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Do politically and economically similar states in the U.S.A. trade more with each other?

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Abstract

Estimating a Gravity model for trade between the U.S. states, we find that politically and economically similar states trade more among themselves. We use two different definitions of political similarity based on outcomes in Presidential and Gubernatorial elections, and they all give similar results. For economic similarities, we follow the literature on Linder's hypothesis.

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1 Introduction

Do politically and economically similar states trade more with each other in the United States? This is the main question that this paper addresses. An answer to this question has significant implications for policy makers as more trade between the states is likely to foster growth in the U.S., and attempts should be made to take down barriers to domestic trade in the form of, for example, political similarities.

For trade between countries, several studies have examined the effect of politics on trade flows. Pollins (1989a, 1989b) show that bilateral trade flows are significantly influenced by political relationship between nations, and relative cooperativeness or hostility in bilateral political ties. Marrow et al. (1998) find that trade flows are greater between nations with similar political interests than those dissimilar interest. According to Simmons (2005), cordial relation between trading partners helps them to enjoy joint gains from trade. Whitten et al. (2020) investigates how China's political relation with foreign countries affect their bilateral trade. They hypothesized that warmer relations lead to a larger increases in trade while cooler relations have the opposite effect. They also find that shocks to relations are highly persistent and frequently cause changes in trade. As for trade between the states of the United States, political polarizations since the 1970s – as noted by Glaeser and Ward (2006) and Abramowitz and Saunders (2008) – raise the question if such polarization acts as a barrier to domestic trade between the states. Ishise and Matsuo (2015) made an attempt to test this hypothesis and found evidence for the existence of such a barrier.

The reasons why politically similar states in the U.S. may trade more is possibly very different from why political relationships between nations affect international trade. In the case of domestic trade, perhaps network formations have something to do with it. One can also think of possible reasons why politically dissimilar states might trade more with each other. For example, if politically similarities are caused by similar endowment ratios, the well-known Heckscher-Ohlin model would predict a lower inter-industry trade for them. In any case, for reasons mentioned above, it is interesting to test empirically if politically similar states in the United States trade more or less with each other.

For trade between countries, Linder (1961) put forward product quality and intra-industry trade as two reasons why economically similar nations might trade more with each other. This is in contrast to the traditional Heckscher-Ohlin model for inter-industry trade, where countries with similar capital-labor endowment ratios would trade little with each other. Bergstrand (1990) found a greater similarity in per-capita income was associated with more intra-industry trade between nations. Other studies, using bilateral international trade data and the Gravity model, have tested the Linder hypothesis, and found overwhelming support for it (see, for example, Thursby and Thursby, 1987; Tang, 2003; Baltagi et al., 2003; Hallak, 2010). In fact, Baltagi et al. (2003) found that without the Linder's effect, the regression would suffer from misspecification error. Similar arguments might apply to U.S. domestic trade as well. Dingel(2017), using three years CFS data at the micro levels individual product trade between U.S. cities, finds support for Linder's hypothesis.

There are a few other studies that examine interstate trade in the U.S.A., using Gravity analysis (see, for example, Wolf, 2000; Millimet and Osang, 2007; Martinez-San et

al. (2017). Wolf (2000) and Millimet and Osang (2007) use CFS data for the years 1993 and 1997. Their purpose was to test the existence or otherwise of border effect.

In this paper, we apply the gravity model of trade to analyze U.S. inter-state trade of the years 1993, 1997, 2002, 2007, 2012 and 2017. Presidential and Gubernatorial election data are used to generate our political similarity variables. For the Linder variable, we follow the literature and consider absolute value of differences in per-capita income.

As mentioned before, Dingel (2017) also tests the Linder's hypothesis using inter-state trade data for the U.S., albeit for three years only and six years as we do. More importantly, his data is much more micro than our data. Although more micro data is useful to check for the validity of the hypothesis for each product and for trade between cities, the state-level data is likely to be subject to less noise because of the law of large numbers and therefore we work with more stable variables. Dingel (2017) does not consider the political issue of trade between blue states and red states. Ishise and Matsuo (2015), on the other hand, uses inter-state trade data as we do, though not six years like us, but for four years, and tests if political dissimilarities between the states acts as a barrier to trade. They do not consider Linder's hypothesis. There are other important differences between our analysis and that of Ishise and Matsuo (2015).

Using four years CFS data, Ishise and Matsuo (2015) define a blue-red dummy which is time invariant. Like Egger et al.(2011) (which is a study about the bilateral international trade), they use cross-sectional analysis for each of the four years. They include time-invariant importer and exporter fixed effects. We use a longer time period (six years) and define the political variable as time-dependent. Given the existence of quite a few so-called swing states, our approach seems more reasonable. Not all states can be labeled as a blue or a red state for all years; the distinction between the two is not that black and white. Given that our data is at five year intervals, the dependence of the political variable on time is even more justifiable.[1] We also use alternative definitions of the red-blue divide in terms of gubernatorial elections, apart from using Presidential elections as the yardstick. There are also differences in terms of the econometric methodology used. Whereas Ishise and Matsuo (2015) use non-linear (Probit) Generalized Method of Moments (GMM) mode with instrumental variable to deal with endogeneity, we follow the recent literature on gravity analysis with our panel data and employ Poisson Pseudo Maximum Likelihood (PPML) method (see, for example, Yotov et al., 2016). Our approach allows us to use pairwise fixed effects and importer-time and exporter-time fixed effects. Thus, we are able to focus on the two main effects and at the same time deal with a rich set of fixed effects to deal with endogeneity arising from unobserved heterogeneity.

The rest of the paper is organized as follows. Section 2 describes the estimation methodology and the data. We report our OLS and PPML estimation for various specifications and perform several robustness checks with different definitions of politics and Linder and explain our empirical results in Section 3. In section 4 we present our concluding remarks

[1]Given that the adjustment of trade in response to changes in a covariate can take time, Cheng and Wall (2005) suggested the use of interval data even when annual data are available. In gravity analysis, it is common to use data at intervals of 3-5 years (see, for example, Trefler, 2004; Baier and Bergstrand, 2007; Olivero and Yotov, 2012; Anderson and Yotov, 2016). For us, the interval is not a choice; this is how the data are available.

with policy implications.

2 Estimation Methodology and Data

2.1 Econometric Specification

The structural gravity equation we use is similar to the one estimated by Anderson and Van Wincoop (2003), Anderson and Yotov (2010), and Bergstrand et al. (2015). The estimable econometric specification of these models have been developed by these author from theoretical micro-foundations, and, *inter alia*, these include multilateral resistances and bilateral transaction costs.

Since bilateral trade data with many countries have many zero observations, according to Silva and Tenreyro (2006, 2011) the Poisson Pseudo-Maximum Likelihood (PPML) estimates generate more robust results than traditional OLS estimates, besides being consistent in the presence of heteroskedasticity. Since in our data set less than 1% of all observations take zero values, we use both the PPML and OLS methods.

For the PPML estimation, the model that we estimate is:

$$X_{ijt} = exp[\beta_0 + \beta_1 \text{POLITICS}_{ijt} + \beta_2 \text{LINDER}_{ijt} + \beta_3 \text{HPOP}_{ijt} + \beta_4 \text{BPOP}_{ijt} + n_{it} + \theta_{it} + \delta_{ij}] + \epsilon_{ijt} \quad (1)$$

where X_{ijt} is the U.S. domestic trade flows between state i and state j at time t, ϵ_{ijt} is the error term, and n_{it}, θ_{jt} and δ_{ij} are respectively exporter-time, importer-time, and bilateral, fixed effects. As stated by Head and Mayer (2014) and Yotov et al. (2016), the importer-time and exporter-time fixed effects will capture all state-specific, time-dependent variables, and similarly, the bilateral fixed effects will absorb all time-independent, bilateral variables like distance. Therefore, spurious correlation arising because of omitted variables of those kinds will not occur (Baier and Bergstrand, 2007).

POLITICS_{ijt} is one of the main variables of interest, and two different alternative definitions of it – political similarities between states – are derived from Presidential and Gubernatorial election results. For Presidential and Gubernatorial elections, it takes the value 1 if both states i and j voted for the same political party in the last election, and 0 otherwise.

Our second variable of interest is LINDER which represents economic similarities between the states. Following the literature, we consider two alterative definitions. First, we consider the absolute difference between the per-capita income (PCI) of the states (see, for example, Thursby and Thursby, 1987; Hallak, 2010). That is, $\text{LINDER}_{ijt} = |\text{PCI}_{it} - \text{PCI}_{jt}|$. We also consider the absolute difference in log of per-capita income, i..e., $\text{LINDER1}_{ijt} = |ln(\text{PCI}_{it}) - ln(\text{PCI}_{jt})|$ (see, for example, Baltagi et al., 2003; Tang, 2003).

Since Rauch and Trindade (2002) found ethnic compositions of countries influence trade via network effects, we have added the product of the log of Hispanic and Latino population and the product of the log of the Black population in the two states as the

additional variables: $\text{HPOPL}_{ijt} = ln(\text{HPOP}_{it}) * ln(\text{HPOP}_{jt})$ and $\text{BPOPL}_{ijt} = ln(\text{BPOP}_{it}) * ln(\text{BPOPL}_{jt})$ where HPOP_{it} and BPOP_{it} are the levels of Hispanic and Latino, and Black population respectively, in state i at time t.

As for OLS estimations, the model is:

$$X_{ijt} = \beta_0 + \beta_1 \text{POLITICS}_{ijt} + \beta_2 \text{LINDER}_{ijt} + \beta_3 \text{HPOP}_{ijt} + \beta_4 \text{BPOP}_{ijt} + n_{it} + \theta_{it} + \delta_{ij} + \epsilon_{ijt} \quad (2)$$

where $\text{HPOP}_{ijt} = \text{HPOP}_{it} * \text{HPOP}_{jt}$ and $\text{BPOP}_{ijt} = \text{BPOP}_{it} * \text{BPOP}_{jt}$, and HPOP_{it} and BPOP_{it} are measured in units of 10,000.

Three points are to be noted. First, Since PPML is essentially a log-linear model, the right-hand side variables HPOPL and BPOPL are in terms of logarithms, and one of the Linder variables – LINDER1 – is also in terms of logaritms. Second, in our OLS estimations, we estimate a linear model in order not to lose the zero observations, and therefore none of the explanatory variables are in terms of logarithms. In particular, we do not use LINDER1 in OLS regressions. Finally, we run all the regressions using pairwise clustering of the errors.

2.2 Data Sources

United States inter-state domestic trade flow data of years 1993, 1997, 2002, 2007, 2012, and 2017 are obtained from the Commodity Flow survey (CFS) data, generated by the Bureau of Transportation Statistics (BTS) and the U.S. Census Bureau (USCB). The CFS track shipments, measured in million-dollar value, by the modes of transportation: Truck, Rail, Inland water, Great Lakes, Deep Sea, Air, Pipeline, Parcel, U.S. Postal Service, or Courier. The CFS data covers on shipments originating from selected types of business establishments located in the 50 states and the District of Columbia; it does not cover Puerto Rico and other U.S. possessions and territories. Data on the political variables were obtained from the Mit Election Data Science Lab,[2] and Wikipedia.[3] Data on per-capita income was obtained from the Bureau of Economic Analysis (BEA) and data on Hispanic and Latino population from the U.S. Census Bureau and Black population from The Kaiser Family Foundation website.[4] The tables of variable definition and summery statistics are provided below.

[2] https://electionlab.mit.edu/data

[3] https://en.wikipedia.org/wiki/1993 and https://en.wikipedia.org/wiki/Alabama_Senate.

[4] https://www.kff.org/other/state-indicator/distribution-by-raceethnicity/

Table I: Definition of the variables

Variable	Definition
X_{ijt}	U.S.A domestic trade in million $ (1993 - 2017)
President_{ijt}	If both states won by the same political party, it is 1, and 0 otherwise.
Governor_{ijt}	If both states won by the same political party, it is 1, and 0 otherwise.
Linder_{ijt}	Absolute difference in per capita income (PCI in $): $\lvert \text{PCI}_{it} - \text{PCI}_{jt} \rvert$
Linder1_{ijt}	Absolute difference of per capita income in log: $\lvert ln(\text{PCI}_{it}) - ln(\text{PCI}_{jt}) \rvert$
HPOP_{it} (in unit of 10, 000)	Hispanic and Latino population
BPOP_{it} (in unit of 10, 000)	Black population
HPOP_{ijt}	HPOPij * HPOPjt
BPOP_{ijt}	BPOPij * BPOPjt
HPOPL_{ijt}	ln (HPOPit) * ln (HPOPjt)
BPOPL_{ijt}	ln (BPOPij) * ln (BPOPjt)

Table II: Descriptive Statistics

Variables	Observations	Mean	Std. Dev.	Min	Max
X_{ijt} (in million $)	15276	2177.41	4767.69	0	78028
President_{ijt}	15300	0.0505	0.499	0	1
Governor_{ijt}	15300	0.492	0.499	0	1
Linder_{ijt}	15300	6561.67	6027.045	0	43227
Linder1_{ijt}	15300	0.1803	0.1351	0	0.7765
HPOP_{it} (in unit of 10, 000)	15,300	80.83189	207.4403	0.574	1500
BPOP_{it} (in unit of 10, 000)	15,300	67.28698	79.27277	0.1722	320
HPOP_{ijt}	15300	6349.656	41981.35	0.3657528	1650000
HPOPL_{ijt}	15300	148.1987	29.29837	75.81681	267.9032
BPOP_{ijt}	15300	4444.232	9710.434	.0433427	99200
BPOPL_{ijt}	15300	147.5856	35.24151	58.34935	223.8848

It is to be noted that for one year (2007) two of the states (Kansas and Texas) had the same per-capita income and hence all the Linder variables take the minimum value of zero.

3 Results

The basic results for the PPML estimation are presented in Table III. The politics variables – President and Governor – are binary variables: take the value 1 if both states voted for the

same political party and 0 otherwise. For the Linder's variable, we consider two alternative definitions used in the literature: absolute difference in per-capita income, LINDER (see, for example, Thursby and Thursby, 1987; Hallak, 2010) and absolute difference in the log of per- capita income, LINDER1 (see, for example, Baltagi et al., 2003; Tang, 2003). All the regressions include importer-time, exporter-time, and pair-wise fixed effects, and we consider pairwise clustering of the errors. The signs of the coefficients of both political and economic similarities are statistically significant throughout. The coefficients of LINDER and LINDER1 are negative (more trade among economically similar states) and that of President and Governor are positive (more trade among politically similar states). Since we shall compare the magnitude of the key coefficients with linear OLS estimates, in Table III we provide the values of the marginal coefficients of the politics and Linder variables.

We add two ethnicity variables, and they are the product of the log of Hispanic and Latino population in the two states ($HPOPL_{ijt}$) and the product of the log of Black population in the two states ($BPOPL_{ijt}$). The coefficients for these variables are positive and significant except that the coefficient of $BPOPL_{ijt}$ here is insignificant when Governor is the politics variable.

We also run linear OLS regressions and the results are presented in Table IV. Since it is a linear regression, we do not use LINDER1 which is in logs, and replace $HPOPL_{ijt}$ and $BPOPL_{ijt}$ (which are in logs) respectively by $HPOP_{ijt}$ and $BPOP_{ijt}$ (which are not in logs). Once all the coefficients are significant and similar qualitatively as those in Table III.

From Figure 1 in which estimated values of domestic trade are plotted against the actual ones for both PPML and OLS (using the equation in column 3 of Tables III and column 2 of Table IV), we see that the PPML estimation gives a better fit than the OLS.

As mentioned before, the inclusion of the different fixed effects take care of possible endogeneity arising from omitted variables. In case there is endogeneity because of two-way causality – which is unlikely in our context, in Table IV we present PPML regression results taking one-year lag of the variable President. The qualitative nature of the results remain quite robust.

In terms of the magnitude of the marginal effects, the states which vote for the candidate from the same political party in Presidential elections, on an average, trade in the range of \$63- \$76 million worth more than the other states, according to our OLS regression (columns 1-3 in Table 4). The marginal coefficients in the PPML regressions are much smaller: \$43- \$48 (columns 1-6 in Table III), and the difference between PPML and OLS estimates are even bigger for the coefficient of Governor. As for the Linder's effect, a difference in \$1000 in per-capita income implies a higher trade between the pair by \$49.3 million in OLS estimation and \$13.3 in PPML. It is to be noted that others have also found that OLS estimation tend to overestimate the coefficients. For example, Martnez-San Román et al. (2017) who study home bias in US intra-national trade using gravity mode find that PPML coefficients are almost half of the OLS coefficients.

Table3. Baseline PPML Estimates

Dependent Variable Domestic Trade (ijt)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
President (ijt)	0.0212***	0.0202**	0.0221***	0.0212***	0.0211***	0.0203**			
	(0.008)	(0.012)	(0.006)	(0.008)	(0.008)	(0.012)			
President(ijt) Marginal	46.16***	43.98**	48.12***	46.16***	45.94***	44.20***			
	(0.008)	(0.012)	(0.006)	(0.008)	(0.008)	(0.012)			
Linder(ijt)	-0.00000610***		-0.00000680***	-0.00000618***			-0.00000559***	-0.00000599***	-0.00000558***
	(0.000)		(0.000)	(0.000)			(0.001)	(0.000)	(0.001)
Linder(ijt) Marginal	-0.0133***		-0.0148***	-0.0135***			-0.0122***	-0.0130***	-0.0121***
	(0.000)		(0.000)	(0.000)			(0.000)	(0.000)	(0.000)
Linder1(ijt)		-0.147***			-0.167***	-0.132***			
		(0.001)			(0.000)	(0.004)			
HPOPL (ijt)			0.0195***		0.0183***			0.0109*	
			(0.000)		(0.000)			(0.081)	
BPOPL (ijt)				0.0510***		0.0505***			-0.00268
				(0.000)		(0.000)			(0.596)
Governor(ijt)							0.0113*	0.0111*	0.0113*
							(0.081)	(0.086)	(0.081)
Governor(ijt) Marginal							24.60*	24.17*	24.60*
							(0.081)	(0.081)	(0.081)
R-Squared	0.9671	0.9669	0.9671	0.9670	0.9669	0.9668	0.9786	0.9786	0.9786
Observations	15276	15276	15276	15276	15276	15276	15276	15276	15276

Note: Marginal coefficients of some of the variables are presented separately in the additional rows. P-values are in parenthesis. ***, **, * denote significant at 1%, 5% and 10%, respectively. All specifications include exporter-time fixed effects, importer-time fixed effects and pairwise fixed effects.

Table 4. Baseline OLS Estimates

Dependent Variable Domestic Trade (ijt)	(1)	(2)	(3)	(4)	(5)	(6)
President(ijt)	73.26*	63.49*	76.32*			
	(0.084)	(0.093)	(0.066)			
Linder(ijt)	-0.0493***	-0.0509***	-0.0512***	-0.0482***	-0.0499***	-0.0502***
	(0.000)	(0.000)	(0.000)	(0.000)	(-0.000)	(0.000)
HPOP (ijt)		0.202***			0.202***	
		(0.000)			(0.000)	
BPOP (ijt)			1.11***			1.10***
			(0.000)			(0.000)
Governor(ijt)				77.78***	74.74***	68.19**
				(0.006)	(0.008)	(0.016)
Constant	2462.7***	2349.5***	1980.7***	2453.2***	2337.0***	1979.5***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
R-Squared	0.9165	0.9212	0.9186	0.9165	0.9212	0.9187
Observations	15276	15276	15276	15276	15276	15276

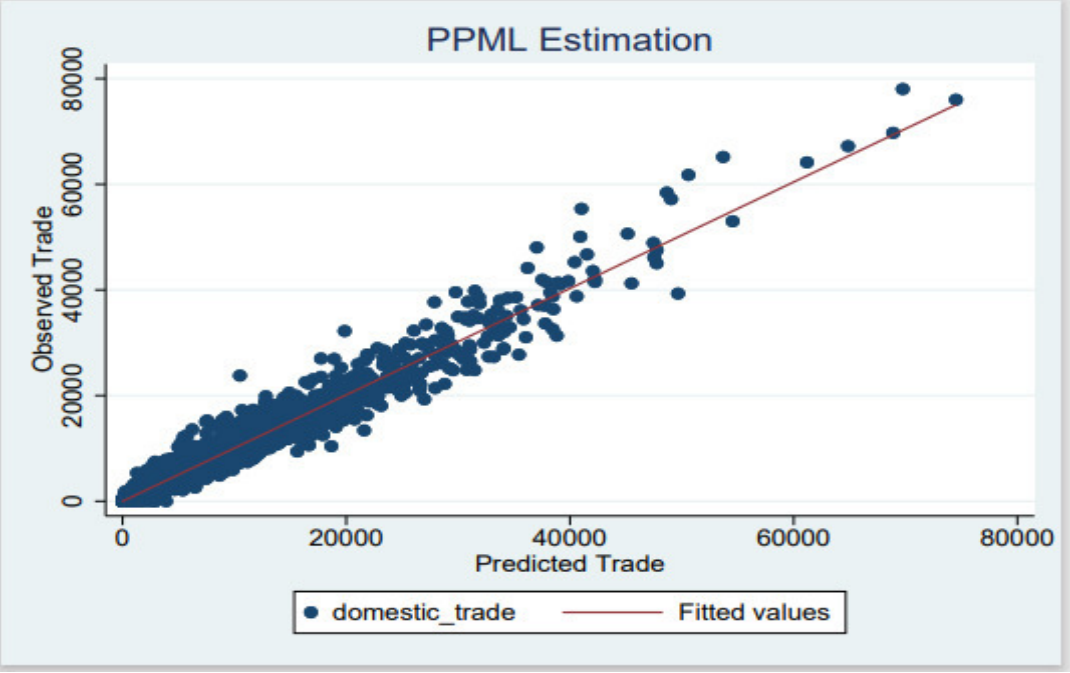
Note: P-values are in parenthesis. ***, **, * denote significant at 1%, 5% and 10%, respectively. All specifications include exporter time fixed effects, importer-time fixed effects and pairwise fixed effects.

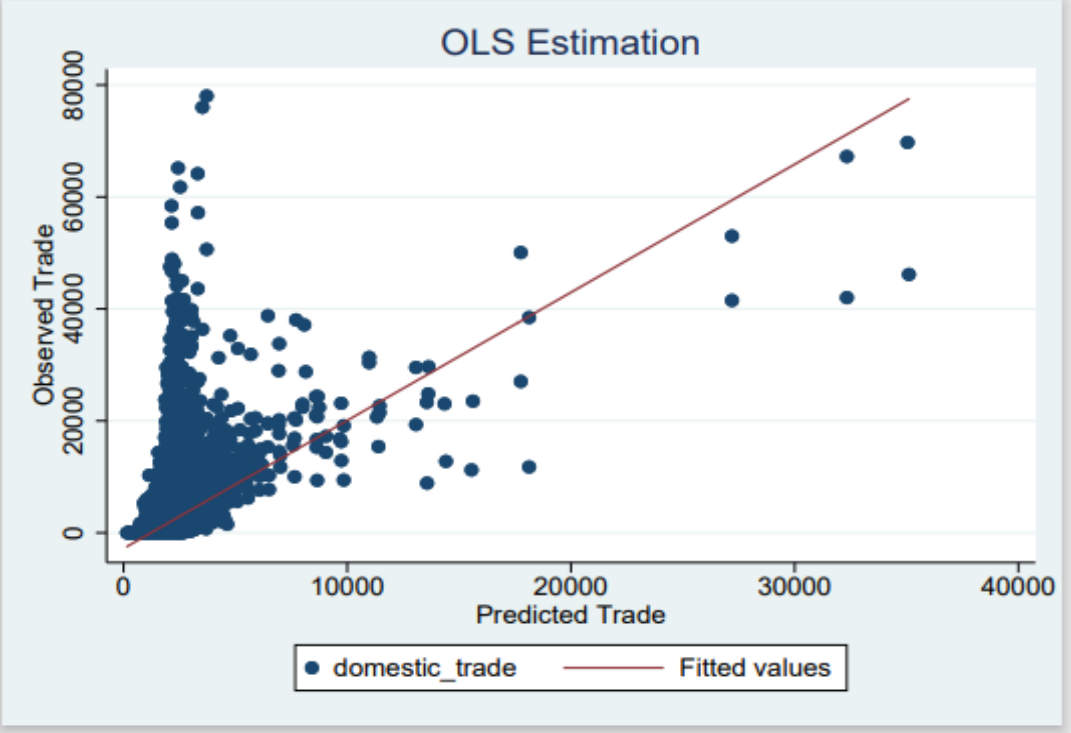
Table 5. Robustness Checks: PPML Estimates with one-year lag of the variable President(ijt)

Dependent Variable Domestic Trade(ijt)	(1)	(2)	(3)	(4)	(5)	(6)	(7)
President ij(t-1)	0.0259***	0.0247***	0.0257***	0.0254***	0.0253***	0.0266***	0.0265***
	(0.002)	(0.004)	(0.002)	(0.003)	(0.003)	(0.002)	(0.002)
Linder(ijt)		-0.00000681***		-0.00000722***	-0.00000693***		
		(0.000)		(0.000)	(0.000)		
Linder1(ijt)			-0.193***			-0.201***	-0.185***
			(0.000)			(0.000)	(0.000)
HPOPL (ijt)				0.0172***		0.0164***	
				(0.000)		(0.000)	
BPOPL (ijt)					0.0505***		0.0502***
					(0.000)		(0.000)
R-Squared	0.9674	0.9676	0.9675	0.9677	0.9676	0.9675	0.9674
Observations	12726	12726	12726	12726	12726	12726	12726

Note: P-values are in parenthesis. ***, **, * denote significant at 1%, 5% and 10%, respectively. All specifications include exporter time fixed effects, importer-time fixed effects and pairwise fixed effects.

Figure 1: Observed and predicted values of domestic trade in PPML and OLS estimations





4 Conclusion

Using recent developments in gravity analysis and using inter-state trade data for the USA for six years (1993, 1997, 2002, 2007, 2012 and 2017), this paper examines if states that economically and politically similar trade more among each other or not. We use different alternative definitions of political and economical similarities. We find, in a fairly robust way, that both politically similarity and economical similarity result in significantly more trade.

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