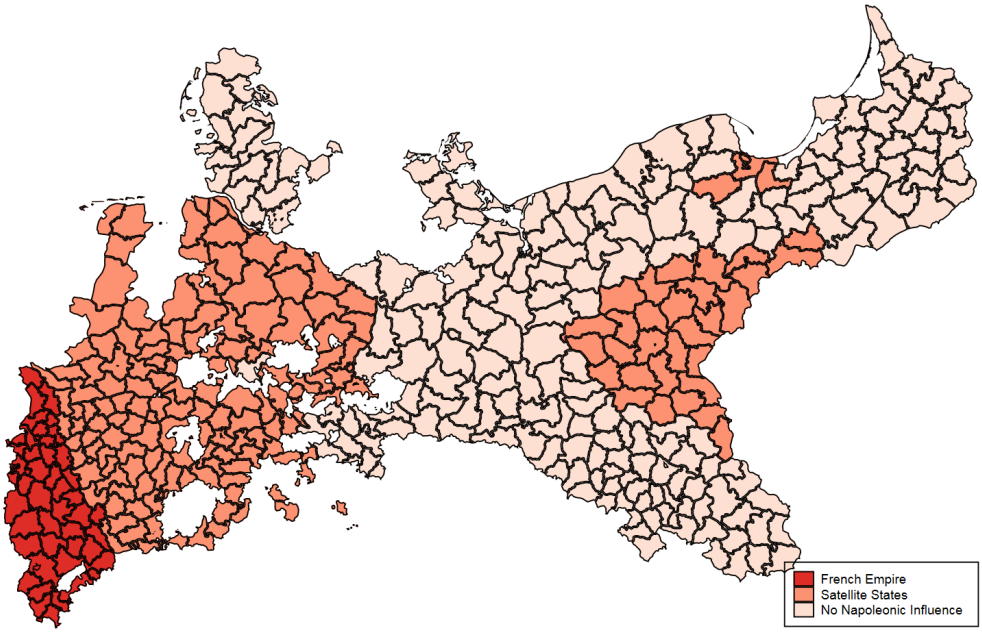
SUPPLEMENTAL MATERIALS TO "INSTITUTIONAL TRANSPLANT AND CULTURAL PROXIMITY: EVIDENCE FROM NINETEENTH - CENTURY PRUSSIA" BY G. LECCE AND L. OGLIARI

A APPENDIX

Prussian counties by French Presence

Figure A1 shows the counties in territories controlled by Napoleon differentiating between annexed areas and satellite states in our sample. All the counties under Napoleonic influence west of the Elbe river belonged either to the Duchy of Warsaw, a state established by Napoleon in 1807 after the Treaty of Tilsit, or to the Republic of Danzig, a semi-independent city-state established by Napoleon on 9 September 1807. We consider the German northwest territories (the Duchy of Arenberg) as satellite states even though they were later annexed, in December 1810, by the French Empire.

Figure A1: Counties Under Napoleonic Influence



Summary Statistics by Napoleonic Treatment and Complete Baseline Specification

We start this section by presenting summary statistics separately for invaded and not-invaded territories to better gauge the characteristics of the treatment and the control groups in Table A1. As expected, the comparison shows that invaded areas tend to be on average more developed than the not-invaded ones and, while demographic characteristics are comparable across the two groups, the not-invaded areas display a higher share of Protestants in the county population. In Table A2 we follow Donges et al. (2017) and test whether we can predict either the probability of falling under French influence or the duration of the French rule with pre-1789 variables that account for geographic and economic characteristics. The suggestive findings corroborate the anecdotal evidence that Napoleonic military campaigns were not driven by the economic prospects of the invaded areas but rather by geo-political and ideological reasons. [1] In Table A3 we report the complete set of estimated coefficients of the specifications reported in Table 3.

Table A1: Summary Statistics (by Counties with/without French Institutions)

Variable	Mean	Std. Dev.	Min.	Max.	N
PANEL: NO FRENCH INSTITUTIONS					
Income of male elem. school teachers (1886)	938.234	177.887	722.221	1954.194	209
Protestant Share	0.772	0.315	0.016	0.999	209
% of county population in urban areas	0.255	0.193	0	1	209
% females	0.515	0.012	0.467	0.541	209
% age below 10	0.248	0.025	0.158	0.297	209
Total Population (log)	10.873	0.393	9.768	13.625	209
County Area (log)	11.017	0.969	5.989	12.899	209
University in 1517	0.005	0.069	0	1	209
Hanseatic or Imperial City	0.053	0.224	0	1	209
Coal Deposits	0.196	0.398	0	1	209
PANEL: FRENCH INSTITUTIONS					
Income of male elem. school teachers (1886)	1022.542	212.517	711.961	1838.763	238
Protestant Share	0.532	0.391	0.003	0.998	238
% of county population in urban areas	0.294	0.24	0	1	238
% females	0.506	0.016	0.44	0.546	238
% age below 10	0.246	0.025	0.153	0.299	238
Total Population (log)	10.743	0.427	9.359	11.91	238
County Area (log)	10.605	1.263	5.313	12.955	238
University in 1517	0.038	0.191	0	1	238
Hanseatic or Imperial City	0.139	0.346	0	1	238
Coal Deposits	0.34	0.475	0	1	238

[1] We find a negative correlation between years of French invasion and coal deposits. However, this correlation arises only when including the entire set of geographical controls in the specification, while the simple correlation between our institutional variable and the coal deposits is positive.

Table A2: Exogeneity Test - Napoleonic Invasion and Socioeconomic Drivers

Dependent Variable	Napoleon (1)	Napoleon (2)	Years of French Inv. (3)	Years of French Inv. (4)
Urb. Rate - 1790	-0.0101	-0.0295	-1.084	-0.860
	(0.134)	(0.126)	(1.377)	(1.283)
Pop.Density - 1790	0.000368	0.000957	-0.0113	0.000820
	(0.000925)	(0.000755)	(0.00896)	(0.00581)
City population in 1500	6.490	6.613	98.98	104.6*
	(5.499)	(5.899)	(66.56)	(59.95)
Educational Centers	0.187***	0.0706	1.228	-0.648
	(0.0541)	(0.0626)	(0.801)	(0.751)
Hanseatic or Imperial City	0.165***	0.112	0.731	-0.0746
	(0.0632)	(0.0689)	(0.838)	(0.718)
Coal Deposits	-0.00619	-0.0212	-1.159**	-1.297***
	(0.0462)	(0.0422)	(0.585)	(0.469)
Geographic Controls	yes	yes	yes	yes
Distance Controls	no	yes	no	yes
R^2	0.336	0.447	0.371	0.596
Obs.	413	413	413	413

Notes: The dependent variable is in the column heading. *Geographic Controls*: latitude, area of the county (log) and Polish-speaking area. *Distance Controls*: distance from Paris, distance from the imperial capital (Berlin), distance from the district capital. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table A3: Baseline Specification

Log Average Wage for Male Elementary Teachers in 1886	(1)	(2)	(3)	(4)	(5)
Napoleon	0.0377**	0.114***	0.109***	0.121***	-0.595
	(0.0172)	(0.0224)	(0.0220)	(0.0278)	(0.813)
Protestant Share	0.0938***	0.172***	0.184***	0.170***	0.190***
	(0.0189)	(0.0261)	(0.0254)	(0.0330)	(0.0401)
Napoleon × Protestant Share		-0.112***	-0.121***	-0.174***	-0.208***
		(0.0332)	(0.0325)	(0.0335)	(0.0403)
Polish-speaking provinces	-0.0416***	-0.0366***	-0.0377***	-0.0281*	-0.0243
	(0.0143)	(0.0139)	(0.0137)	(0.0157)	(0.0217)
Latitude in radius *100	-0.00458	-0.00686*	-0.0111***	-0.00315	-0.00751
	(0.00381)	(0.00400)	(0.00426)	(0.00365)	(0.00622)
County Area (log)	-0.0780***	-0.0767***	-0.0695***	-0.0869***	-0.0850***
	(0.00762)	(0.00756)	(0.00898)	(0.0136)	(0.0173)
Coal Deposits	0.0828***	0.0845***	0.0783***	0.0121	-0.0302
	(0.0172)	(0.0172)	(0.0167)	(0.0131)	(0.0220)
Imperial city in 1517			0.0412	-0.00246	-0.116**
			(0.0340)	(0.0272)	(0.0486)
Hanseatic city in 1517			0.0865***	0.0116	-0.00607
			(0.0327)	(0.0234)	(0.0308)
City population in 1500			1.105	1.313	7.194
			(1.373)	(1.486)	(14.16)
Number of Farms 1882 (log)				0.0689***	0.0641***
				(0.0163)	(0.0185)
% of Labor Force in Mining				0.112	0.107
				(0.0855)	(0.0831)
% of County Population in Urban Areas				0.293***	0.298***
				(0.0437)	(0.0500)
Total Population (log)				0.0165	0.0190
				(0.0329)	(0.0390)
Year in which annexed by Prussia				0.000166***	0.000182**
				(5.74e-05)	(7.25e-05)
% Jews				-1.816***	-1.523**
				(0.481)	(0.636)
Distance to Berlin in km				-9.86e-05**	-9.81e-05*
				(4.86e-05)	(5.18e-05)
Dist. to District Capital				-0.000204	-0.000135
				(0.000162)	(0.000161)
# free apartment for teachers				-0.000162	-7.82e-05
				(0.000226)	(0.000270)
% Pupils with Dist. to School over 3 km				-0.341	-0.316
				(0.218)	(0.195)
(log) # of Teachers				-0.0511	-0.0476
				(0.0411)	(0.0454)
(log) # of Pupils				0.117***	0.106**
				(0.0413)	(0.0426)
Napoleon × City population					-6.492
					(14.26)
Napoleon × Hanseatic city					0.0234
					(0.0520)
Napoleon × Imperial city					0.124**
					(0.0620)
Napoleon × Polish-speaking provinces					-0.0408
					(0.0365)
Napoleon × Latitude					0.00773
					(0.00910)
Napoleon × County Area (log)					0.00230
					(0.0151)
Napoleon × Coal Deposits					0.0639**
					(0.0276)
R^2	0.396	0.406	0.429	0.667	0.677
Obs.	447	447	447	447	447

Notes: Robust standard errors in parenthesis. *** p<0.01, ** p<0.05, * p<0.1

Robustness Checks

This section presents a series of checks to verify the robustness of the baseline estimates. First, we use different proxies for the dependent variable. Then, we test our model specification by adding both historical and contemporaneous controls, using different clustering and performing the analysis on different samples. The coefficients of the interaction terms β_3 obtained implementing our baseline specification (Equation 1) are reported in Table A4.

Dependent Variable Panel a) of Table A4 shows that the baseline results hold for alternative proxies for economic prosperity. In row (1), we use the average income of male elementary school teachers in levels. The results are consistent with the baseline model, and the interaction term is statistically significant and negative. The coefficients differ in terms of magnitude compared to our main specification wherein the dependent variable is measured as the logarithm. In row (2), we use another direct measure of income, that is, the log wage of a daily laborer in 1892.[2] Then, as in Becker and Woessmann (2009), we use income tax revenue per capita as the dependent variable in row (3). Finally, in row (4) we use Prussian urbanization data made available by Matzerath. We matched approximately 400 counties with the reported administrative regions and use the urbanization rate in 1871 as the dependent variable. In the specification we also control for the urbanization in 1816, and the total county population (in level) reported by the official statistics in 1816 and 1871.[3] The coefficients of the interaction terms remain consistently negative and statistically significant.

Protestant Variable Panel b) focuses on the religious affiliation measure. First, to rule out the possibility that the results are affected by minor changes in the Protestant share variable, we use a Protestant (absolute) majority dummy (row 5). Note that the coefficients have the same sign as in the baseline specification, and they remain significant at conventional levels. We then compute the Protestant share using the first available wave of the Prussian census, which was conducted in 1816 immediately after the Congress of Vienna. While this variable is available only for the 349 counties that formed Prussia at that time, its correlation with the Protestant share in 1871 is extremely high (0.98).[4] Accordingly, our main results are unchanged (row 6). Third, one may still worry that the persistence of religious affiliation after the Napoleonic wars is not sufficiently informative of the religious composition at the end of the eighteenth century given that war itself may have caused religious migration. To address this concern, we construct a historical measure of the Protestant majority in the seventeenth century using data from Cantoni (2012) and Spenkuch (2010). Although it is defined at the principality (rather than at the county) level, and it is not available for the entire sample, the advantage of this variable is that it was measured two centuries before the arrival of Napoleon. The main evidence is unaffected even when using the historical Protestant dummy (row 7). Finally, we follow the literature and instrument the Protestant share using the distance from Wittenberg. This should isolate exogenous variation in religious affiliation using the concentric diffusion of Protestantism through Prussia from its origins in Luther's city (row 8).[5] The results are qualitatively unchanged, and the coefficient of interest is even larger than that for the baseline estimate.

[2]Table A4 displays the results for male laborers in urban areas. The coefficients are virtually the same when using the wage of a rural male daily laborer or the wage of a female daily laborer. These results are available upon request.

[3]The sample is significantly reduced because of the match with the urbanization data and the different institutional environment in 1816 (Prussia had a smaller territory, see also row 6).

[4]Of the invaded territories, Prussia was given the Rhineland and the Duchy of Warsaw. All states that we consider satellites remained independent after the Congress of Vienna and were annexed by the Kingdom of Prussia only later.

[5]The t-statistic of the first stage is approximately 14.

Additional Controls In panel c), we introduce additional controls that may affect our results. One potential concern is that pre-Napoleonic differences in the economic prosperity of the counties are not fully accounted by the baseline controls. We hence retrieve population and urbanization data in 1790 from the History Database of the Global Environment, and we construct measures of population densities and urbanization before the Napoleonic invasion (row 9).[6] Another possible concern is that our result is induced by differences in purchasing power across regions or by other drivers of the demand for teachers and, consequently, of their wages. Hence, we first include a price measure to capture potential differences in purchasing power across counties (row 10). This proxy is constructed as the ratio of total expenditures on new school buildings in 1886 to the total number of new school buildings, which should capture variation in housing prices. We then add a group of sociodemographic variables from 1871 – including household size, the share of females and the share of the population under 16 – that might influence the demand for teachers. We also include the share of the population of Prussian origin and the share of the population born in the county to control for the stock of both internal and foreign migrants (row 11). Finally we add the literacy rate to control for the value that people in different counties attribute to schooling (row 12). The latter control is of particular importance for Protestant areas where, on average, the literacy rate is higher. In row 13, rather than using total number of pupils and teachers, which might capture population size, we used alternative education measures as enrollment rates and student-teacher ratios in 1886. Finally we include a dummy variable that captures the presence of ore deposits (row 14). We construct this dummy variable from the map BII (metal ore mining) in Pfohl and Friedrich (1928). The results consistently confirm the baseline estimates.[7]

Clustering To allow for an arbitrary variance-covariance matrix capturing potential serial correlation in the residual error term, panel d) considers clustered standard errors at the pre-Napoleonic-principality level (row 15); at the pre-Napoleonic-ruler level (row 16), since many principalities were under the control of the same authority; at the pre-unitary-state level after the Napoleonic German Mediatization, as defined by Acemoglu et al. (2011) (row 17); and at the Prussian political-district level in 1871 (row 18). The coefficients of interest are always statistically significant, as in the baseline estimates.

Samples Finally, in panel e), we show that our evidence is not driven by influential observations. First, we trim (row 19) and winsorize (row 20) the extreme 1% of observations of our dependent variable. In row (21), we compute a measure of the influence of each observation on the estimated coefficient. In particular, an observation is considered influential when the difference between the regression coefficient estimated using the whole sample and that calculated excluding the observation is above a standard cut-off value.[8] We then exclude all the influential observations for the coefficient of interest (*Napoleon* $\times$ *Linguistic*

[6]This data, compiled by the PBL Netherlands Environmental Assessment Agency, are available at 0.5 by 0.5 degree grid. We construct population density by summing information on population of all the cells belonging to each county and dividing by the county area. Similarly, we construct urbanization rates by summing cell-level information on people living in urban areas and dividing it by total population.

[7]The magnitude of the coefficient halves when using religious affiliation as our cultural distance proxy mainly due to the inclusion of literacy rate. Nonetheless, the robustness of the coefficients is confirmed by the results of Oster tests. The bias-adjusted estimated effect of the interaction term, *Napoleon* $\times$ *Protestant Share*, is always strictly negative and much larger than the OLS estimate (Oster, 2017), suggesting that the degree of omitted variable bias is unlikely to explain the size of the estimated effect.

[8]The cut-off value we use for a highly influential observation is $2/\sqrt{(n)}$, but our results are robust to the use of different cut-offs.

Distance or *Napoleon* $\times$ *Protestant Share* or *Napoleon* $\times$ *No French Ties*). Moreover, in rows (22)-(26), we consider alternative subsamples. In row (22), we exclude Polish-speaking areas, as these territories are mostly Catholic and have below-average economic performance. We then exclude the Duchy of Nassau (row 23), since it joined the Confederation of the Rhine but did not implement the Code despite formally adopting it. (See Arvind and Stirton (2010)). Then, we exclude the territories under the direct control of the French Empire and consider as treated only those territories in the Confederation of the Rhine (i.e., satellite states) that adopted the Code (row 24) in order to exclude the possibility that our results are mainly driven by the Rhineland. We also exclude territories annexed after 1810 (row 25) because they were under French influence for only a few months. Finally, in row (26), of the territories under the control of Napoleon, we keep only those annexed by the French Empire. Although the resulting sample contains only approximately 60% of the original observations, the sign of the coefficient on the interaction term is always negative, and statistically significant.

Overall, the results obtained using different samples show that the interaction between institutions and cultural distance is statistically significant, has the expected sign and is remarkably stable.

Table A4: Robustness Checks – Specification

	Nap. × Ling. Dist.			
	Coeff.	s.e.	Obs.	R^2
a) Dependent Variable				
1) Wage Elem. Teacher (level)	-216.3***	(46.65)	447	0.675
2) Wage Urb. Male Lab. 1892 (log)	-0.236***	(0.0545)	430	0.686
3) Income Tax Revenue p.c. 1877	-0.806***	(0.200)	421	0.384
4) Urbanization 1871	-6.652**	(2.654)	291	0.985
b)Protestant Variable				
5) Protestant Dummy	-0.124***	(0.0274)	447	0.666
6) Protestant Share 1816	-0.144***	(0.0323)	349	0.859
7) Protestant Dummy 1600	-0.149**	(0.0756)	438	0.668
8) IV Distance from Wittemberg	-0.669***	(0.127)	447	0.354
c) Additional Controls				
9) Pop Density & urb. rate 1790	-0.208***	(0.0438)	413	0.682
10) Price (Real estate unit price)	-0.204***	(0.0418)	441	0.675
11) Socio-Demographic	-0.139***	(0.0474)	447	0.705
12) Literacy	-0.138***	(0.0377)	447	0.702
13) Educational Proxies	-0.189***	(0.803)	447	0.683
14) Ore Deposits	-0.208***	(0.0408)	447	0.677
d) Clustering Levels				
15) Pre-Napoleonic Principality	-0.208***	(0.0692)	447	0.677
16) Pre-Napoleonic Ruler	-0.208***	(0.0626)	447	0.677
17) Post-Napoleonic Kingdom	-0.208***	(0.0516)	447	0.677
18) District 1871	-0.208***	(0.0499)	447	0.677
e) Alternative Samples				
19) Trimming (1%)	-0.203***	(0.0318)	439	0.674
20) Winsorising (1%)	-0.205***	(0.0375)	447	0.680
21) Df Beta	-0.241***	(0.0279)	426	0.728
22) Excluding Polish-speaking Areas	-0.260***	(0.0574)	328	0.660
23) Excluding Duchy of Nassau	-0.238***	(0.0407)	438	0.704
24) Excluding Rhineland	-0.186***	(0.0440)	395	0.673
25) Excluding Areas Annexed after 1810	-0.232***	(0.0422)	411	0.696
26) Excluding Confederation of the Rhine	-0.190**	(0.0847)	261	0.720

Notes: The dependent variable is the logarithm of the average annual wage of an elementary school teacher in 1886, unless otherwise specified in the table. All specifications include *Geographic Controls*, *Historical Controls*, *Socioeconomic Controls*, *Education Controls* and *Hist & Geo Interactions*. See also, the notes to Table 3. Robust standard errors in parentheses, unless otherwise specified in the table.
*** p<0.01, ** p<0.05, * p<0.1

Omitted Variables: Fixed Effect Specification

A potential concern with our identification strategy is that the presence of unobserved characteristics may influence both economic outcomes and cultural traits. In this section, we address this issue by conditioning on a series of different fixed effects. Specifically, we add a set of ruler fixed effects and three groups of geographic dummies to the baseline specification. This allows us to take into account all pre-Napoleonic principality-level characteristics (e.g., institutional setting) and exploit only the within-region variation in the explanatory variables. The latter can be attributed to the eventful history of the Holy Roman Empire, where recurring wars, alliances and inheritances periodically reshaped political borders. Table A5 reports the results.

The first set of fixed effects we include is defined at the ruler level (*Ruler FE*) and controls for all features common to territories under the same ruler (e.g., institutional reforms, legal framework). We identify 18 different rulers at the time of the Napoleonic invasions and include a dummy for each of them (column 1).[9] Identification now relies on cross-county variation in Protestant share within a ruler's land.[10] The coefficient of interest, although slightly smaller, is negative and statistically significant when we exploit within-ruler variation, suggesting that the economic effect of French institutions crucially relies on the cultural background.

Table A5: Fixed Effects Specification

Log Average Wage of a Male Ele. School Teacher (1886)	(1)	(2)	(3)	(4)
Napoleon	-0.320	-0.453	-0.499	-0.0400
	(0.658)	(0.790)	(0.787)	(0.829)
Protestant Share	0.131***	0.200***	0.119***	0.110***
	(0.0290)	(0.0433)	(0.0425)	(0.0369)
Napoleon × Protestant Share	-0.0884**	-0.208***	-0.0801*	-0.0623*
	(0.0381)	(0.0404)	(0.0453)	(0.0367)
Specification	Ruler FE	Dist. Berlin	Dist. Paris	Dist. French Border
R^2	0.794	0.681	0.735	0.732
Obs.	447	447	447	447

Notes: The dependent variable is the logarithm of the average annual wage of an elementary school teacher in 1886. All specifications include *Geographic Controls*, *Historical Controls*, *Socioeconomic Controls*, *Education Controls* and *Hist & Geo Interactions*. See also, the notes to Table 3. Robust standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

To further tackle this issue, we compute the distance quintiles between each county and Berlin, Paris or the closest French Border and include a dummy variable for each quintile. The results are reported respectively in columns (2), (3) and (4). Reassuringly, the estimated coefficient on the interaction term has the expected sign, and it is significant across all specifications. Adding the distance dummies, especially the distance from the French border, occasionally reduces the magnitude of this coefficient. This is not surprising given that the distance from the French border also captures the trajectory and timing of the military expansion of the French Empire and, thus, the intensity of the treatment.

[9] As noted above, several principalities were under the same ruler; thus, the number of ruler fixed effects, 18, is smaller than the number of principalities, 36.

[10] Notice that we observe the Protestant share at a lower level of aggregation (county level) than the principality. We thereby exploit within-principality religious variation for identification.

Intensity of the Institutional Treatment

In this section, we investigate how the moderating effect of cultural distance changes with the length of exposure to the new institutions. In Section , we thoroughly discuss the differences in implementation that are partially due to the timing of the military campaign. It could be that a longer (or more intense) exposure to the new institution reduces the importance of cultural distance in the transplantation process, as the new rules have more time to cement. To explore this question, in Table A6, we use three measures that capture different facets of the intensity of the institutional treatment.

First, we differentiate between territories that were annexed by the French Empire and those belonging to the Confederation of the Rhine (i.e., satellite states). In the former group, the effects of treatment might be stronger, not only because the Code was imposed and fully implemented but also because the administrative structure and local governors were replaced with French ones. Moreover, when considering the years of French invasion, the annexed territories are those with the longest period of exposure to the French institutions: 19 years compared to 6 years for the majority (96%) of the counties belonging to satellite states. Column (1) shows that the coefficients on the interaction terms remain negative and significant. Although the coefficients on the interaction terms are not statistically different when we distinguish between annexed territories and satellite states, our findings suggest that cultural distance has a slightly larger impact on the effect of the new institutions on economic performance in places where the strength of the authority enforcing the institutional reforms was higher.

Second, we use the number of years of French influence. Again, we want to capture the differences in exposure to French institutions. The coefficients reported in column (2) confirm that more years under French rule imply a stronger negative effect when the Protestant share is high.

Table A6: Intensity of Treatment

Log Average Wage of a Male Ele. School Teacher (1886)	(1)	(2)	(3)
Protestant Share	0.194***	0.140***	0.371***
	(0.0407)	(0.0388)	(0.0671)
Prot. Share × Fr.Empire	-0.219***		
	(0.0756)		
Prot. Share × Satellite	-0.172***		
	(0.0426)		
Prot. Share × Years of French		-0.0120**	
		(0.00479)	
Prot. Share × ACJR Ind.			-0.00611***
			(0.00116)
R^2	0.692	0.673	0.683
Obs.	447	447	431

Notes: The dependent variable is the logarithm of the average annual wage of an elementary school teacher in 1886. All specifications include *Geographic Controls*, *Historical Controls*, *Socioeconomic Controls*, *Education Controls* and *Hist & Geo Interactions*. See also the notes to Table 3. Robust standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

Third, we use an index proposed by Acemoglu et al. (2011) that summarizes different reforms: the enactment of the French Civil Code, the restructuring of agricultural relations, the abolition of guilds and the abolition of serfdom (column 3). This index is derived by simply adding up the total number of years prior to 1871 (the year of the German unification) in which each of the four reforms had been in effect and then dividing this total number of years by four. Higher values of the indexes reflect a longer exposure to progressive reforms. With the caveat in mind that the duration of the reforms might not be fully exogenous, the estimate seems to confirm that a more intense exposure to progressive institutions (i.e., longer duration and higher number of reforms) had a weaker impact on economic performance in Protestant areas. The overall findings suggest that cultural distance continues to play a significant role even when the intensity of the institutional treatment increases.

Competing Explanations

This section investigates alternative explanations for our findings. We focus on factors, other than culture, that may interact with the new institutions, thereby affecting long-run economic outcomes. The coefficients of interest are reported in Table A7.

State Capacity Dittmar and Meisenzahl (2016) provide evidence on the links between Protestantism, enhanced state capacity and growth. In particular, they show that the 103 reformed cities that boosted public good provision in the sixteenth century by adopting city-level laws, called church ordinances (*kirchnordnung*), experienced significantly higher population growth in the long run. The coefficients on the interaction between cultural proximity, especially when measured by religious affiliation, and institutions may be explained by the fact that French institutions were ineffective in counties with high levels of public good provision, since they already had good institutions. This could be true if the pre-existing and new institutions are substitutes. In order to rule out this possibility, we collect data on the *kirchnordnung*, following Dittmar and Meisenzahl (2016). Specifically, we identify 45 cities in our sample that adopted this particular legal institution in the sixteenth century, and we construct a dummy variable (*Church Ordinances*) that equals one if at least one city in the county promulgated a *kirchnordnung*.[11] The results reported confirm the hypothesis that counties with institutionalized public good provision were on a higher growth path, as the coefficient on *Church Ordinances* is positive and significant. Importantly, however, the results also show that the interaction between the measure of state capacity and French institutions has a small and not always significant coefficient. Accordingly, including this interaction in the main specifications does not alter our results (column 1).

Institutional Proximity Our results might be induced by institutional rather than cultural proximity. During the eighteenth century, some rulers, perhaps inspired by Enlightenment principles, enacted reforms in their states to promote literacy and simplify justice and administration (See Arvind and Stirton, 2010). It is possible that by the time Napoleon arrived, the local population was already used to a modern legal framework in places where these early reforms were implemented and was, hence, more likely to accept Napoleonic institutions. In order to disentangle the contribution of *institutional similarity* from that of cultural commonality in moderating the economic effect of the transplant, we construct a measure of historical institutional proximity. In particular, we collect data on progressive reforms of the educational, judicial or administrative systems implemented in each state between 1701 and 1790. We classify rulers who implemented at least one modernizing reform as *Reformists*, and we create a dummy variable that equals one if the principality had at least one *Reformist* ruler between 1701 and 1790. The coefficient on the interaction term $Reformist \times Cultural\ dist$ shows that the similarities of Napoleonic institutions with pre-existing ones positively affect the success of the transplant. However, our coefficients of interest remain negative, highly significant, and similar in magnitude to those of the baseline specification, confirming that cultural traits – in particular, cultural proximity – play a role beyond pre-existing institutional characteristics.

Legitimacy of the Pre-Napoleonic Ruler The intricate web of family ties characterizing the European aristocracy, coupled with complex succession laws, implied that the same prince frequently ruled several – occasionally non-contiguous – principalities. This implied prolonged absences that could erode the ruler's legitimacy and, in turn, entail various degrees of reception of new institutions. In addition to the inclusion of ruler fixed effects in Table A5, we explore this possible alternative explanation by constructing a dummy variable, *Peripheral Ruler*, which identifies 21 peripheral principalities (277 counties) with respect

[11] The geographical area we examine does not perfectly overlap with that analyzed by Dittmar and Meisenzahl (2016). Approximately one-half of the cities they consider are included in our sample.

to the ruler's main residence. For example, Charles Theodore (1724-1799) was Prince Elector of Bavaria, where he maintained his main residence, but he also ruled the Electorate Palatinate and Duchy of Julich and Berg. For those three territories, the *Peripheral Ruler* dummy takes the value 1 in our sample. Reassuringly, column (3) confirms that our results are not affected by the physical presence of the ruler.

Education Policies Among other reforms, Napoleon restructured the educational system. His main objective was to breed well-prepared military and administrative elites, and his interventions principally targeted higher education, leaving primary schooling in the hands of Catholic religious institutions and old local-community schools.[12] A fruitful interaction could have arisen where an already-developed primary education system was combined with innovative Napoleonic educational policies. In order to test this potential channel, we use information on the presence of schools and monasteries – the most prominent primary educational centers at the time – in 1517. We define a dummy variable that takes the value 1 if a school or a monastery was present in the county and interact this variable with our institutional measure. In order to control for pre-existing hubs of higher education, we also include a dummy variable identifying the presence of universities in the county before the Napoleonic invasions. The results show that the presence of educational centers does not generate any synergy with the Napoleonic institutions. The addition of these controls does not affect the sign, magnitude or significance of the coefficient of interest (column 4).

Previous French Invasions Central Europe was plagued by continuous conflict following the creation of the Holy Roman Empire, and some areas in our sample had been repeatedly invaded by France before the Napoleonic wars. On the one hand, this could have forged a historical collective memory identifying France as *the* traditional enemy and Bonaparte as the villain insofar as he was the legitimate successor of the French kings. The rejection of French institutions could thus be driven by animosity originating from previous invasions rather than from cultural distance.[13] On the other hand, protracted occupations could have improved the reception of new institutions, as they imply interactions with the French military and cultural exchanges with the local population. We construct a dummy variable that equals one if the area was occupied by French troops after the Peace of Westphalia (1648). The results suggest that previous French occupation does not systematically influence the adoption of the new institutional framework. Moreover, our main message is not affected by the introduction of this control variable, and the coefficients on *Napoleon* $\times$ *Cultural dist* remain negative and significant (column 5).

Severity of the Napoleonic Conflict An essential characteristic of the institutional transfer we examine is that it was forceful, often achieved through conquest, and carried out in one of the major theaters of the Napoleonic wars. If destruction from war has a persistent economic effect (longer than the 70-year period over which our dependent variable is constructed) and if harsher conflicts occurred in invaded culturally distant areas, then our results may be contaminated by the severity of the Napoleonic conflict. To control for this potential confounding factor, we collect data on all major battles during the Napoleonic military campaigns (1796-1815) and create a dummy variable that equals one if there was a relevant battle in the county.[14] The results are robust to the inclusion of this additional control variable (column 6).

[12] According to Ellis (2003) ch. 3, Napoleon paid very little attention to primary education – especially for girls – while promoting technical training and higher education by establishing polytechnics, conservatories of art and trades, and *lycées*.

[13] We did not find any anecdotal evidence that conflicts were harsher in Protestant areas or in specific linguistic regions. Rather, French invasions often involved the Catholic lands of the Rhenish area. For example, Trier was besieged and occupied by French troops three times between 1632 and 1675, and in 1673, the French military destroyed all its churches and abbeys.

[14] We define major battles as those with at least 1,000 deaths. Of a total of 23 battles, only 5 occurred in the counties included in our sample: Dennewitz in 1813 (approximately 30,000 casualties); Friedland in 1807 (30,000); Heilsberg in 1807 (7,400); Lutzen in 1813 (31,000) and Eylau in 1807 (40,000).

Table A7: Competing Explanations

	State capacity	Pre-Napoleonic reforms	Peripheral ruler	Educational centers	French occupation	Battles	Fragmentation	Horserace
Log Average Wage Male Elem. Teachers in 1886	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Napoleon	-0.591	-1.273	-0.809	-0.614	-1.031	-0.590	-0.706	-1.017
	(0.829)	(0.856)	(0.948)	(0.811)	(0.884)	(0.816)	(0.816)	(1.225)
Protestant Share	0.188***	0.175***	0.212***	0.190***	0.200***	0.190***	0.168***	0.168***
	(0.0405)	(0.0491)	(0.0405)	(0.0403)	(0.0409)	(0.0403)	(0.0380)	(0.0563)
Napoleon × Protestant Share	-0.205***	-0.168***	-0.241***	-0.208***	-0.218***	-0.208***	-0.179***	-0.157**
	(0.0427)	(0.0481)	(0.0434)	(0.0406)	(0.0398)	(0.0406)	(0.0385)	(0.0659)
Church Ordinances	0.0452*							0.0707**
	(0.0230)							(0.0313)
Nap × Church Ordinances	-0.0338							-0.0413
	(0.0360)							(0.0456)
Pre-Napoleonic Reforms.		-0.261***						-0.245***
		(0.0560)						(0.0822)
Nap × Reforms		0.248***						0.241***
		(0.0530)						(0.0784)
Peripheral Ruler			0.0833***					0.0446
			(0.0273)					(0.0809)
Napoleon × Peripheral Ruler			-0.0504*					-0.00554
			(0.0305)					(0.0804)
University in 1517				-0.0372				-0.0694
				(0.0312)				(0.0868)
Nap × Universities				0.0537				0.0949
				(0.0461)				(0.0944)
Monasteries or Schools in HRE				0.0957**				0.000193
				(0.0440)				(0.0372)
Napoleon × % Monasteries or Schools in HRE				-0.0613				0.0228
				(0.0544)				(0.0511)
Previous French Presence					-0.0189			0.0240
					(0.0830)			(0.167)
Napoleon × Previous French Presence					0.0245			-0.0111
					(0.0896)			(0.169)
Battles						-0.00493		0.00764
						(0.0386)		(0.0378)
Nap × Battles						-0.00909		-0.00407
						(0.0434)		(0.0517)
Religious Fragmentation							0.141**	0.0460
							(0.0605)	(0.0965)
Napoleon × Religious Fragmentation							-0.155**	-0.0657
							(0.0763)	(0.111)
Linguistic Fragmentation							-0.00525	0.0236
							(0.0510)	(0.0349)
Nap × Linguistic Fragmentation							0.0218	-0.0226
							(0.0771)	(0.0677)
R^2	0.678	0.716	0.676	0.680	0.667	0.677	0.682	0.725
Obs.	447	427	429	447	429	447	447	427

Notes: The column headings indicate the alternative channel we investigate in the specification. The dependent variable is the logarithm of the average annual wage of an elementary school teacher in 1886. All specifications include *Geographic Controls*, *Historical Controls*, *Socioeconomic Controls*, *Education Controls* and *Hist & Geo Interactions*. See also the notes to Table 3. The complete table can be found in the Appendix. Robust standard errors are in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

Religious and Linguistic Fragmentation Several papers have investigated the costs and benefits of diversity, whether racial, ethnic, religious, or linguistic (e.g., Alesina and La Ferrara, 2005). On the one hand, fragmented societies are more prone to poor policy management and pose more political economic challenges than do homogeneous societies. Accordingly, in counties characterized by high fragmentation, the functioning of French institutions could be impaired. On the other hand, a diverse cultural or ethnic mix may provide a variety of abilities and experiences that boost productivity through innovation and creativity. In this case, a highly fractionalized county may be a better recipient of French institutions. To test this alternative explanation, we construct and include in the baseline specification two different measures: a Herfindahl index using the shares of the three largest religious groups (Protestants, Catholics and Jews) and a similar index using the number of languages spoken in the county.[15] We use these measures and their interactions with the Napoleonic dummy. The coefficients of these new controls are not systemati-

[15]The latter index is not weighted by population shares speaking a given language due to the lack of data.

cally significant, and our main results are unchanged (column 7).

Summary Finally, in column (8), we implement a horse-race model, including all controls for the alternative explanations. Our main results survive this demanding exercise. These findings confirm that despite complex interactions among institutions and historical and socioeconomic factors, cultural similarity does play a role in institutional transplants and long-term economic outcomes.

Baseline Specification on Invaded Territories

In this section we perform a sensitivity analysis using only the subsample of counties that were under the Napoleonic rule. This exercise is meant to isolate the effect of cultural proximity within the invaded areas. To this purpose, we estimate variations of the following model:

$$y_i = \alpha + \beta_1 Cultural\ dist_i + \mathbf{H}_i\beta_4 + \mathbf{G}_i\beta_5 + \mathbf{E}_i\beta_6 + \mathbf{X}_i\beta_7 + \varepsilon_i \tag{3}$$

where y_i is the log of the average income of male elementary school teachers in county i; $Cultural\ dist_i$ is the measure of cultural distance; $\mathbf{H_i}$, $\mathbf{G_i}$, $\mathbf{E_i}$ and $\mathbf{X_i}$ are vectors of historical, geographical, educational and socioeconomic controls, respectively; and ε_i is an error term. We report results using three different measures of cultural distance from France: the Protestant share in the county population; a linguistic distance measure, and a dummy capturing the cultural links between Pre-Napoleonic German and French elites (See Section for the definition of the variables).

First, we focus on our main proxy of cultural distance, the Protestant share in the county population. Moving along columns the set of controls increases. Results suggest that the Protestant share is not systematically associated with economic outcomes. This result is quite surprising and in contrast with the existing literature (e.g. Becker and Woessmann, 2009) which finds that Protestantism had a strong positive impact on economic development. Indeed, throughout the analysis the average effect of the Protestant share have been consistently positive and precisely estimated. In fact, if we were perform the analysis only in the subsample of territories not invaded by Napoleon, the effect of the Protestant share is positive, significant and three times as large as the one found in column (3). This evidence is in line with our baseline results, and it suggests that the effects of French institutions negatively interacts with local culture by reducing the positive effect of Protestantism on economic growth.

In the remaining columns, we reestimate eq. (4) using alternative proxies of cultural distance. Columns (4)-(6) present the result using linguistic distance. Consistently with the baseline results, cultural distance is negatively associated with economic performances in the invaded territories. This evidence is also confirmed by the results in columns (7)-(9), where we repeat the analysis using the *No French Ties* variable. Overall the result of this sensitivity test corroborate our baseline evidence, and further suggest that territories that received the Napoleonic institutions were disadvantaged if they were culturally distant from France.

Table A8: Effect of Culture in Territories under Napoleonic Rule

Log Average Wage Male Elem. Teachers in 1886	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Protestant Share	0.0226	0.0315	0.0767**						
	(0.0262)	(0.0262)	(0.0310)						
Ling. Dist				-0.0040***	-0.0043***	-0.0024***			
				(0.00061)	(0.0006)	(0.00059)			
No French Ties							-0.0589***	-0.0783***	-0.0442***
							(0.0215)	(0.0202)	(0.0163)
Geographic Controls	yes	yes	yes	yes	yes	yes	yes	yes	yes
Historical Controls	no	yes	yes	no	yes	yes	no	yes	yes
Economic Controls	no	no	yes	no	no	yes	no	no	yes
Education controls	no	no	yes	no	no	yes	no	no	yes
R^2	0.431	0.458	0.750	0.452	0.481	0.750	0.448	0.485	0.750
Obs.	238	238	238	238	238	238	238	238	238

Notes: The analysis is performed only on the subsample of the territories under Napoleonic rule. Territories under Napoleonic rule are defined as both French empire and Satellite state (dummy *Napoleon* equal to 1). See also the notes to Table 4 for the definitions of the controls. Robust standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

B APPENDIX - DATA

Linguistic Regions

For the baseline measure, all the counties in the dataset are mapped into 35 different linguistic regions according to Ethnologue database classification. The languages we identify are: Armenian, Alemannic, Bavarian, Belarusian, Czech, Danish, Frisian, Northern, German, Standard, Kashubian, Limburgish, Lithuanian, Luxembourgish, Palatinate Franconian, Plautdietsch, Polish, Prussian, Ripuarian, Romani, Baltic, Romani, Carpathian, Russian, Rusyn, Saterfriesisch, Saxon, East Frisian Low, Saxon, Low, Saxon, Upper, Silesian, Silesian, Lower, Sorbian, Lower, Sorbian, Upper, Swabian, Ukrainian, Westphalien, Wymysorys, Yeniche.

For the ancestral distance measure instead, the counties in the sample are mapped into 23 different linguistic regions according to the a detailed map of the ancestral languages provided at http://www.muturzikin.com/carteeurope.htm and dialects of Europe as in Spolaore and Wacziarg (2014). The map includes only native languages, discarding languages spoken by migrants. We end up with 39 clusters of counties speaking the same ancestral languages. Each cluster is composed by counties speaking the same combination of the 23 languages (i.e. the counties of Fulda and Erfurt are home to two ancestral languages *Upper Saxon* and *Eastern Franconian*, hence they belonterg to the same cluster). The ancestral languages we identify are: Aachterhoeks, Kashubian, Danish, German Standard, Drents, French, Northern Frisian, Frisian, Gronings, Upper Sorbian, Limburgish, Lithuanian, Low Saxon, Dutch, Palatinate Franconian, Polish, Rusyn, Sallands, Samogitian, Swabian, Upper Saxon, Silesian and Eastern Franconian.

Linguistic Variable Construction

To construct the linguistic distance measure, we first exploit the linguistic information reported in the Ethnologue database, which describes the languages that are currently spoken in each NUTS2 region. We map the county of our dataset to the current NUTS2 region and attribute to the county all the languages spoken in that region. We define the linguistic distance metrics as the average linguistic distance of the languages spoken in a given county, in the same spirit of Fearon (2003) and Desmet et al. (2009). The distance metric between language j and f is:[16]

$$d_{jf} = 1 - \left(\frac{l_{jf}}{m_{jf}} \right)^{\delta} \tag{4}$$

where l is the number of shared branches between j and f, m is the maximum number of branches between the two languages, and δ is a parameter that determines how fast the distance declines as the number of shared branches increases.[17,18]

[16]The variable d_{jf} takes values in the unit interval. We rescale d_{jf} to take values in [0, 100].

[17]In the baseline specification, we set $\delta = 0.05$ as suggested by Desmet et al. (2009). All our results (available upon request) are robust when using other values for $\delta \in (0, 1]$.

[18]For instance, French is classified as: Indo-European - Italic - Romance - Italo-Western - Western- Gallo-Iberian - Gallo-Romance - Gallo-Rhaetian - Oil - Francais, while the classification for Standard German is Indo-European - Germanic - West - High German - German - Middle German- East Middle German - German Standard. They share 1 node on a maximum of 17 nodes. Hence, fixing $\delta = 0.05$, the distance between the two languages is 0.132 .

To construct the alternative linguistic measure, we follow Spolaore and Wacziarg (2014) and exploit a detailed map of the ancestral languages and dialects of Europe and match every language in the source map to the corresponding counties in our dataset.[19] We end up with 23 ancestral languages matched to each of the 447 counties.[20] Then, for each ancestral language, we use the linguistic classification from the Ethnologue to compute the linguistic distance of each language from the French spoken in Paris.

Pre-Napoleonic Principalities

All the counties in the dataset are mapped into 36 different principalities belonging to the Holy Roman Empire, the Kingdom of Prussia and the Kingdom of Poland. We refer to the political situation in 1789. The principalities we identify are: Austrian Netherlands, Bishopric of Cologne, Bishopric of Fulda, Bishopric of Hildesheim, Bishopric of Munster, Bishopric of Osnabruck, Bishopric of Paderborn, Bishopric of Trier, County of Mark, County of Hohenzollern-Sigmaringen, County of Lingen, County of Nassau, County of Nassau-Saarbrucken, Duchy of Berg, Duchy of Brunswick-Wolfenbuttel, Duchy of Cleves, Duchy of Julich, Duchy of Oldenburg, Duchy of Schleswig-Holstein, Duchy of Weimar, Duchy of Westphalia, East Frisia, Electoral Palatinate, Electorate of Brandeburg, Electorate of Brandenburg - County of Ravensberg, Electorate of Brandenburg - Kingdom of Prussia, Electorate of Brandenburg - Lower Silesia, Electorate of Brandenburg - Pomerania, Electorate of Brandenburg - Principality of Minden, Electorate of Hanover, Electorate of Mainz, Electorate of Saxony, Landgraviate of Hesse-Kassel, Palatinate-Zweirbrucken, Polish-Lithuanian Commonwealth and Swedish Pomerania Provinces. Finally some autonomous cities were classified as Imperial or Independent cities.

Pre-Napoleonic Rulers: No French Ties

We identified rulers from different sources, the time span we consider is 1701-1790. For example, the Bishopric of Hildesheim had 5 rulers in this period: Jobst Edmund von Brabeck, Joseph Clemens of Bavaria, Clemens August, Friedrich Wilhelm von Westphalen and Franz Egon von Fürstenberg. Among all these rulers only Joseph Clemens of Bavaria had at least one french direct relative. His mother was the Princess Louise Victoire d'Orléans-Alençon. Joseph Clemens of Bavaria allied with France during the War of Spanish Succession and found refuge at the French court after the war. In this principality *No French Ties* has been coded as 0.

Church Ordinances

We identified 45 church ordinances in the following Prussian counties: Anklam, Aschersleben (2), Berlin, Celle, Danzig, Delitzsch, Dortmund, Einbeck, Emden, Erfurt, Frankfurt am Main, Gottingen, Gelnhausen, Greifswald, Halberstadt, Hanau, Hannover, Hildesheim, Jerichow I, Kassel, Luneburg, Liebenburg, Magdeburg, Marburg, Merseburg (2), Naumburg, Nordhausen, Osnabruck, Ost-Havelland, Potsdam, Prenzlau,

[19] As in Spolaore and Wacziarg (2014), the source for the language data is the map provided at http://www.muturzikin.com/carteeurope.htm. The map includes only native languages and discards languages spoken by migrants.

[20] The different combinations of languages spoken in a county generate 39 language clusters. For instance, the counties of Fulda and Erfurt are home to two ancestral languages, *Upper Saxon* and *Eastern Franconian*; hence, they belong to the same cluster.

Ruppin, Salzwedel, Siegen, Stader Geest, Stendal, Stettin, Tecklenburg, Torgau, Weissenfels, West-Havelland, Wetzlar, Wittenberg.

Pre-Napoleonic Principalities Aggregated by Ruler	*No French Ties*	*Pre-Napoleonic Reforms*
Duchy of Berg, Duchy of Julich and Electorate Palatinate	0	0
Electorate of Brandeburg[a], Duchy of Cleves, County of Mark, County of Lingen	0	1
Austrian Netherlands	0	0
Bishopric of Munster	1	1
Bishopric of Cologne, Duchy of Westphalia	0	1
Bishopric of Osnabrück	1	0
Bishopric of Paderborn	1	1
County of Nassau	0	1
Principality of Nassau Saarbrücken	0	1
East Frisia	1	1
Electorate of Mainz	1	1
Electorate of Trier	0	0
Electorate of Saxony and Polish Lithuanian Commonwealth (since 1764)	0	1
Electorate of Saxony	0	0
Duchy of Weimar	1	1
Duchy of Brunswick-Wolfenbüttel	1	1
Bishopric of Hildesheim	0	1
Landgraviate of Hesse-Kassel and Swedish Pomerania Province	0	1
Bishopric of Fulda	1	1
Electorate of Hanover	1	0
Duchy of Schleswig-Holstein	1	0

[a]Throughout the paper we divide the territories of the Electorate of Brandeburg in six different areas according to the timing of the Prussian expansion.

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