau}^{ice} - 1$, in %)						
Mean	9.8	6.1	5.8	5.1	4.2	3.6
Median	9.4	5.1	4.8	4.5	3.8	3.1
Model (b) - With Additive & Ad-Valorem TC						
Ad-valorem term ($\widehat{\tau}^{adv} - 1$, in %)						
Mean	5.4	3.4	2.8	2.8	2.4	2.1
Median	4.9	3.0	2.4	2.5	2.6	1.8
Additive term ($\widehat{t^{add}/\widetilde{p}}$, in %)						
Mean	4.6	2.6	3.1	2.4	2.1	1.5
Median	2.9	1.3	1.9	1.5	1.3	0.8
# observations	19196	17916	29387	36677	37643	38820

Notes: TC = Transport Costs. Statistics are obtained weighting each observation by its share in trade (mode-dependent). Additive term expressed in fraction of fas price.

Table A.7: Air: Measures of goodness of fit, 4-digit level

	Year					
	1974	1981	1989	2001	2009	2013
R^2						
Model (a)	0.48	0.49	0.50	0.50	0.45	0.35
Model (b)	0.63	0.66	0.65	0.66	0.54	0.45
SER						
Model (a)	0.8	0.9	0.83	0.87	0.88	0.93
Model (b)	0.67	0.74	0.69	0.80	0.80	0.86
Log-likelihood						
Model (a)	-17505.6	-21813.5	-30960.6	-44067.6	-49375.6	-53197.9
Model (b)	-14895.8	-18589.9	-26553.5	-37297.9	-45747.6	-49899.1
AIC criteria						
Model (a)	36243.1	44966.9	63417.1	89747.2	100317.13	107963.7
Model (b)	31873.6	39495.8	55777.1	77439.9	94059.1	102224.3
Test LL						
2×(ll(UR) -ll(R))	5219.5	6447.1	8814.1	13539.4	7256.0	6597.5
# restrictions	640	698	778	833	824	818
p-value	0.00	0.000	0.00	0.00	0.00	0.000

Notes: Model (a) = with only ad-valorem transport costs. Model (b) = with additive & ad-valorem transport costs. R^2 between the log of predicted ratio and the log of the observed ratio. The number # of restrictions is equal to the number of parameters estimated, i.e. the number of partner countries plus the number of products.

Table A.8: Vessel: Measures of goodness of fit, 4-digit level

	Year					
	1974	1981	1989	2001	2009	2013
R^2						
Term I only	0.50	0.45	0.47	0.41	0.37	0.35
Terms A & I	0.66	0.62	0.62	0.58	0.51	0.46
SER						
Model (a)	0.58	0.64	0.61	0.0.72	0.79	0.82
Model (b)	0.48	0.53	0.51	0.61	0.69	0.75
Log-likelihood						
Model (a)	-16460.1	-16951.6	-26771.4	-39008.3	-43888.9	-47161.6
Model (b)	-12743.65	-13546.9	-21752.8	-33281.0	-39078.9	-43399.2
AIC criteria						
Model (a)	34464.2	35491.2	55272.9	79800.7	89459.8	95987.2
Model (b)	28271.3	29877.8	46595.6	69743.9	81155.7	89692.4
Test LL						
2×(ll(UR) -ll(R))	12385.80	11226.8	17354.7	20113.5	16608.2	12589.6
# restrictions	797	814	881	910	886	874
p-value	0.000	0.000	0.000	0.000	0.000	0.000

Notes: Model (A) = with only ad-valorem transport costs. Model (B) = with additive & ad-valorem transport costs. R^2 between the log of predicted ratio and the log of the observed ratio. The number # of restrictions is equal to the number of parameters estimated, i.e. the number of partner countries plus the number of products.

C. Transport Cost Estimates: Yearly Detailed Results

In this section, we complement Table 1 of the main text by reporting the year-to-year results of the estimation driven at the 3-digit classification level. Table B.1 reports the results for each year over 1974-2019 for vessel; Table B.2 reports similar results for air transport. In both cases, we report the estimated values of the transport costs (weighted mean and median) when only ad-valorem costs are modeled (Model (A)), when both additive and ad-valorem costs are modeled (Model (B)) and when only additive costs are modeled (Model (A)). In all tables, statistics are weighted by value.

Table B.1: Vessel: Transport costs estimates, all years, products at 5-digit level, sectors at 3-digit level

	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
Data														
# obs.	19,007	18,710	13,615	12,826	16,601	17,274	17,356	17,788	18,075	18,883	21,650	23,348	23,730	23,626
# sectors	239	239	227	191	234	237	232	231	231	231	232	232	233	234
# origin countries	154	151	160	162	161	164	163	165	160	157	160	171	172	171
Observed transport costs														
Mean (in %)	8.9	8.7	8.4	7.9	7.6	7.3	6.2	5.8	6.3	6.2	6.4	6.5	6.1	5.9
Median (in %)	7.3	7.2	7.0	6.5	6.6	5.9	4.9	4.8	5.2	5.1	5.4	5.6	4.5	4.5
Std. dev.	6.7	6.5	5.8	5.4	5.4	6.4	5.0	5.0	5.3	5.3	5.1	5.2	5.1	4.9
Model (A)														
Mult. term ($\widehat{\tau}^{ice}$)														
Mean (in %)	9.8	9.9	8.9	8.3	8.1	7.5	6.5	6.0	6.3	7.0	7.0	7.0	6.7	6.2
Median (in %)	9.6	8.5	8.0	7.3	7.1	6.5	5.5	5.0	5.9	5.7	6.1	6.7	7.0	6.3
Std. dev.	5.3	7.3	4.1	3.8	4.1	3.9	4.0	3.3	3.3	3.8	3.5	3.6	3.5	3.1
Model (B)														
Mult. term ($\widehat{\tau}^{adv}$)														
Mean (in %)	5.4	4.8	5.4	3.9	5.9	4.6	3.1	3.3	3.4	4.6	4.1	4.0	3.9	3.5
Median (in %)	4.9	4.1	4.8	3.2	5.4	4.1	2.4	2.9	2.9	4.0	3.5	3.6	3.6	3.0
Std. dev.	4.1	4.7	2.7	3.0	3.1	2.6	2.3	2.3	2.5	2.6	2.8	2.9	2.7	2.3
Additive term ($\widehat{t}/\widetilde{p}$)														
Mean (in %)	5.1	5.5	3.5	4.8	2.5	3.1	3.4	2.9	3.5	2.5	3.2	3.2	2.9	2.9
Median (in %)	2.9	3.7	1.9	3.8	1.2	1.7	2.3	1.5	2.3	1.6	2.2	2.1	1.8	1.8
Std. dev.	8.5	7.1	5.4	6.2	4.2	4.8	4.6	4.6	5.5	4.2	4.5	3.9	4.1	4.1
Elasticity ($\widehat{\beta}$)														
Mean (in %)	0.41	0.47	0.31	0.52	0.24	0.34	0.50	0.38	0.46	0.28	0.41	0.42	0.38	0.40
Median (in %)	0.38	0.46	0.27	0.57	0.20	0.33	0.51	0.33	0.46	0.27	0.36	0.37	0.33	0.38
Std. dev.	0.30	0.31	0.23	0.28	0.23	0.27	0.25	0.28	0.28	0.22	0.27	0.27	0.26	0.24
Model (C)														
Additive term ($\widehat{t}^{add}/\widetilde{p}$)														
Mean (in %)	14.4	14.9	14.2	15.0	11.1	12.8	10.0	9.7	10.8	11.0	11.1	10.6	10.0	9.0
Median (in %)	9.5	10.5	8.4	8.5	6.7	7.2	6.7	6.7	6.8	7.1	7.2	7.4	7.3	6.6
Std. dev.	25.2	23.6	22.9	23.1	35.9	27.8	17.0	15.9	50.0	17.3	22.6	18.0	15.8	16.1

Table B.1: Vessel, Yearly estimates, Continued

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Data														
# obs.	27,662	29,106	28,383	28,095	29,050	30,839	31,865	32,146	32,344	33,182	33,986	34,585	36,093	36,407
# sectors	234	231	232	230	232	232	232	228	228	229	231	230	230	229
# origin countries	183	182	179	182	198	201	206	201	206	206	204	209	206	209
Observed transport costs														
Mean, in %	5.6	5.3	5.4	5.2	4.9	4.9	5.0	5.0	4.6	4.5	4.9	5.2	5.3	5.2
Median, in %	4.1	4.1	4.1	3.8	3.7	3.7	3.8	3.7	3.5	3.2	3.5	3.8	4.3	3.9
Std. dev.	5.0	4.7	4.8	4.6	4.5	4.5	4.6	4.8	4.3	4.3	4.6	4.5	4.7	4.7
Model (A)														
Mult. term ($\widehat{\tau}^{ice}$)														
Mean (in %)	6.1	5.7	5.7	5.5	5.0	5.2	5.2	5.1	4.8	4.7	4.8	5.0	5.1	5.0
Median (in %)	5.7	4.8	4.6	4.4	4.2	4.6	4.1	4.3	3.9	3.9	3.9	4.5	4.8	4.6
Std. dev.	3.4	3.2	3.2	3.3	2.9	3.0	3.2	3.2	2.9	3.0	3.1	2.6	2.8	2.7
Model (B)														
Mult. term ($\widehat{\tau}^{adv}$)														
Mean (in %)	4.0	3.0	3.3	3.0	2.6	2.9	2.6	2.8	2.6	2.7	2.1	2.5	2.5	2.7
Median (in %)	3.5	2.6	2.8	2.7	2.3	2.6	2.2	2.5	2.2	2.3	1.8	2.1	2.1	2.6
Std. dev.	2.5	2.3	2.2	2.2	1.9	2.1	2.0	2.0	2.0	1.8	2.0	1.8	2.1	1.9
Additive term ($\widehat{t}/\widetilde{p}$)														
Mean (in %)	2.4	2.9	2.8	2.9	2.7	2.7	2.9	2.7	2.5	2.2	3.2	2.8	2.8	2.4
Median (in %)	1.3	2.0	1.7	1.8	1.8	1.6	2.0	1.8	1.6	1.3	2.0	2.0	2.2	1.6
Std. dev.	3.7	3.6	4.1	4.2	3.8	3.7	4.0	3.9	4.1	3.7	4.7	4.0	4.3	3.7
Share of additive costs ($\widehat{\beta}$)														
Mean	0.34	0.45	0.39	0.45	0.44	0.43	0.47	0.45	0.44	0.39	0.53	0.49	0.51	0.43
Median	0.34	0.42	0.38	0.44	0.46	0.40	0.45	0.45	0.43	0.38	0.47	0.46	0.48	0.43
Std. dev.	0.21	0.25	0.21	0.23	0.23	0.26	0.24	0.20	0.20	0.19	0.29	0.24	0.28	0.22
Model (C)														
Additive term ($\widehat{t}^{add}/\widetilde{p}$)														
Mean (in %)	8.9	8.6	10.2	9.1	8.1	8.1	8.4	8.4	8.0	8.0	8.2	8.0	8.0	7.8
Median (in %)	6.1	5.7	6.3	4.8	4.2	4.9	4.6	4.7	4.2	4.1	4.2	4.4	4.9	4.4
Std. dev.	17.9	18.3	17.6	15.6	13.3	12.2	13.7	15.4	15.0	14.9	15.8	14.2	15.9	14.4

Table B.1: Vessel, Yearly estimates, Continued

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Data														
# obs.	37,256	37,673	37,757	41,431	41,764	39,604	38,950	37,336	37,748	38,567	38,387	38,477	39,147	40,031
# sectors	229	229	230	229	231	227	228	226	226	227	223	224	225	225
# origin countries	206	211	210	206	207	207	199	207	198	202	203	203	203	204
Observed transport costs														
Mean (in %)	4.9	5.6	5.7	5.4	5.1	4.7	4.4	4.3	4.2	3.6	3.7	3.7	3.7	4.3
Median (in %)	3.8	4.5	4.8	3.9	3.7	3.6	3.6	3.5	3.2	2.6	2.9	2.6	2.8	3.3
Std. dev.	4.4	4.8	4.8	4.9	4.6	4.2	3.8	3.5	3.6	3.2	3.2	3.2	3.1	3.4
Model (A)														
Mult. term ($\widehat{\tau}^{ice}$ -1)														
Mean, in %	4.8	5.3	5.4	5.4	4.8	4.7	4.4	4.3	4.0	3.5	3.6	3.6	3.5	3.9
Median, in %	4.1	4.9	5.0	4.9	4.3	4.2	3.8	4.1	3.5	3.0	3.1	3.3	2.9	3.3
Std. dev.	2.6	2.8	2.9	2.6	2.6	2.3	2.2	2.1	2.0	1.8	1.8	1.8	1.8	1.9
Model (B)														
Mult. term ($\widehat{\tau}^{adv} - 1$)														
Mean, in %	2.1	2.4	2.7	2.6	2.3	2.5	2.1	2.2	1.9	1.8	1.8	2.2	2.0	2.0
Median, in %	1.7	1.9	2.8	2.2	1.9	2.3	1.8	2.0	1.8	1.6	1.4	1.8	1.6	1.7
Std. dev.	2.1	2.3	2.1	2.2	2.0	2.0	2.0	1.7	1.7	1.5	1.5	1.2	1.4	1.4
Additive term ($\widehat{t}/\widetilde{p}$)														
Mean (in %)	2.9	3.2	2.9	3.0	2.8	2.4	2.4	2.1	2.5	1.9	1.9	1.5	1.6	2.1
Median (in %)	2.3	2.5	1.9	2.2	1.9	1.8	2.1	1.7	1.9	1.6	1.6	0.8	1.2	1.6
Std. dev.	3.4	4.1	4.2	3.4	3.8	3.0	2.8	2.4	2.5	2.0	2.0	2.0	1.9	2.2
Share of additive costs ($\widehat{\beta}$)														
Mean	0.56	0.55	0.47	0.53	0.54	0.49	0.54	0.48	0.54	0.54	0.52	0.33	0.41	0.47
Median	0.53	0.48	0.45	0.50	0.52	0.45	0.53	0.47	0.53	0.52	0.52	0.30	0.40	0.47
Std. dev.	0.27	0.29	0.27	0.28	0.27	0.27	0.29	0.25	0.30	0.30	0.25	0.21	0.25	0.23
Model (C)														
Additive term ($\widehat{t}^{add}/\widetilde{p}$)														
Mean, in %	8.0	8.3	8.1	8.4	7.5	7.0	6.6	6.4	6.3	5.4	5.2	5.2	5.2	6.0
Median, in %	4.7	5.2	5.3	5.7	5.1	4.6	5.3	4.5	4.6	3.9	3.5	3.3	3.2	4.2
Std. dev.	13.9	13.9	13.2	14.7	13.1	14.8	9.5	8.1	9.8	6.9	7.6	8.7	7.7	8.4

Table B.1: Vessel, Yearly estimates, Continued

	2016	2017	2018	2019
Data				
# obs.	40,569	40,647	41,118	41,137
# sectors	225	225	222	223
# origin countries	207	208	209	212
Observed transport costs				
Mean (in %)	4.1	4.0	4.0	4.1
Median (in %)	3.2	3.2	2.8	3.0
Std. dev.	3.3	3.2	3.9	3.5
Model (A)				
Mult. term ($\widehat{\tau}^{ice}$)				
Mean (in %)	3.9	3.7	3.6	3.9
Median (in %)	3.3	3.4	3.1	3.8
Std. dev.	1.8	1.9	1.6	1.7
Model (B)				
Mult. term ($\widehat{\tau}^{adv}$)				
Mean (in %)	2.3	2.4	2.0	2.0
Median (in %)	2.0	2.0	1.8	1.7
Std. dev.	1.5	1.3	1.3	1.4
Additive term ($\widehat{t}/\widetilde{p}$)				
Mean (in %)	1.8	1.6	1.8	2.2
Median (in %)	1.4	1.0	1.3	1.8
Std. dev.	1.8	1.9	2.0	2.3
Elasticity ($\widehat{\beta}$)				
Mean (in %)	0.41	0.33	0.43	0.50
Median (in %)	0.41	0.34	0.42	0.47
Std. dev.	0.24	0.21	0.25	0.25
Model (C)				
Additive term ($\widehat{t}^{add}/\widetilde{p}$)				
Mean (in %)	5.9	5.8	5.5	5.9
Median (in %)	4.1	4.1	3.7	4.3
Std. dev.	8.0	8.1	9.1	13.7

As mentioned in the paper, the estimates for air transport costs in 1989 show a surprisingly high value for the additive component (the additive cost is estimated to amount to 4.6% of the export price, whereas it amounts to 2.5% on average between 1974 and 1988, and to 1.7% over the following decade 1990-2000). This can be attributed to the presence of outliers in the distribution of the additive costs estimates. The maximum value for $\widehat{t}/\widetilde{p}$ is 10,000% in 1989, whereas it amounts to 1,690% on average over 1974-1988 and to 1,500% on average over 1990-2000. Accordingly, in the paper we discard this year 1989 when we report the average values over the period of the transport costs estimates in air transport.

Still, this does not make much difference. When 1989 is included, the weighed mean transport cost value amounts to 1.9% for the ad-valorem component, vs 1.8% when 1989 is excluded. The weighed median value is left unchanged at 2.9% whether 1989 is included or not.

Table B.2: Air: Transport costs estimates, all years, products at 5-digit level, sectors at 3-digit level

	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
Data														
# obs.	14,955	15,299	11,397	10,707	15,222	15,684	16,118	16,864	17,322	18,181	20,644	19,908	20,695	20,793
# sectors	203	200	189	156	204	202	204	205	207	211	213	207	206	210
# origin countries	152	157	166	159	169	169	165	164	164	165	163	169	171	172
Observed transport costs														
Mean (in %)	5.3	6.0	6.0	6.8	5.3	4.6	4.0	4.5	4.6	5.1	5.5	5.4	5.7	5.8
Median (in %)	3.3	3.0	2.9	3.2	2.5	2.3	1.6	1.8	1.9	1.9	2.5	2.7	2.7	2.8
Std. dev.	6.7	7.7	7.5	8.4	7.2	6.3	6.4	6.8	7.0	7.6	7.9	7.3	7.6	7.7
Model (A)														
Mult. term ($\widehat{\tau}^{ice}$)														
Mean (in %)	6.9	7.5	7.2	7.7	6.9	6.1	5.4	6.0	6.4	6.9	7.2	6.1	6.2	6.6
Median (in %)	5.4	6.4	6.9	7.2	6.3	5.3	3.8	4.8	5.4	6.1	6.9	5.5	5.5	6.3
Std. dev.	5.2	5.3	5.0	5.7	5.1	4.9	4.9	5.1	5.4	5.7	5.6	4.8	5.0	4.8
Model (B)														
Mult. term ($\widehat{\tau}^{adv}$)														
Mean (in %)	3.6	3.7	3.7	4.2	3.2	3.0	2.3	2.8	2.8	2.6	3.3	2.5	3.2	2.6
Median (in %)	2.7	2.6	2.8	3.0	2.1	2.4	1.6	1.8	1.9	1.9	2.7	1.8	2.1	2.0
Std. dev.	3.2	3.1	3.0	3.6	2.9	2.7	2.5	2.7	2.6	2.6	2.9	2.2	2.9	2.4
Additive term ($\widehat{t}/\widetilde{p}$)														
Mean (in %)	2.6	3.0	2.5	2.8	2.5	2.1	2.0	2.0	2.3	2.8	2.5	2.8	2.6	2.9
Median (in %)	1.1	1.2	1.0	1.2	1.0	0.7	0.5	0.6	0.8	1.0	1.0	1.3	1.2	1.4
Std. dev.	4.0	4.8	3.8	5.2	4.3	3.8	4.1	4.3	4.9	5.0	4.3	4.1	3.9	4.4
Elasticity ($\widehat{\beta}$)														
Mean (in %)	0.34	0.34	0.30	0.32	0.33	0.29	0.33	0.29	0.32	0.38	0.30	0.42	0.36	0.45
Median (in %)	0.30	0.28	0.29	0.28	0.28	0.24	0.28	0.26	0.30	0.41	0.28	0.41	0.34	0.45
Std. dev.	0.24	0.23	0.22	0.23	0.22	0.22	0.23	0.23	0.22	0.23	0.22	0.22	0.24	0.21
Model (C)														
Additive term ($\widehat{t}^{add}/\widetilde{p}$)														
Mean (in %)	6.9	7.6	7.1	8.1	6.6	5.6	4.8	5.2	5.5	6.2	6.2	6.0	6.5	6.2
Median (in %)	4.4	4.4	4.1	4.2	3.2	2.5	1.8	2.2	2.7	2.9	2.9	3.4	3.6	3.5
Std. dev.	9.4	10.3	11.7	13.4	27.1	9.5	8.3	9.9	10.7	10.1	9.8	8.4	9.8	8.7

Table B.2: Air, Vessel, Yearly estimates, Continued

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Data														
# obs.	24,665	25,197	24,958	25,156	26,192	28,297	29,948	31,038	32,187	33,502	33,492	33,523	35,027	34,885
# sectors	217	213	212	213	214	216	214	217	217	224	221	219	218	219
# origin countries	186	185	181	180	200	200	206	207	208	207	211	208	208	210
Observed transport costs														
Mean (in %)	4.7	4.4	4.1	4.0	3.7	3.7	3.5	3.3	3.0	3.0	2.8	2.9	2.8	2.7
Median (in %)	2.2	2.0	1.9	1.8	1.6	1.8	1.6	1.7	1.5	1.5	1.5	1.4	1.4	1.3
Std. dev.	6.7	6.4	6.0	6.0	5.7	5.8	5.5	5.1	4.9	5.1	5.0	5.0	4.8	4.8
Model (A)														
Mult. term ($\widehat{\tau}^{ice}$)														
Mean (in %)	5.7	5.3	5.0	5.1	4.9	5.1	4.6	4.6	4.2	4.1	3.8	3.8	3.6	3.5
Median (in %)	5.3	4.6	4.4	4.5	4.5	4.4	3.7	3.8	3.1	3.0	2.7	2.8	2.5	2.4
Std. dev.	4.3	4.1	3.9	4.1	3.9	4.0	3.8	3.5	3.5	3.5	3.5	3.4	3.3	3.4
Model (B)														
Mult. term ($\widehat{\tau}^{adv}$)														
Mean (in %)	3.1	3.1	2.4	2.7	2.2	2.3	2.2	2.1	1.9	1.8	1.8	1.7	1.7	1.6
Median (in %)	2.0	1.8	1.6	1.5	1.5	1.6	1.3	1.4	1.4	1.3	1.3	1.4	1.2	1.1
Std. dev.	2.9	2.7	2.1	2.5	2.1	2.1	2.1	1.8	1.9	1.9	1.8	1.7	1.6	1.8
Additive term ($\widehat{t}/\widetilde{p}$)														
Mean (in %)	1.7	4.6	1.8	1.8	1.9	1.9	1.7	1.6	1.5	1.5	1.4	1.4	1.3	1.3
Median (in %)	1.0	0.7	0.8	0.6	0.9	0.8	0.8	0.7	0.6	0.6	0.5	0.5	0.5	0.5
Std. dev.	2.9	168.6	3.3	4.2	3.6	3.7	3.5	3.4	3.1	2.8	3.0	2.9	2.8	2.8
Elasticity ($\widehat{\beta}$)														
Mean (in %)	0.33	0.29	0.33	0.32	0.36	0.34	0.36	0.34	0.32	0.36	0.34	0.33	0.31	0.35
Median (in %)	0.31	0.28	0.29	0.30	0.36	0.33	0.33	0.33	0.31	0.35	0.32	0.29	0.30	0.34
Std. dev.	0.22	0.22	0.21	0.23	0.22	0.21	0.23	0.20	0.20	0.20	0.19	0.20	0.20	0.20
Model (C)														
Additive term ($\widehat{t}^{add}/\widetilde{p}$)														
Mean (in %)	4.8	17.9	4.4	4.6	4.3	4.4	4.0	3.8	3.6	3.6	3.4	3.3	3.1	3.1
Median (in %)	2.4	2.3	2.3	2.2	2.1	2.0	1.7	1.7	1.6	1.7	1.6	1.6	1.4	1.4
Std. dev.	8.4	790.9	10.0	9.2	8.2	7.8	7.1	9.2	6.8	6.4	6.1	5.9	5.5	5.7

Table B.2: Air, yearly estimates, Continued

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Data														
# obs.	35,161	35,891	36,991	41,806	42,554	40,859	40,164	38,279	40,284	41,191	40,912	40,049	40,683	42,311
# sectors	218	220	219	217	219	217	218	217	216	218	216	212	212	216
# origin countries	209	212	210	211	208	210	209	209	210	209	210	210	209	210
Observed transport costs														
Mean (in %)	3.2	3.1	3.1	3.1	2.8	3.0	3.1	2.8	3.1	3.0	2.7	2.5	2.5	2.6
Median (in %)	1.4	1.4	1.3	1.4	1.3	1.6	1.8	1.6	1.9	1.9	1.7	1.6	1.7	1.7
Std. dev.	5.8	5.5	5.5	5.5	5.2	5.5	5.3	4.8	5.2	4.6	4.3	4.0	3.8	3.9
Model (A)														
Mult. term ($\widehat{\tau}^{ice}$)														
Mean (in %)	3.8	3.9	4.0	4.1	3.9	4.1	4.1	4.0	4.2	3.9	3.7	3.4	3.2	3.2
Median (in %)	2.7	2.6	2.9	3.0	2.7	3.0	3.2	3.0	3.4	3.1	3.0	2.9	3.2	2.9
Std. dev.	3.8	3.7	3.6	3.6	3.5	3.7	3.6	3.6	3.7	3.4	3.2	2.4	2.2	2.2
Model (B)														
Mult. term ($\widehat{\tau}^{adv}$)														
Mean (in %)	1.6	1.9	1.9	2.0	1.8	2.3	2.3	2.3	2.6	2.2	2.2	1.7	1.7	1.9
Median (in %)	1.2	1.4	1.4	1.6	1.4	1.9	1.9	1.8	2.2	1.7	1.9	1.7	1.4	1.8
Std. dev.	1.8	1.9	2.0	1.9	2.1	2.3	2.3	2.3	2.3	2.2	2.1	1.2	1.1	1.3
Additive term ($\widehat{t}/\widetilde{p}$)														
Mean (in %)	1.6	1.4	1.5	1.4	1.3	1.2	1.2	1.2	1.1	1.1	0.9	1.0	1.0	0.8
Median (in %)	0.5	0.5	0.6	0.5	0.5	0.5	0.5	0.5	0.4	0.4	0.4	0.5	0.4	0.3
Std. dev.	3.5	3.2	3.0	3.0	2.7	2.6	2.6	2.5	2.4	2.2	1.9	2.0	1.9	1.7
Elasticity ($\widehat{\beta}$)														
Mean (in %)	0.36	0.30	0.33	0.29	0.31	0.24	0.24	0.23	0.21	0.24	0.24	0.27	0.27	0.20
Median (in %)	0.35	0.26	0.33	0.27	0.27	0.20	0.21	0.19	0.18	0.19	0.22	0.25	0.23	0.15
Std. dev.	0.21	0.19	0.20	0.21	0.21	0.18	0.18	0.19	0.18	0.20	0.18	0.20	0.21	0.17
Model (C)														
Additive term ($\widehat{t}^{add}/\widetilde{p}$)														
Mean (in %)	3.6	3.7	3.7	3.8	3.5	4.3	4.3	4.3	4.4	3.9	3.7	3.3	3.2	3.1
Median (in %)	1.7	1.7	1.7	1.9	1.6	2.4	2.4	2.3	2.7	2.4	2.3	2.1	2.0	1.7
Std. dev.	6.5	6.6	6.6	6.6	6.4	7.3	7.3	7.5	7.4	6.5	6.3	4.9	4.8	5.0

Table B.2: Air, yearly estimates, Continued

	2016	2017	2018	2019
Data				
# obs.	42,618	43,235	44,030	44,133
# sectors	220	219	217	218
# origin countries	213	212	212	213
Observed transport costs				
Mean (in %)	2.3	2.6	2.5	2.3
Median (in %)	1.6	1.4	1.6	1.6
Std. dev.	3.6	3.8	3.7	3.6
Model (A)				
Mult. term ($\widehat{\tau}^{ice}$)				
Mean (in %)	3.0	3.3	3.2	3.0
Median (in %)	2.3	3.0	2.9	2.6
Std. dev.	2.3	2.4	2.3	2.3
Model (B)				
Mult. term ($\widehat{\tau}^{adv}$)				
Mean (in %)	1.8	2.0	1.8	2.0
Median (in %)	1.7	1.9	1.7	1.8
Std. dev.	1.2	1.4	1.3	1.5
Additive term ($\widehat{t}/\widetilde{p}$)				
Mean (in %)	0.7	0.8	0.8	0.6
Median (in %)	0.2	0.4	0.3	0.3
Std. dev.	1.7	1.9	1.8	1.7
Elasticity ($\widehat{\beta}$)				
Mean (in %)	0.18	0.20	0.20	0.19
Median (in %)	0.16	0.13	0.14	0.13
Std. dev.	0.17	0.18	0.19	0.19
Model (C)				
Additive term ($\widehat{t}^{add}/\widetilde{p}$)				
Mean (in %)	2.7	3.0	3.0	2.9
Median (in %)	1.4	1.8	1.8	1.6
Std. dev.	5.0	5.1	5.7	5.6

D. Eliminating the composition effects: Primary vs. Manufacturing sector

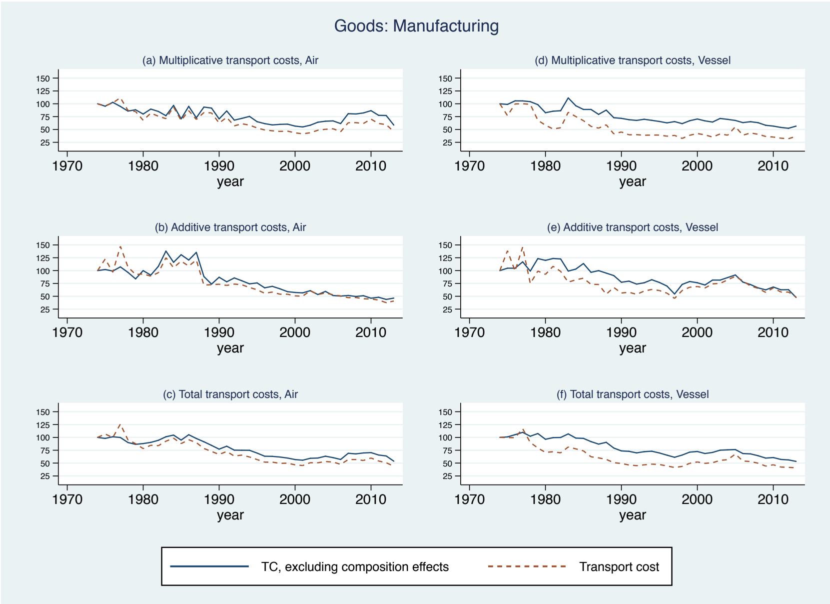
In this section, we refine the characterization of the evolution of international transport costs by distinguishing primary goods trade flows and and manufactured goods trade flows. The evolution in transport costs over time, by transport mode (overall transport costs and composition effects excluded) are reported in Figure C.1 for the manufacturing sector, and in Figure C.2 for the primary goods. For easing comparison, we also report the results obtained on the whole range of trade flows (i.e., Figure 2 of the paper), in Figure C.3.

The classification retained to categorize trade flows follows the UNCTAD classification (on STIC Revision 3)[1]. Are considered as "primary goods" all flows recorded as "Food

[1]See "UNCTAD product groupings and composition (SITC Rev. 3)" in http://unctadstat.unctad.org/EN/Classifications.html, accessed Septembre 2018

and live animals" (First digit "0" in the SITC Classification), "Beverages and tobacco" (First digit "1"), "Crude materials, inedible, except fuels" (First digit "2"), "Mineral fuels, lubricants and related materials" (First digit "3"), "Animal and vegetable oils, fats and waxes" (First digit "4"), "Pearls, precious & semi-precious stones" (Classified "667" in the SITC Classification) and "Non-ferrous metals" (classified "68" in the SITC Classification).

Figure C.1: Transport costs (with and without composition effects), Manufacturing



As reported in Figures C.1 and C.2, both the "pure" transport costs and the unfitted measure, in the red dashed have regularly declined over the period in both sectors, by roughly the same order of magnitude (50% in air, 60% in vessel for overall transport costs, panels (c) and (f)). However the role of trade composition effects in accounting for this trend pattern differs depending on the sector.

In the manufacturing sector, Figure C.1) reports a very similar time trend decomposition than what is obtained on the whole range of goods (Figure C.3). In air transport, most of the decrease can be imputed to the reduction of"ceteris paribus" transport costs (the blue continuous line), trade composition effects playing virtually no role (Figure C.1, left-hand panels (a), (b) and (c)). Trade composition effects matter more in vessel transport (Figure C.1, right-hand panels (d), (e) and (f)), primarily in the ad-valorem component. As for the whole range of flows, the 60% decrease in the unfitted transport costs in vessel can de decomposed in a 50% decrease in the "ceteris paribus" transport costs (fitted), the 10% remaining to trade composition effects.

The situation is strikingly different for primary goods only. In this case, it is in air transport that composition effects do matter (Figure C.2, left-hand panels (a), (b) and (c)), while we observe not much role for them in vessel transport (Figure C.2, left-hand panels (d), (e) and (f)). Furthermore, in air transport, composition effects matter by partially offsetting the decrease in the "ceteris paribus" transport costs (ie, implying a reduction in the "raw" transport costs over time much less pronounced than the fitted transport cost measures).

One explanation for the similarity between the results for the manufacturing goods trade and for total trade can be found in the share of primary goods in total flows as

Figure C.2: Transport costs (with and without composition effects), Primary goods

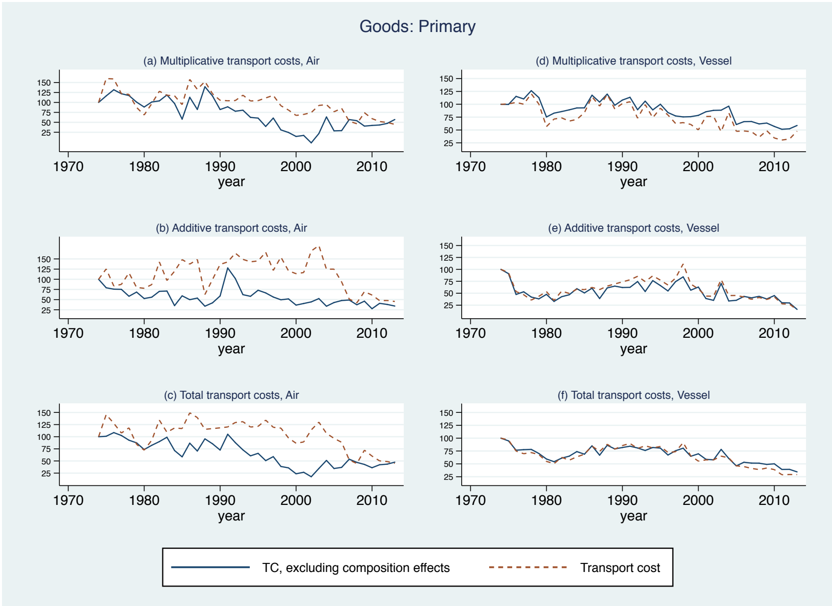
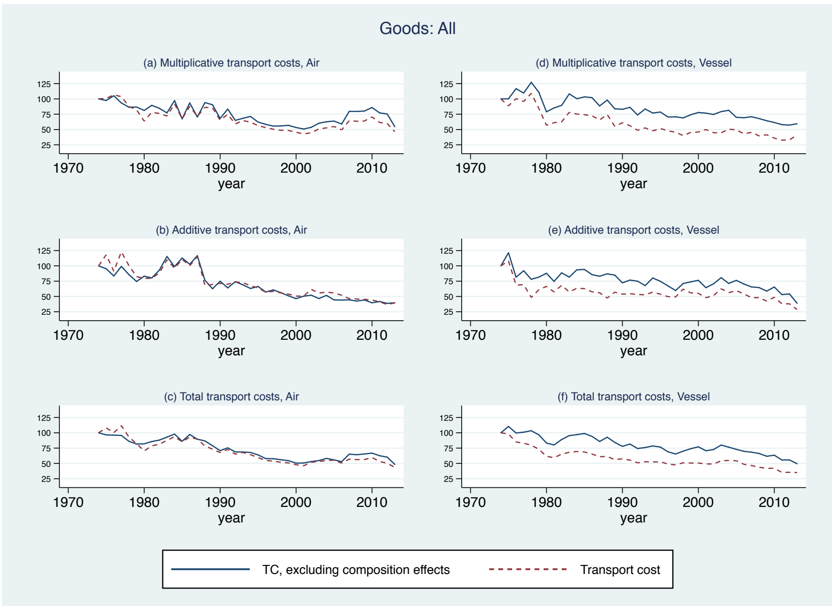


Figure C.3: Transport costs (with and without composition effects)



reported in Figure C.4. In air transport, the share of primary goods in the total value of US imports is very small, around 10%. Primary goods make a higher proportion of trade flows in vessel transport, especially over 1974-1982 (between 40% and 60%). On the following sub-period though, their share has fallen to 20-30%. Given the modest proportion of primary goods in total import flows of the US economy compared to the manufactured sector, it is hence not surprising that the diagnosis made about the time trend of transport costs when all types of flows are considered is driven by the trend patterns that occur within the manufacturing sector.

Figure C.4: Share of primary goods in the value of total US imports