Supplementary Materials for
From Beijing to Bentonville:
Do Multinational Retailers Link Markets?

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Table 1: City presence on bilateral exports, Individual retailers, L.2, for footnote 8

	(1) FRA	(2) DEU	(3) GBR	(4) USA	(5) 4 countries	(6) 50 countries
$\text{cityGPC}^{Carrefour}_{o,t-2}$	0.267[b]				0.121[b]	0.0939[b]
	(0.102)				(0.0544)	(0.0380)
$\text{cityRS}^{Carrefour}_{o,t-2}$	0.324				0.136	0.152[c]
	(0.235)				(0.0988)	(0.0786)
$\text{cityGPC}^{Metro}_{o,t-2}$		.			.	.
		.			.	.
$\text{cityRS}^{Metro}_{o,t-2}$		0.704[a]			0.352[a]	0.335[b]
		(0.146)			(0.112)	(0.125)
$\text{cityGPC}^{Tesco}_{o,t-2}$			0.456[a]		0.140[c]	0.0591
			(0.135)		(0.0723)	(0.0440)
$\text{cityRS}^{Tesco}_{o,t-2}$			.		.	.
			.		.	.
$\text{cityGPC}^{Walmart}_{o,t-2}$				0.149[b]	0.149[c]	0.158[b]
				(0.0647)	(0.0744)	(0.0610)
$\text{cityRS}^{Walmart}_{o,t-2}$				-0.228	-0.00847	0.106
				(0.176)	(0.140)	(0.0817)
ln(gviopa_{ot})	-0.0645	0.147	-0.0754	0.181[b]	-0.0374	0.0669
	(0.208)	(0.111)	(0.131)	(0.0866)	(0.0915)	(0.0819)
ln(pop_{ot})	-0.315	-0.194	-0.327	-0.135	-0.0799	-0.0804
	(0.550)	(0.452)	(0.466)	(0.217)	(0.350)	(0.133)
Constant	20.54[a]	13.41[a]	22.27[a]	14.27[a]	20.80[a]	14.60[a]
	(6.303)	(4.041)	(4.681)	(2.737)	(3.191)	(2.326)
year FE	Yes	Yes	Yes	Yes	No	No
city FE	Yes	Yes	Yes	Yes	No	No
city-country FE	No	No	No	No	Yes	Yes
country-year FE	No	No	No	No	Yes	Yes
N	315	315	315	315	1260	14141
R^2	0.145	0.294	0.333	0.598	0.339	0.256
groups	35	35	35	35	140	1716
S.E of u_i	1.862	1.800	1.953	1.900	2.089	2.867
S.E.of e_{it}	0.642	0.380	0.462	0.341	0.461	0.874
RMSE	0.605	0.358	0.435	0.321	0.434	0.817

Note: Robust standard errors in parentheses are clustered at the city level with [a], [b], and [c] respectively denoting significance at the 1%, 5% and 10% levels.

Table 2: Bilateral presence, with linkage variables both parts lagged, for footnote 9

	(1)	(2)	(3)	(4)	(5)
	Bilateral retailer effects			Comparison	Mundlak
$\text{GPC}^{2pl}_{od,t-1}$	0.116	0.370^{a}	-0.0377	0.229^{b}	-0.0377
	(0.0749)	(0.107)	(0.0960)	(0.101)	(0.0958)
$\text{RS}^{2pl}_{od,t-1}$	0.0275	0.0611^{b}	0.00702	0.0348	0.00702
	(0.0232)	(0.0232)	(0.0198)	(0.0234)	(0.0198)
$\text{cityGPC}_{o,t-1}$				0.139^{c}	-0.0951
				(0.0729)	(0.0774)
$\text{cityRS}_{o,t-1}$				0.0986	-0.283
				(0.0897)	(0.192)
mean($GPC^{2pl}_{od,t-1}$)					1.110^{a}
					(0.229)
mean($RS^{2pl}_{od,t-1}$)					0.183
					(0.147)
ln(gviopa_{ot})	0.308^{b}	0.260^{c}		0.218^{c}	0.0130
	(0.141)	(0.129)		(0.123)	(0.283)
ln(pop_{ot})	-0.239	-0.161		-0.0289	-2.105^{a}
	(0.150)	(0.125)		(0.138)	(0.442)
ln(gdppa_{dt})	1.021^{a}				
	(0.114)				
ln(pop_{dt})	2.184^{b}				
	(1.006)				
Constant	-9.249^{c}	7.534^{c}	14.40^{a}	8.845^{b}	19.72^{b}
	(5.019)	(3.803)	(0.0849)	(3.503)	(8.612)
Year FE	Yes	No	No	No	No
City-country FE	Yes	Yes	Yes	Yes	Yes
Country-year FE	No	Yes	Yes	Yes	Yes
City-year FE	No	No	Yes	No	No
N	12525	12644	12644	12644	12644
R^2	0.150	0.236	0.296	0.239	0.290
groups	1713	1715	1715	1715	1715
S.E of u_i	2.729	2.872	3.219	2.801	3.638
S.E.of e_{it}	0.904	0.871	0.846	0.869	0.847
RMSE	0.840	0.808	0.783	0.806	0.785

Note: Robust standard errors in parentheses are clustered at the city level with ^{a}, ^{b}, and ^{c} respectively denoting significance at the 1%, 5% and 10% levels. F (34, 34) equals 3524.1335 in column 5, which implies that the heterogeneity c_{ot} was correlated with the averages of w_{odt}. The Mundlak technique implies that the estimates in column 4 are inconsistent.

Table 3: Individual retailer province presence on bilateral exports, L.1, cluster(province)

	(1)	(2)	(3)	(4)	(5)	(6)
	FRA	DEU	GBR	USA	4 countries	All countries
$\text{provGPC}_{o,t-1}^{Carrefour}$	-0.0215				-0.219[b]	-0.116[a]
	(0.0895)				(0.0803)	(0.0414)
$\text{provRS}_{o,t-1}^{Carrefour}$	0.181				0.0700	0.0979
	(0.152)				(0.0914)	(0.0778)
$\text{provGPC}_{o,t-1}^{Metro}$		.			.	.
		.			.	.
$\text{provRS}_{o,t-1}^{Metro}$		0.463[a]			0.471[a]	0.494[a]
		(0.143)			(0.109)	(0.117)
$\text{provGPC}_{o,t-1}^{Tesco}$			0.196		0.194[a]	0.117[b]
			(0.158)		(0.0629)	(0.0433)
$\text{provRS}_{o,t-1}^{Tesco}$			0.112		-0.0432	-0.0150
			(0.131)		(0.0660)	(0.0439)
$\text{provGPC}_{o,t-1}^{Walmart}$				0.223[a]	0.166[a]	0.170[a]
				(0.0771)	(0.0592)	(0.0471)
$\text{provRS}_{o,t-1}^{Walmart}$				-0.236[c]	-0.195[b]	-0.100
				(0.123)	(0.0864)	(0.0767)
$\ln(\text{gdppa}_{ot})$	-0.919	0.0465	1.871	0.697	0.675	0.650[c]
	(0.785)	(0.450)	(1.806)	(0.550)	(0.511)	(0.349)
$\ln(\text{pop}_{ot})$	2.295	1.025	-0.222	-0.280	0.849	-0.780
	(2.121)	(1.086)	(2.151)	(1.235)	(1.047)	(0.863)
Constant	27.56	9.854	-31.81	2.407	-4.787	2.541
	(22.43)	(15.66)	(57.52)	(16.42)	(17.43)	(10.35)
year FE	Yes	Yes	Yes	Yes	No	No
city FE	Yes	Yes	Yes	Yes	No	No
city-country FE	No	No	No	No	Yes	Yes
country-year FE	No	No	No	No	Yes	Yes
N	300	300	299	300	1199	13554
R^2	0.325	0.540	0.447	0.728	0.510	0.377
groups	30	30	30	30	120	1472
S.E of u_i	2.519	1.768	1.782	2.086	1.826	3.191
S.E.of e_{it}	0.615	0.377	0.606	0.323	0.483	0.835
RMSE	0.583	0.357	0.574	0.306	0.458	0.786

Note: Robust standard errors in parentheses are clustered at the province level with [a], [b], and [c] respectively denoting significance at the 1%, 5% and 10% levels.

Table 4: Province major vs. other retailer spillovers

	(1) FRA	(2) DEU	(3) GBR	(4) USA	(5) 4 countries
$\text{provGPC}^{major}_{o,t-1}$	-0.188[b]	.	0.236[c]	0.189[a]	0.0784
	(0.0742)	.	(0.129)	(0.0646)	(0.0785)
$\text{provGPC}^{other}_{o,t-1}$	1.363[a]	-0.0579	-0.297	-0.204[b]	-0.0581
	(0.329)	(0.104)	(0.250)	(0.0850)	(0.103)
$\text{provRS}^{major}_{o,t-1}$	0.167	0.479[a]	0.141	-0.313[b]	0.0529
	(0.141)	(0.129)	(0.148)	(0.124)	(0.0880)
$\text{provRS}^{other}_{o,t-1}$	-0.0888	0.0389	0.0821	0.245[a]	0.0990
	(0.138)	(0.0926)	(0.139)	(0.0869)	(0.0922)
$\ln(\text{gdppa}_{ot})$	-1.059	0.134	2.194	0.894	0.508
	(0.813)	(0.512)	(1.923)	(0.546)	(0.608)
$\ln(\text{pop}_{ot})$	2.097	1.147	-0.0650	-0.339	0.724
	(1.897)	(1.358)	(1.990)	(1.037)	(1.588)
Constant	38.63	6.482	-42.72	-3.895	-0.271
	(23.53)	(19.59)	(61.46)	(15.04)	(22.23)
Year FE	Yes	Yes	Yes	Yes	No
City FE	Yes	Yes	Yes	Yes	No
Country-year FE	No	No	No	No	Yes
City-country FE	No	No	No	No	Yes
N	300	300	299	300	1199
R^2	0.350	0.542	0.458	0.748	0.461
groups	30	30	30	30	120
S.E of u_i	2.189	1.729	1.718	2.121	1.963
S.E.of e_{it}	0.606	0.377	0.602	0.312	0.506
RMSE	0.574	0.358	0.570	0.296	0.479

Note: Robust standard errors in parentheses are clustered at the province level with [a], [b], and [c] respectively denoting significance at the 1%, 5% and 10% levels.

Table 5: Aggregated province presence on bilateral exports

	(1)	(2)	(3)
	t=1	all t	w/ F.1
provGPC$_{ot}$		0.527	0.274
		(2.350)	(2.922)
provRS$_{ot}$		0.0131	0.0142
		(0.0128)	(0.0124)
provGPC$_{o,t-1}$	-0.00466	-0.0893	-0.103
	(0.0910)	(0.0701)	(0.0679)
provRS$_{o,t-1}$	0.177^{b}	0.0452	0.0429
	(0.0819)	(0.119)	(0.120)
provGPC$_{o,t-2}$		3.610^{b}	3.489^{b}
		(1.631)	(1.627)
provRS$_{o,t-2}$		0.0315	0.0293
		(0.0497)	(0.0482)
provGPC$_{o,t+1}$			0.588
			(2.120)
provRS$_{o,t+1}$			-0.00169
			(0.0144)
ln(gdppa$_{ot}$)	0.532	0.667	0.644
	(0.490)	(0.460)	(0.487)
ln(pop$_{ot}$)	-0.528	-1.911^{c}	-1.808
	(1.238)	(1.116)	(1.171)
Constant	3.140	6.998	7.219
	(14.95)	(13.06)	(13.73)
Country-year FE	Yes	Yes	Yes
City-country FE	Yes	Yes	Yes
N	13554	13554	13262
R^2	0.359	0.364	0.365
groups	1472	1472	1472
S.E of u_i	3.161	3.884	3.826
S.E.of e_{it}	0.846	0.843	0.836
RMSE	0.797	0.795	0.787

Note: Robust standard errors in parentheses are clustered at the province level with ^{a}, ^{b}, and ^{c} respectively denoting significance at the 1%, 5% and 10% levels.

Table 6: bilateral effects, cluster(province)

	(1) od+t	(2) od+dt	(3) od+dt+ot	(4) od+dt	(5) c(dyad)
$GPC_{od,t-1}$	0.0140	0.202	-0.0167	0.204	0.204^a
	(0.102)	(0.137)	(0.0774)	(0.143)	(0.0735)
$RS_{od,t-1}$	0.0460^b	0.0584^b	-0.00768	0.0193	0.0193
	(0.0198)	(0.0214)	(0.0177)	(0.0184)	(0.0148)
$provGPC_{o,t-1}$				-0.0399	-0.0399
				(0.0916)	(0.0383)
$provRS_{o,t-1}$				0.144	0.144^a
				(0.0906)	(0.0412)
$\ln(gdppa_{ot})$	0.518	0.479		0.563	0.563^a
	(0.510)	(0.503)		(0.479)	(0.182)
$\ln(pop_{ot})$	-0.119	-0.462		-0.671	-0.671
	(1.315)	(1.244)		(1.183)	(0.441)
$\ln(gdppa_{dt})$	1.135^a				
	(0.106)				
$\ln(pop_{dt})$	2.739^a				
	(0.837)				
Constant	-17.56	4.249	14.30^a	2.940	2.940
	(15.94)	(16.14)	(0.00795)	(14.60)	(5.816)
Year FE	Yes	No	No	No	No
City-country FE	Yes	Yes	Yes	Yes	Yes
Country-year FE	No	Yes	Yes	Yes	Yes
City-year FE	No	No	Yes	No	No
N	13445	13554	13554	13554	13554
R^2	0.271	0.358	0.427	0.360	0.360
groups	1470	1472	1472	1472	1472
S.E of u_i	3.328	3.155	3.044	3.204	3.204
S.E.of e_{it}	0.882	0.847	0.809	0.846	0.846
RMSE	0.832	0.798	0.761	0.797	0.797

Note: Robust standard errors in parentheses are clustered at the province level, except for the last column, with ^{a}, ^{b}, and ^{c} respectively denoting significance at the 1%, 5% and 10% levels. We have also done Hausman test by using Mundlak approach. The F (29, 29) equals 741.91, which implies the unobserved city-year heterogeneity is correlated with two linkage variables. In other words, the estimates in columns 4 and 5 are inconsistent.

Table 7: Province retailer presence effect on province-year export capability

	(1) L.1	(2) weighted	(3) All	(4) F.1
provGPC_{ot}			1.244	-0.113
			(2.487)	(3.529)
provRS_{ot}			0.0154	0.0243
			(0.0208)	(0.0168)
$\text{provGPC}_{o,t-1}$	2.131	2.624	-2.288	-3.133
	(1.893)	(1.913)	(2.214)	(2.059)
$\text{provRS}_{o,t-1}$	0.0395^{c}	0.0377	-0.00891	-0.0143
	(0.0210)	(0.0226)	(0.0184)	(0.0165)
$\text{provGPC}_{o,t-2}$			4.045^{b}	4.936^{b}
			(1.537)	(1.939)
$\text{provRS}_{o,t-2}$			0.0485	0.0463
			(0.0456)	(0.0432)
$\text{provGPC}_{o,t+1}$				2.291
				(2.887)
$\text{provRS}_{o,t+1}$				-0.00732
				(0.0176)
$\ln(\text{pop}_{ot})$	-1.411	-1.624	-1.801	-1.875
	(1.212)	(1.323)	(1.309)	(1.413)
$\ln(\text{gdppa}_{ot})$	0.707	0.886	0.916	0.881
	(0.493)	(0.597)	(0.613)	(0.662)
Constant	-11.09	-16.49	-16.51	-16.15
	(15.07)	(19.22)	(19.81)	(20.50)
N	300	270	270	263
R^2	0.760	0.791	0.795	0.794
RMSE	0.293	0.326	0.325	0.328

Note: Robust standard errors in parentheses are clustered at the province level with ^{a}, ^{b}, and ^{c} respectively denoting significance at the 1%, 5% and 10% levels. Province fixed effects and year fixed effects are controlled for in four columns. In the last three columns, each observation is weighted by the inverse of the standard error.

Table 8: Data Source of Global Procurement Centers in China

Retailer	Year	Month	Province	City	Source	Accessed on
Walmart	1981			Hongkong	http://walmartstores.com/Media/Investors/1981AR.pdf	May-22-2009
Walmart	2001	12	Guangdong	Shenzhen	The World's biggest corporation in the global economy, P237	
Walmart	2002	10	Shanghai	Shanghai	The World's biggest corporation in the global economy, P302	
Walmart	2003		Guangdong	Dongguan	The World's biggest corporation in the global economy, P307	
Carrefour	1994	6		Hongkong	www.fccihk.com/member/member.asp?Item=93-5k[1]	Jul-3-2008
Carrefour	2002	9	Shanghai	Shanghai	http://www.cnad.com/html/Article/2004/0521/20040521133727692591.shtml	Jun-1-2009
Carrefour	2001	11	Guangdong	Guangzhou	http://media.news.sohu.com/27/74/news147137427.shtml	May-22-2009
Carrefour	2001	7	Guangdong	Shenzhen	http://english.peopledaily.com.cn/english/200107/26/eng20010726_75861.html	Nov-10-2007
Carrefour	2002		Beijing	Beijing[2]		
Carrefour	2002	1	Tianjin	Tianjin	http://news.enorth.com.cn/system/2002/01/18/000247686.shtml	Nov-12-2007
Carrefour	2004		Liaoning	Dalian	http://www.linkshop.com.cn/web/Article_News.aspx?ArticleId=33220&ClassID=91	Nov-11-2007
Carrefour	2002	5	Shandong	Qingdao	http://news.xinhuanet.com/chanjing/2002-05/22/content_404360.htm	May-22-2009
Carrefour	2002	3	Hubei	Wuhan	http://www.cnhubei.com/aa/ca52528.htm	Nov-11-2007
Carrefour	2002		Fujian	Xiamen[2]		
Carrefour	2002	6	Zhejiang	Ningbo	http://baike.baidu.com/view/18119.htm	Jun-9-2009
Carrefour	2005		Sichuan	Chengdu	http://www.sh360.net/firm/Firm094/7500.html	Nov-10-2007
Carrefour	2005	10	Zhejiang	Yiwu	http://info.china.alibaba.com/news/detail/v5000180-d5607305.html	Jun-10-2009
Carrefour	2006	4	Sichuan	Chongqing	http://www.sh360.net/firm/Firm094/7500.html	Jun-10-2009
Metro	1976			Hongkong	http://www.globalsources.com/PEC/PROFILES/GEMEX.HTM	May-22-2009
Metro	1995		Shanghai	Shanghai[3]		
Metro	2005		Shandong	Qingdao	http://www.linkshop.com.cn/web/Article_News.aspx?ArticleId=38047&ClassID=90	Jun-10-2009
Metro	2004		Guangdong	Dongguan	http://www.qdsf.gov.cn/n241/n243/n283/7637.html	Jun-11-2009
Tesco	1971			Hongkong	http://www.globalsources.com/PEC/PROFILES/TESCO.HTM	Jul-10-2008
Tesco	2001		Shanghai	Shanghai	http://www.globalsources.com/PEC/PROFILES/TESCO.HTM	Jul-10-2008
Tesco	2004		Guangdong	Shenzhen[4]	http://www.deloitte.com/dtt/cda/doc/content/DTT_DR_China21Century.pdf	Jun-11-2009

Note: 1. Another website states it was established in 1996. (Source: http://www.kompass.com/en/HK004101). 2. For Carrefour, Beijing and Xiamen are frequently reported in the media reports with the other 9 cities (Tianjin, Dalian, Qingdao, Wuhan, Ningbo, Guangzhou, Shenzhen, and Kunming) as 10 global procurement centers of Carrefour in China (http://www.shandongipc.gov.cn/zxcontent.asp?id=25976, accessed on May 22, 2009.). However, no report about them as individuals has been found. Since the openings of the other eight procurement centers were all in 2002. Year 2002 is taken as the year in which these two procurement centers were established. 3. Metro came to China in 1995, cooperating with JinJiang Group to establish Metro JinJiang Cash & Carry Co. Ltd (http://www.metro-cc.com/servlet/PB/menu/1075005_l2/index.html). There has been also a statement that the operation in Metro AG in China is highly centralized(http://www.linkshop.com.cn). To be conservative, year 1995 is applied. 4. With www.sourcing.org.cn/en/Article_Show.asp?ArticleID=593.

4 Technical Note

As we use specification (2) in the paper, we realize that a large quantity of city-year and country-year dummies are dropped automatically by STATA, and the estimates of the key variable differ just when we run the same regression repeatedly. We implement specification (2) by using the code

$$\texttt{xtreg } X_{odt} \texttt{ ot2-ot300 dt2-dt500, i(od).}$$

X_{odt} is the sum of retail-goods exports from city o to destination country d in year t. ot2-ot300 include all city-year dummies except for the first one. dt2-dt500 include all country-year dummies other than dt1. The constant term is included in the specification. Dyadic fixed effects are controlled by "i(od)." Without adding any other variables which includes key variables, the specification will drop $(N_o + N_d + N_t - 3)$ dummies.

These origin-year and destination-year dummies are dropped because there are three sets of perfect collinearity problems imbedded in the specification. In addition, these three sets of perfect collinearity problems also explain why we cannot solve this problem by arbitrarily dropping $(N_o + N_d + N_t - 3)$ dummies. Collinearity occurs between city-year and dyadic fixed effects, between country-year and dyadic fixed effects, and between the city-year and the country-year fixed effects. The collinearity between the city-year and dyadic fixed effects results from the fact that dyadic and city-year fixed dummies share the *same* number of years. After demeaning on each dyad, the sum of dummies over all years of the same city is a zero vector except for the city whose one city-year dummy has been dropped. In other words, for each city, one of its city-year dummies must be dropped in order to deal with the perfect collinearity problem generated by city-year and dyadic fixed effects. Thus, when we use the code above to implement specification (2), (N_o-1) city-year dummies are to be dropped. Similarly, for each country, one of its country-year dummies has to be dropped. Therefore, (N_d-1) country-year dummies are dropped when we use the previous code. The perfect collinearity between the city-year and the country-year fixed effects are also driven by the fact that cities and countries have the same number of years in the data set. For each year, the vector obtained by adding up all cities' city-year dummies in that year is equal to the the vector arrived at by adding up all countries' country-year dummies in the same year. After inputting the previous code, $(N_t - 1)$ dummies, one for each year other than the first year, are dropped. In order to avoid the collinearity problem resulting from the city-year and the country-year fixed effects, one item (either a city or country) in *each* year has to be dropped.

The following simple example demonstrates these three sets of perfect collinearity problems. Suppose there are 2 countries, 2 years, and 2 cities.

$Prov$	$Country$	$Year$	dtr	$dt1$	$dt2$	$dt3$	$dt4$	otr	$ot1$	$ot2$	$ot3$	$ot4$
BJ	USA	96	1	1	0	0	0	1	1	0	0	0
BJ	USA	97	2	0	1	0	0	2	0	1	0	0
TJ	USA	96	1	1	0	0	0	3	0	0	1	0
TJ	USA	97	2	0	1	0	0	4	0	0	0	1
BJ	ARG	96	3	0	0	1	0	1	1	0	0	0
BJ	ARG	97	4	0	0	0	1	2	0	1	0	0
TJ	ARG	96	3	0	0	1	0	3	0	0	1	0
TJ	ARG	97	4	0	0	0	1	4	0	0	0	1

The perfect collinearity problem between city-year and country-year dummies: the vector achieved by adding up the 2 cities' city-year dummies in 96 is equal to the vector that results from adding up the 2 countries' country-year dummies in 96. Both vectors are equal to $(1, 0, 1, 0, 1, 0, 1, 0)^T$. For every city or country, there are one dummy for 96 and one dummy for 97. Therefore, it is clear that by using city-year and country-year fixed effects simultaneously, we incur a perfect collinearity problem in each year. The previous code is equivalent to having $dt2$-$dt4$ and $ot2$-$ot4$ in this simple case. Based on the analysis, we can see that there is still a perfect collinearity problem in 97, i.e. $dt2$+$dt4$=$ot2$+$ot4$.

Now we turn to the perfect collinearity between the dyadic and city-year dummies. Following the previous matrix, we achieve the following matrix after demeaning the variables on each dyad.

$Prov$	$Country$	$Year$	dtr	$dt1$	$dt2$	$dt3$	$dt4$	otr	$ot1$	$ot2$	$ot3$	$ot4$
BJ	USA	96	1	$\frac{1}{2}$	$\frac{-1}{2}$	0	0	1	$\frac{1}{2}$	$\frac{-1}{2}$	0	0
BJ	USA	97	2	$\frac{-1}{2}$	$\frac{1}{2}$	0	0	2	$\frac{-1}{2}$	$\frac{1}{2}$	0	0
TJ	USA	96	1	$\frac{1}{2}$	$\frac{-1}{2}$	0	0	3	0	0	$\frac{1}{2}$	$\frac{-1}{2}$
TJ	USA	97	2	$\frac{-1}{2}$	$\frac{1}{2}$	0	0	4	0	0	$\frac{-1}{2}$	$\frac{1}{2}$
BJ	ARG	96	3	0	0	$\frac{1}{2}$	$\frac{-1}{2}$	1	$\frac{1}{2}$	$\frac{-1}{2}$	0	0
BJ	ARG	97	4	0	0	$\frac{-1}{2}$	$\frac{1}{2}$	2	$\frac{-1}{2}$	$\frac{1}{2}$	0	0
TJ	ARG	96	3	0	0	$\frac{1}{2}$	$\frac{-1}{2}$	3	0	0	$\frac{1}{2}$	$\frac{-1}{2}$
TJ	ARG	97	4	0	0	$\frac{-1}{2}$	$\frac{1}{2}$	4	0	0	$\frac{-1}{2}$	$\frac{1}{2}$

From this matrix, we can find that both $dt1+dt2$ and $dt3+dt4$ are equal to $(0,0,0,0,0,0,0,0)^T$. In other words, after demeaning, there is a perfect collinearity problem across the time-varying dummies for each city. The traditional method of dropping only the first city-year dummy cannot solve the collinearity problem for all the other cities. In order to deal with this problem, we must drop one city-*year* dummy for each city.

A similar argument also applies to the country-year dummies. In addition, we notice that the previous perfect collinearity problem between the city-year and country-year dummies still exists after demeaning the variables over dyads.

In summary, if we put all city-year and country-year dummies in the specification and use dyadic fixed effects, without adding any other key variables, STATA automatically drops $(N_o + N_d + N_t - 1)$ dummies in total. In order to solve the previous collinearity problems, the method for manually dropping the dummies is to:

- Drop one city-*year* dummy for each city;
- Drop one country-*year* dummy for each country;
- Drop one *city*-year *or country*-year dummy for each year.