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The Cost of Decentralization: Linguistic Polarization and the Provision of Education^{*}

Francesco Cinnirella[†] and Ruth M. Schueler[§]

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Abstract

Decentralization is expected to improve the provision of public goods as it can better respond to people's preferences. In this paper we argue that decentralization of education policy in a context of heterogeneous local preferences and with high coordination costs can lead to underprovision of education. To test this hypothesis we analyze the provision of public education in nineteenth-century Prussia which was characterized by a decentralized education system and a linguistically polarized society. Using unique county-level data on education expenditure we show that linguistic polarization had a negative impact on local spending. Instrumental variable estimates using distance to the eastern border suggest that the negative relationship can be interpreted as causal. Fixed-effect estimates exploiting a policy change in education spending show that centralization increased the provision of teachers in more linguistically polarized counties. Overall our results are consistent with the interpretation that decentralization can have heterogeneous effects.

Keywords: Human Capital, Education, Public Goods, Polarization, Decentralization, Prussia

JEL classification: H410, H750, I220, N130, N330

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1. Introduction

Decentralization of public services to lower levels of government has been a policy objective in the last decade both in developed and developing countries (World Bank, 2004). Generally it is argued that decentralization allows responding better to people's preference whereas, in a centralized system, the provision of uniform public goods does not reflect local preferences.¹ More specifically, the standard approach states that in the absence of spillovers and with heterogeneous preferences a decentralized system is to be preferred (Oates, 1972, 1999).

Consistent with the standard view recent studies have shown that decentralization increases the responsiveness of local governments to local needs. Faguet (2004) has shown that decentralization in Bolivia changed the pattern of investments in human capital, water and sanitation, making the provision of public services more related to real local needs. Barankay and Lockwood (2007) using a panel data set of Swiss cantons find that decentralization in education expenditure is associated with higher educational attainment. Similarly, Galiani et al. (2008) find that a longer exposure of secondary schools to decentralization has a positive effect on student test scores in Argentina. However Galiani et al. (2008) uncover some effect heterogeneity as schools located in poor municipalities did not benefit from decentralization. In a cross-country framework Hanushek et al. (2013) show that decentralization in terms of local school autonomy has a positive effect on student achievement in developed countries and a negative impact in developing and low-performing countries.²

In the standard framework preferences over the provision of public goods are assumed to vary across localities, whereas within localities preferences are assumed to be homogeneous. In this paper we examine empirically the extent to which decentralization in the presence of heterogeneous preferences *within* localities, namely within counties, can lead to underprovision of education. We show consistently that a shift from decentralization to centralization of education expenditure leads to a larger provision of school inputs in the presence of divergent and conflicting preferences.

The case of divergent interests in a "decision making-area" (Hanushek et al., 2013) is not conceptually new in the theoretical literature. In such a framework special interest groups with decisional power are expected to disagree about the level and the allocation of public spending (Alesina et al., 1999; Besley and Coate, 2003; Miguel and Gugerty, 2005). Therefore, from a theoretical perspective it is not immediately clear whether decentralization is conducive to a

¹ Besley and Coate (2003) question the assumption that centralization implies uniformity. They propose an alternative model based on political economy considerations which still stresses the drawbacks of centralization.

² Willis et al. (1999), Bardhan (2002), and Kremer et al. (2003) argue that decentralization leads to inefficient provision of education.

superior outcome. To our knowledge this is the first paper that analyzes and quantifies empirically the disadvantages associated with local provision of public education in the presence of heterogeneous preferences.³

To analyze this particular case we exploit historical evidence on the provision of primary education in nineteenth century Prussia. In particular we use a unique historical dataset on primary education expenditure at the county level in 1886. Nineteenth century Prussia is particularly well-suited to analyze this issue as the educational system was highly decentralized, namely decisions on school-funding were taken at the municipal level (Hühner, 1998).⁴ The presence of different ethnic-linguistic groups, on the other side, reflected conflicting interests about education policies.

The first comprehensive Prussian education census in 1886 provides detailed information at the county level on expenditures on public primary education and on schooling variables such as number of schools, number of teachers, and teacher salaries. For the same level of aggregation (the county) we have information on the language spoken by pupils at home which allows constructing a measure for linguistic polarization.

Indeed, cross-sectional evidence shows that, for a given level of municipal tax revenues and level of development, local expenditure on primary education was systematically lower in counties characterized by high levels of linguistic polarization. Accounting for the subsidiary role of the central state and for a rich set of confounding factors does not affect our main result. Consistently, we find that higher levels of polarization were associated with a lower number of schools per pupils and a higher student-teacher ratio. This is in line with our hypothesis that non-German speaking groups opposed “Prussian” educational policies in order to protect their cultural identity. The two groups could not agree on the allocation of funds in primary education and this led to lower schooling outcomes.

We address the issue of causality in the cross-section using an instrumental variable approach. Here we focus our attention on the counties east of the river Elbe (East Elbian Prussia) which were characterized by a large presence of Slavic groups that spoke mainly Polish going back to the Partitions of Poland. As education policies aimed at establishing German as the main

³ In fact the results of our paper are similar to Miguel and Gugerty (2005). They find that ethnic diversity is related to lower primary school funding and lower quality infrastructure in rural western Kenya. Yet their institutional setting differs crucially from ours as local funding of primary school in Kenya is based on voluntary fundraising and central government accounts for about 90% of total primary school spending. Our framework is almost exactly the opposite as central government in East Elbian Prussia in 1886 accounted for only 13% of total spending in primary education. This makes historical Prussia an optimal testing ground for evaluating local provision of education with conflicting preferences.

⁴ This meant explicitly that funding decisions were taken by municipalities; unions of small towns which were called schooling societies; by rural estates; single landlords or individual school patrons.

language, Polish-speaking people (and other linguistic minorities) felt that their cultural identity was threatened. As a result linguistically polarized counties could not agree on the levels and allocation of local education expenditure. There is abundant contemporary evidence on tensions between German and Polish-speaking groups in East Elbian Prussia. We argue that, in such a context of diverging interests, decentralization of the decision process led to underprovision of primary education. We exploit the geography of Prussia's annexation policies to identify arguably exogenous variation in linguistic polarization. The annexations towards Eastern Europe, such as the Partitions of Poland at the end of the eighteenth century, increased the share of ethnic Poles in Prussia and thus linguistic heterogeneity. The distance of the newly acquired territories to the eastern border is thus used to identify variation in linguistic polarization. Instrumental variable estimates confirm the negative impact of linguistic polarization on local expenditure on primary education.

As decisions on education spending were taken at the municipal level, ideally we would like to carry out the analysis at that level of observation.⁵ Yet the lowest administrative level for which information on pupils' language is available is the county, which encompasses several municipalities. It is therefore possible that the level of linguistic polarization observed at the county level does not reflect the true polarization at the municipal level.⁶ The education census in 1886 provides data on education also by urban and rural municipalities, always aggregated at the county level. Thus we can analyze the impact of polarization on education spending in counties with a single, two, three, or more urban municipalities.⁷ Our results suggest an aggregation bias towards zero. Therefore, in the case of urban municipalities, the impact of linguistic polarization on local education spending at the county level is a lower bound estimate of the true effect at the municipal level.

Our main hypothesis is that coordination failure at the local level between German and non-German speaking groups determined a lower allocation of funds in primary education. A corollary of our argumentation is that linguistic polarization should not affect the local provision of other public goods which are not threatening the cultural identity of the non-German speaking group. Indeed, we find that linguistic polarization is not associated with spending on transport infrastructure such as roads, canals, and railroads, which constituted another major item of public

⁵ Barankay and Lockwood (2007) also investigate the impact of decentralization on educational attainment at a more aggregate level exploiting variation within Swiss cantons.

⁶ However the correlation between linguistic polarization in the urban municipalities of a county and total polarization in the respective county is 0.73. The correlation of linguistic polarization in rural areas and total polarization in the relative county is 0.85.

⁷ Whereas a county can include a single (or few) urban municipalities, it always encompasses a large number of rural municipalities. Therefore it is not possible to select counties with a single or few rural municipalities.

spending. We also do not find any significant relationship between linguistic polarization and local public spending on poor relief. This finding is consistent also with the notion that the underprovision of public services in the presence of heterogeneous preferences should be more accentuated when the group benefitting from the service is clearly identifiable (Alesina et al., 1999; Luttmer, 2001; Vigdor, 2004).

Different from previous literature we argue that in the presence of conflicting interests at the local level, centralization can lead to more efficient public spending. To test this hypothesis we exploit a policy change towards centralization that occurred in Prussia in 1888/89. For the municipalities the fiscal burden to fund primary school increased tremendously due to the rising number of students and teachers. With the new law the state aimed at relieving the municipalities from this burden by increasing its contribution. In particular the state introduced a subsidy to cover the costs of teachers (Hühner, 1998). Between 1886 and 1891 the share of state expenditure on primary education increased from about 10 percent to 35 percent. Using total expenditures in education, the number of teachers per child of mandatory school age, and the student-teacher ratio as outcome, we estimate a fixed-effect model similar in logic to a difference-in-difference approach where the impact of polarization on schooling outcomes is evaluated before and after the policy change. Consistent with our hypothesis we find that counties characterized by higher levels of linguistic polarization benefitted the most from the shift to centralization. We find that right after the policy change, the gap in the number of teachers in polarized counties was substantially closed.

These findings adds to the literature on the heterogeneous effects of decentralization on schooling outcomes (Galiani et al., 2008; Hanushek et al., 2013) and shed new light on the conditions under which decentralization does not respond to people's preferences and can lead to lower outcomes.

The paper is structured as follows: Section 2 surveys the related literature; Section 3 sets out the historical background of nineteenth century Prussia education system; Section 4 describes the dataset; Section 5 presents cross-sectional results on the relationship between linguistic polarization and spending in education; Section 6 shows the relationship between linguistic polarization and schooling variables; Section 7 presents fixed-effect estimates of the impact of centralization; Section 8 concludes.

2. Related literature

Beyond the literature on decentralization, this paper contributes to two other strands of literature. First, it contributes to the vast literature on ethnic fractionalization and the provision of public goods. The seminal paper by Alesina et al. (1999) frames a theoretical model linking the heterogeneity of preferences across ethnic groups to the amount and type of public goods provided. The paper furthermore explores the negative association between ethnic fractionalization and a range of public goods using data from U.S. cities, metropolitan areas, and urban counties. The authors argue that the main channel for the negative association is in-group bias, that is, people tending to favor their own kind.

Luttmer (2001) provides support to these results showing that individuals' preferences for income redistribution are affected by the characteristics of others around them. In a similar fashion Vigdor (2004) elaborates a simple model of individual response decision according to which individual's contribution to local public goods is a positive function of *within-group affinity* (Vigdor, 2002). Empirically Vigdor (2004) finds that more heterogeneous counties had significantly lower census response rates in 2000, which is intended as an action which generates public benefits.⁸

Miguel and Gugerty (2005) investigate the impact of ethnic diversity on local school funding in Kenya by using historical settlement patterns as an instrument. They find that shifting from complete ethnic homogeneity to average school ethnic diversity decreases school funding by approximately 20 percent of the mean local school funding per pupil. They suggest that the inability of ethnically diverse school boards to enforce social sanctions within the municipality is crucial to the allocation of school funds.

Dahlberg et al. (2012) and Gerdes (2011) exploit natural experiments that randomly placed refugees across Swedish or Danish municipalities, respectively. Dahlberg et al. (2012) find that previous estimates are positively biased and thereby underestimate the true negative effect of fractionalization on support for redistribution. Gerdes (2011) instead finds no evidence of a decline in the public sector in response to an increase in immigration.⁹

From a historical perspective, Chaudhary and Rubin (2015) show how religious identity affects preferences and therefore public policy. The authors exploit a natural experiment in the Indian Princely States where the religion of each ruler as the decision-making authority upon local matters was arbitrary. They find that the provision of public goods was higher in those cases

⁸ See also the more detailed literature review in Alesina and La Ferrara (2005).

⁹ For an overview of the recent empirical literature with a focus on the experimental literature see the survey by Stichnoth and Van der Straeten (2013).

where the religion of the respective ruler and of the population's majority aligned as well as in the absence of private markets.

Finally, we contribute to the literature that explains the rise of modern school systems and that investigates the role of education in industrializing societies. Lindert (2004) attributes the advancement of the Prussian primary school system to its decentralized organization both in terms of decision-making and funding as well as to the low-cost provision of teaching staff. Go and Lindert (2010) argue that the expansion of mass schooling in the U.S. took off through increased political voice which was reflected in the electoral support for tax-based schooling. Chaudhary et al. (2012) find that the impact of decentralization on education differed by the political and economic conditions among the elites in the case of Brazil, Russia, India, and China. Gallego (2010) shows that, in the context of fifty former colonies, democracy has a positive effect on primary education whereas political decentralization is relevant to explain secondary and higher education. Cvrcek and Zajicek (2013) look at the Habsburg Empire and find that the expansion of the school system was mainly driven by the political and financial support of local political elites when instruction took place in the “right language”.

3. Historical background

3.1 The school system

In 1886 Prussia's school system was locally organized and funded. According to Lindert (2004) this was largely responsible for the school system's success. Indeed, Prussia's high school-enrollment and literacy rates made it a role model for other European countries (Clark, 2007).

At the same time, however, the Prussian administration was aware that the school system in the East, and especially in those regions with a high share of Polish-speaking people, lagged behind the rest of the country in terms of student-teacher ratios and enrollment rates largely due to low school-related investments. We argue that lower investments in the educational system in the eastern regions of Prussia stemmed from high linguistic polarization in a context of high decentralization. The historical narrative supports this hypothesis by pointing out that municipalities with a linguistically mixed population suffered especially when it came to the provision of school buildings and teachers, explicitly mentioning the coexistence of languages as a reason for this situation (Grzes, 1992).

Local organization of schooling meant that the municipality was responsible for levying and allocating school funds (Heinrich et al., 1992; Lamberti, 1989; Lindert, 2004). In many places, provincial or even district legislation regulated school financing, but in the absence of such regional regulations, the *Allgemeines Landrecht*, the Prussian subsidiary law, held. However,

regardless of which law applied, the municipality was the decision-making unit when it came to school finance (Königliches Statistisches Bureau in Berlin, 1889). Schools were separated by religious denomination, leading thus to linguistic separation when denomination and language corresponded. Interconfessionally mixed schools (*Simultanschulen*) mostly existed in municipalities that could not afford operating more than one school (Groeben, 1992).

School funding came from various sources, including tuition fees, foundations, schooling societies, municipal taxes, and contributions from the nobility (patronage). Decisions as to how allocate local school funds were made by the school board (*Schulvorstand*), which consisted of the noble landlord in the estates or the mayor in urban and rural municipalities, the local clergyman, and two to four members of the school entity (*Schulgemeinde*) whose election had to be confirmed by the chief administrative officer of the county, the *Landrat*. In 1887, the likelihood that members of the Polish-speaking population would sit on these school boards decreased when a ministerial decree ruled that the county's *Landrat* should confirm members of the school board only if would-be members were inclined to foster the German-language policy imposed by the Prussian authorities. The purpose of this decree was to assure that Polish and other minority languages were effectively eliminated from being taught (Glück, 1979). According to Grzes (1992), linguistic barriers and diverging interests led to particular problems in the organization of primary schools in linguistically mixed regions.

A uniform minimum wage for teachers was not introduced until 1897 (Berger, 1897) and a coherent framework for the maintenance of public elementary schools was not enacted into Prussian law until 1906 (Anderson, 1970; Lamberti, 1989). In addition to school funding, the municipality was also responsible for appointing teachers (Glück, 1979). In 1886 a new law regarding the appointment of school teachers in the provinces of Posen and West Prussia was enacted. This law shifted the authority to recruit and hire teachers from the local to the state level in these two provinces (Lamberti, 1989). Before its enactment all decisions on hiring teachers, teacher pay, and facility upgrades were made by the municipalities. Thus, 1886, the year in which the reforms were instituted, is the first and last year in which it is possible to observe the effects of linguistic polarization on primary education in a context of high decentralization.

3.2 The origins of linguistic polarization in Prussia

The presence of German and non-German speaking groups in Prussia at the end of the nineteenth century primarily dates back to the conquest of Pomerania and Silesia in the seventeenth and eighteenth centuries and to the three partitions of Poland at the end of the eighteenth century as well as to the so-called fourth partition of Poland during the Congress of

Vienna in 1815 (Hansen and Wenning, 2003). The partitions of Poland had the consequence that one-third of the Prussian population had formerly belonged to the Polish-Lithuanian Commonwealth (Alexander, 2008). These Slavic regions had experienced an immigration of German settlers since the early Middle-Ages following the territorial expansion of both the Holy Roman Empire and the Teutonic Order. The result was that Poles and Germans lived side by side, even before these regions became Prussian (Zernack, 2008).

After coming under the Prussian rule, Prussia's active settlement policy, with its objective of populating vacant or devastated land, increased the level of polarization. While settlers initially came from German-speaking regions such as the Palatinate or Franconia, periodic wars and epidemics led to a shortage of German colonizers. This is what ultimately led Lutheran Austrians (*Salzburger*), Masurian Poles, Lithuanians, as well as the French Huguenots,¹⁰ to be invited to settle in the southern and eastern regions of East-Elbian Prussia. After the three partitions of Poland, the Prussian state authorities reengaged in their population-enhancing policies by supporting German colonizers to settle in the newly acquired Grand Duchy of Posen and, especially, in West Prussia (Zbroschzyk, 2014). The West-to-East migration was only reversed after the foundation of the German Reich when people—of both Polish and German origin—began to move to the industrialized regions of the Rhineland in the 1880s and 1890s (Wünsch, 2008).

The province of Schleswig-Holstein is constituted after the Austro-Prussian war. As the territories of this newly constituted province formerly belonged to Denmark, a substantial share of Danish-speakers becomes Prussian. While the share of Danish speakers within the province is at 18 percent, the Danish-speaking minority constitutes only 0.7 percent of the total Prussian population¹¹.

3.3 Prussian language policy throughout the nineteenth century

Historians concur that it was the foundation of the German Empire in 1871 that ultimately initiated German-Polish antagonism (Alexander, 2008). The German Empire was understood as a nation state, as opposed to the Prussian Empire, which was built on an abstract and fragmentary common identity of its subjects (Clark, 2007).

Until the foundation of the German Empire in 1871, the Prussian authorities considered the Polish- or Slavic-dominated regions as “colonies” with their own cultural identity and, as such, tolerated the use of Slavic languages and local dialects, especially through primary schooling

¹⁰ For the effect of the Huguenot immigration into Prussia on productivity, see Hornung (2014).

¹¹ As the share of Danish speakers is rather low and we will exclude the province of Schleswig-Holstein when it comes to the identification strategy, the following section focuses on the treatment of the Slavic minorities in Prussia, namely the Poles.

(Clark, 2007). The right to freely move across inner-Polish borders and to maintain one's Polish identity had been legally protected as early as the Congress of Vienna in 1815 and such rights were strengthened by the edict of 1822, which recognized the importance of language and nationality to Polish-speaking citizens. These rights were also enforced in the primary school system. For example, a regulation of 1842 mandated that the language of school instruction was to be that of the majority of the pupils (Lamberti, 1989).

After the foundation of the German Reich, Imperial Chancellor Bismarck began to promote Germanization policy. The primary school was to play a key role in this policy by socializing the Polish-speaking students in the East of Prussia (Lamberti, 1989). Several laws were passed in provinces with Slavic minority populations that gradually established German as the only language of instruction. More than half the curriculum was devoted to German and history lessons aiming at educating loyal Prussian citizens (Lundgreen, 1976). However, the Germanization policy did not achieve its objective of a homogenous German-speaking Prussian nationhood. Instead, Poles began to establish their own parallel society by founding banks, organizing themselves in clubs, and passing on Polish-specific human capital in confirmation classes (Alexander, 2008).¹² Foundation of Polish cooperatives was a central aspect of the Polish national movement (Suesse and Wolf, 2014).

This parallel structure meant that Germans and Poles rarely interacted voluntarily in everyday life, which inhibited the exchange between the two groups that could have resulted in mutual values and beliefs, and, consequently, better cooperation. The social conflict between Germans and Poles peaked with the Polish school strikes in the city of Wreschen in 1901 and in the province of Posen in 1906 (Lamberti, 1989).

4. Data

Our data originate from the first comprehensive educational census of 1886 which was published by the Royal Statistical Office of Prussia (Königliches Statistisches Bureau in Berlin, 1889).¹³ The educational census was conducted every five years until 1911 and again after World War I, both in 1921 and 1926. The census provides detailed and comprehensive information on enrollment rates, school facilities, teachers, class size, school organization, teacher income, and students' language for Prussian counties, the smallest administrative unit.

¹² Alexander (2008) argues that the Prussian policy against linguistic minorities and especially against the Poles eventually led to Prussia's decline.

¹³ For a more detailed description of the sources, see Becker et al. (2014).

For our cross-county analysis we concentrate on the first comprehensive education census done in 1886 since that was the last census-year in which the level of local school expenditure was high and the central state played only a marginal role: the share of state contribution was about 10 percent whereas the rest was financed through local spending. In 1891 state contributions reached 35 percent of the total expenditure on public primary education.

The education census of 1886 provides data on the language spoken in the pupils' home. The census distinguishes between German, Polish, Lithuanian, Masurian, Slavic, Danish, and "other" languages. The census also contains information on whether the reported language is the only one spoken at home or whether both German and another language are spoken at home. When constructing the index of linguistic polarization we include the latter category of bilingual pupils in the group of non-German speakers. We assume that the interests and identity of this bilingual group are more aligned with the interests of the non-German speaking group. In any event, omitting the bilingual group when constructing the polarization index does not affect our results.

We measure the antagonism between Germans and other linguistic groups by using the polarization index proposed by Esteban and Ray (1994),¹⁴ which is also employed by Fearon and Laitin (2003) and Collier and Hoeffler (2004), among others. As the Prussian case is characterized mainly by the *dualism* between Germans and Slavs rather than by a conflict between several linguistic groups, the use of the polarization index instead of the fractionalization index is more recommended.¹⁵ A recent work by Esteban et al. (2012) shows that linguistic polarization is related to conflict over public goods, while fractionalization increases conflict over private goods. The polarization index measures how far the distribution of the groups is from a bipolar distribution, which represents the highest level of polarization. Our polarization index has the following form:

$$Pol = 1 - \sum_{i=1}^N \left(\frac{\frac{1}{2} - \pi_{ic}}{\frac{1}{2}} \right)^2 \pi_{ic} \quad (1)$$

where π_{ic} denotes the share of the linguistic group i in county c . Thus, the polarization index varies between 0 and 1. In our case, polarization equals 1 if, for example, 50 percent of the pupils speak German and the other 50 percent speak Polish at home.

¹⁴ For a discussion on which polarization index to use, see Duclos et al. (2004); Montalvo and Reynal-Querol (2005); for a more recent discussion see Esteban and Ray (2012).

¹⁵ In fact, the fractionalization and the polarization index are almost perfectly collinear in the Prussian case as the counties east of the river Elbe were mainly dominated by two linguistic groups, the Germans and the Poles while Germans and Danes prevailed in the province of Schleswig-Holstein.

Our outcomes in terms of educational spending are also constructed from the education census of 1886. The educational census is very detailed and permits distinguishing between educational expenditures stemming from local and national sources. Local funds are comprised of tuition fees and money from foundations, schooling societies, municipalities, patronage, or other sources. National funds are comprised of state funds and state grants that were mainly targeted to municipalities incapable of independently funding their schools (Lamberti, 1989). We measure school spending by the amount of local expenditure per child of mandatory school age (6-14). Successively we also look at “real” school variables analyzing the relationship between linguistic polarization and the number of schools per child and the student-teacher ratio. Finally, we also look at average teacher wages, constructed as the sum of teacher wages paid with local funds divided by the number of full-time teachers.

To control for initial differences in both the supply and demand for education, we use data from the population census of 1871 and 1885, the occupational census of 1882, municipal tax revenues in 1883/1884, and landownership concentration, as well as data from the *Zentralblatt* of 1886, a monthly publication of the Prussian Ministry of Ecclesiastical and Education Affairs reporting the number of secular and clerical school inspectors. This last control variable is important as we aim at separating the effect of linguistic polarization on education expenditure from the impact of the *Kulturkampf*, which aimed at weakening the role of the Catholic Church in providing public secular education in the Catholic-Polish areas.

In the attempt to identify the impact of linguistic polarization, we also account for religious fractionalization in 1871, which, especially in the context of East Prussia, is positively correlated with linguistic heterogeneity.¹⁶ We account for religious fractionalization using the standard measure related to the Herfindahl index:

$$Frac_c = 1 - \sum_i s_{ic}^2 \quad (2)$$

where s_{ic} denotes the share of the religious group i in county c . This index is based on five religious denominations as reported in the census: Catholic, Protestant, other Christian, Jewish, and other religion. The fractionalization index, which varies also between 0 and 1, measures the probability that two individuals randomly drawn from a population belong to a different denomination. The index increases monotonically with the number of groups in a county. For a

¹⁶ In East-Elbian Prussia Polish-speaking people were predominantly Catholic, whereas ethnic Germans were predominantly Protestant.

given number of groups, the index increases as the share of religious groups is more equally distributed.

For the panel analysis on the effect of centralization on school outcomes, we furthermore use information from the education census of 1891, 1896, and 1901 which enables us to exploit a reform that substantially increased the share of state funds in 1888/89.¹⁷

4.1 Descriptive statistics

Prussia did not pass a universal law on school funding until 1906 (Anderson, 1970; Lamberti, 1989). Prior to the law's passage provincial regulations or customary law at the regional level set out guidelines for school funding. This ultimately led to very different funding schemes across the six eastern provinces. Table 1 shows how local and state spending per child aged 6-14 varied widely across Prussian counties.

Average local spending on primary education in 1886 was about 15 Marks per child aged 6-14. This expenditure varied dramatically from a minimum of 7.75 Marks to a maximum of 44 Marks. State expenditure on primary education was on average 1.8 Marks per child. The largest part of the local educational expenditure went to teacher wages: on average, teacher wages constitute 64 percent of total local school spending, whereas expenditures for the construction, expansion and renovation of school buildings account for 15 percent and expenditures for the maintenance of schools sums up to 21 percent of total school funds.

As for the linguistic groups, Germans and Poles are the two dominant groups at 87 and 11 percent, respectively. The polarization index has an average value of 0.15. As the sample east of the Elbe shows, linguistic polarization is substantially higher in the East, reaching 0.29 which is one of the reasons why we restrict our analysis to the sample east of the Elbe below. In East Prussia, 167 out of 214 counties experienced some level of polarization. There are 47 counties (22 percent) where non-German speaking people constitute the majority. The geographic distribution of linguistic polarization is shown in Figure 1. Overall, linguistic polarization increases the closer a county is to the eastern border of Prussia. Yet, the counties on the border have a comparatively lower level of polarization as in many cases there is a majority of non-German speaking population. Indeed, in 21 out of 25 counties on the border, German-speaking people are the minority.

¹⁷ Education censuses are available also for 1906 and 1911. Yet since we do not have all the control variables for those years we perform the panel analysis only until 1901.

Table 1: Descriptive statistics

Variable	Full Sample				East Elbe			
	Mean	Std. dev.	Min.	Max	Mean	Std. dev.	Min.	Max
Linguistic polarization	0.15	0.30	0	1	0.29	0.37	0	1
Local education spending per child (6-14)	15.08	5.35	7.75	43.67	12.91	3.77	7.75	37.02
State education spending per child (6-14)	1.82	1.47	0.000	10.23	2.07	1.22	0	6.46
Log municipal tax per capita	1.37	0.64	-0.13	3.16	1.02	0.54	-0.13	2.92
Share teacher expenditures	0.64	0.07	0.34	0.82	0.63	0.07	0.34	0.78
Share building expenditures	0.15	0.07	0.03	0.54	0.22	0.03	0.12	0.40
Share maintenance expenditures	0.21	0.03	0.12	0.40	0.15	0.07	0.04	0.54
School per 1,000 children (6-14)	6.66	2.70	0.33	14.93	6.64	2.21	0.40	11.47
Teacher per 1,000 children (6-14)	11.21	2.03	6.53	18.26	95.31	14.82	61.08	142.25
Student-teacher ratio	75.35	12.19	48.07	121.18	78.10	12.82	49.03	121.18
Share German language	0.87	0.27	0.04	1	0.75	0.34	0.06	1
Share Polish language	0.11	0.26	0	0.94	0.22	0.34	0	0.94
Share Danish language	0.007	0.082	0	0.963	0	0	0	0
Share Lithuanian language	0.006	0.048	0	0.623	0.012	0.070	0	0.623
Share Wendish language	0.004	0.038	0	0.520	0.008	0.055	0	0.520
Share Slavic language	0.001	0.017	0	0.326	0.003	0.025	0	0.326
Share other language	0.002	0.018	0	0.270	0.000	0.002	0	0.027
Share Protestants	0.64	0.37	0	1	0.68	0.34	0.02	0.995
Urbanization rate	27.49	21.88	0	100	25.51	18.85	0.000	100
Population density	3.92	16.47	0.22	207.59	3.52	17.76	0.29	207.59
Employed in agriculture (%)	19.83	7.60	0.18	33.29	22.00	6.71	0.33	32.32
Employed in manufacturing (%)	11.45	5.38	2.17	27.88	9.55	5.06	2.17	27.07
Employed in administration (share)	1.15	1.68	0.12	14.64	1.19	1.73	0.13	14.64
Landownership concentration (standardized)	0	1	-0.91	6.64	0	1	-1.58	5.90
Time under Prussian rule (years)					196.0	110.3	71	361

Note: Summary statistics for selected key variables in 1886. The number of observations in the full sample is 450 and 214 for the sample east of the Elbe (excluding Schleswig-Holstein).

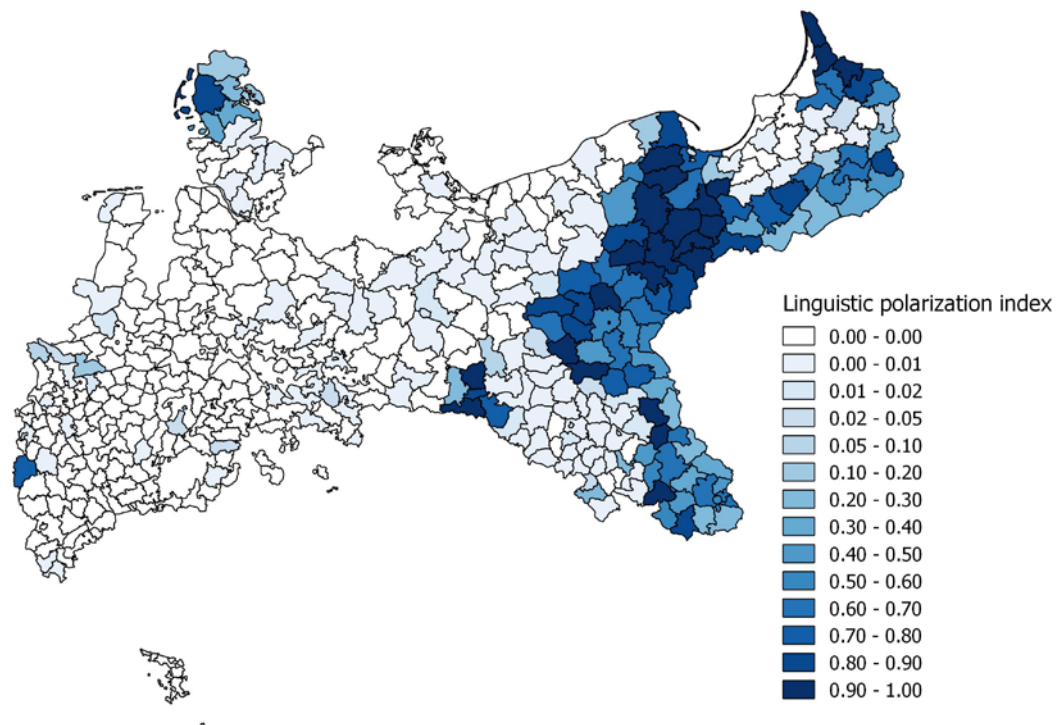


Figure 1: Linguistic polarization across Prussia, 1886

Note: County borders 1871

5. Polarization and local spending

We start exploring the association between linguistic polarization and school funding for the whole Prussia estimating the following OLS model:

$$\text{Log loc exp}_c = \alpha_1 + \beta_1 \text{Pol}_c + X'_c \gamma + \varepsilon \quad (1)$$

where the dependent variable is the logarithm of local spending on primary education per child of mandatory school age (6-14) in county c . Pol_c is the index of linguistic polarization computed at the county level and X is a vector of covariates. The covariates are included one at a time to better understand the impact of the single covariates on the relationship of interest. The OLS estimates are presented in Table 2.¹⁸

The unconditional correlation between linguistic polarization and local school funding is negative and highly significant (column 1). In column 2 we include the share of Protestants. Becker and Woessmann (2009) argue that Luther's preach that every Protestant should be able to read the Bible increased demand for education in Protestant regions, leading to better provision of schooling and, consequently, higher literacy. Indeed we find that counties with a larger share of Protestants are positively associated with local spending on primary education.

Religious fractionalization could be an important potential confounding factor. In column 3 we include the measure for religious fractionalization based on the Herfindahl index. The coefficient has a positive sign but is not statistically significant. One could argue that linguistic polarization has an impact on education spending which varies with religious fractionalization. Indeed, the interaction between linguistic polarization and religious fractionalization in column 4 is significantly negative, providing support in this sense. Where both linguistic polarization and religious fractionalization collide, educational expenditures are lower, leading to a decrease in the main coefficient on linguistic polarization which is, however, still negative and highly significant. The underprovision of primary schooling is often ascribed to the Polish lower demand for education.

¹⁸ We exclude the counties of Kommunionharz and Zellerfeld. These counties were separate counties in 1871. They were incorporated into one county in 1874 and again separated into two counties in 1885. This is why information on the share of people employed in agriculture and manufacturing, the urban share and the landownership concentration is only available at the aggregate county level as this information stems from the period between 1871 and 1885. As we did not want to assign the same value for these variables to the two separated counties, we decided to exclude the two counties from the sample throughout all specifications.

Table 2: Linguistic polarization and local spending on education: OLS estimates

Dependent variable: Log (local spending in education p.c.)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10) East Elbe
Linguistic polarization	-0.425*** (0.039)	-0.403*** (0.040)	-0.427*** (0.045)	-0.292*** (0.083)	-0.256*** (0.056)	-0.250*** (0.033)	-0.283*** (0.039)	-0.178*** (0.055)	-0.161*** (0.047)	-0.173*** (0.050)
Protestant		0.089** (0.035)						0.179*** (0.031)	0.164*** (0.036)	0.132*** (0.046)
Religious fractionalization			0.012 (0.087)	0.091 (0.097)				-0.072 (0.057)	0.079 (0.057)	-0.064 (0.081)
Linguistic polarization x relig. fract.				-0.481** (0.231)						
Polish					-0.285*** (0.055)			0.029 (0.051)	0.044 (0.048)	0.051 (0.047)
Log municipal tax p.c.						0.292*** (0.019)		0.260*** (0.025)	0.167*** (0.031)	0.158*** (0.037)
Population density							0.002** (0.001)	0.001* (0.001)	0.001 (0.001)	0.002*** (0.001)
Urbanization							0.003*** (0.001)	0.002*** (0.001)	0.003*** (0.001)	0.005*** (0.001)
Landownership conc.							-0.023** (0.011)	0.007 (0.011)	0.016 (0.013)	0.001 (0.012)
Emp. in agriculture							-0.011*** (0.004)	0.001 (0.003)	-0.002 (0.003)	0.009* (0.005)
Emp. in manufacturing							0.001 (0.004)	0.006* (0.004)	0.004 (0.005)	0.011 (0.007)
Province FE	No	No	No	No	No	No	No	No	Yes	Yes
Observations	450	450	450	450	450	450	450	450	450	214
R-squared	0.16	0.17	0.16	0.17	0.19	0.50	0.44	0.60	0.71	0.67

Note: OLS estimates. The dependent variable is the logarithm of local spending on primary education per child of mandatory school age (6-14). Protestant denotes the share of Protestants in 1885. Rel. frac. is the religious fractionalization index of 1871, constructed on five religious groups: Protestants, Catholics, other Christians, Jews, and other religion. Polish is the share of Polish-speaking students in 1886. Log municipal tax p.c. denotes the log municipal tax per capita for the year 1883/1884. Urbanization is the share of people living in cities in 1871. Landownership concentration denotes the standardized share of farms larger than 100 ha arable land in 1882. Emp. in agriculture denotes the percentage of people employed in agriculture in 1882. Emp. in manufacturing denotes the percentage of people employed in manufacturing in 1882. Province fixed effects for the provinces of Prussia, Brandenburg, Pomerania, Posen, Silesia, Saxony, Schleswig-Holstein, Hanover, Westphalia, Hesse, Rhine Province, Hohenzollern. Robust standard errors are reported in parentheses.***, **, and * denote significance at 10%, 5%, and 1%, respectively.

As education in primary schools was aimed at Germanizing the population, non-German speaking and specifically Polish-speaking individuals are less likely to derive utility from investing in primary education. Thus it is important to test the extent to which the polarization index captures the lower demand for education of Polish people rather than the coordination problem between conflicting linguistic groups. In column 5 we include the share of pupils who speak only Polish.¹⁹ Indeed, the share of Polish pupils is negatively correlated with local school spending. Although this variable captures part of the impact of linguistic polarization, the coefficient for the latter is still highly significant both economically and statistically. The collision of heterogeneous preferences measured by the linguistic polarization index, therefore, matters on its own and goes beyond a lower interest of the non-German population to invest into an education system that clearly conveys national contents.

Counties characterized by high linguistic polarization could also have less economic prosperity and therefore could afford less education. If this was the case, our interpretation of the negative impact of polarization because of conflicting interests between special interest groups would be incorrect. It is therefore crucial to account for systematic differences in economic prosperity. The best measure available at the county level for the period under consideration is municipal tax revenues for the years 1883/1884. Indeed, we find that log municipal tax revenues are strongly positively associated with log local spending on primary education (column 6). Since municipal tax rates are also measured in logarithm, we can interpret the coefficients as elasticity: an increase of municipal tax revenues by 1 percent is associated with an increase in school spending of 0.3 percent. Importantly, we find that for a given level of tax revenues, redistribution in favor of public primary education was significantly lower in counties with high levels of linguistic polarization.

In column 7 we control for a set of variables which also account for economic prosperity, namely population density, urbanization, concentration of large landownership, the percentage of people employed in agriculture and manufacturing, respectively. As for the latter control, Becker et al. (2011) have shown that primary education played an important role in Prussia's effort to catch up with early-industrializer Britain. Cinnirella and Hornung (2013) show that the concentration of large landownership and the institution of serfdom slow the accumulation of education. We find that population density and urbanization are positively related to school spending, while landownership concentration and employment in agriculture are negatively

¹⁹ It is important to notice that because of the quadratic functional form that relates polarization and the single shares of non-German speaking groups we can estimate separate coefficients. Vigdor (2002) even argues that to accurately measure within-group affinity using geographically aggregated data one should always control for group shares.

related to school spending. Compared to the parsimonious model in column 1, the coefficient for linguistic polarization is smaller in size but still precisely estimated.

In column 8 we include all the control variables simultaneously.²⁰ This specification explains 60 percent of the variation in local spending in primary education. Several variables are significantly correlated with local spending. Yet the coefficient for linguistic polarization continues to be highly significant, albeit smaller in size.

In column 9 we employ an even more restrictive specification by including province fixed effects. In fact, we know that funding schemes varied substantially across provinces. Yet, the negative impact of linguistic polarization remains highly significant even when we exploit only within-province variation. The coefficient in this specification implies that moving from a county with null polarization (e.g. 100% German speaking) to a county with unit polarization (e.g. 50% German speaking and 50% Polish speaking) is associated with a decrease in local spending on primary education of about 16%.

Finally, we restrict our analysis to the sample east of the river Elbe and equally exclude the province of Schleswig-Holstein in order to zoom into the counties where linguistic polarization is the highest. In this case we find a slightly larger negative coefficient on linguistic polarization.²¹

5.1 Addressing causality

The previous estimates indicate that the negative relationship between linguistic polarization and local spending on public primary education is not due to differences in religious affiliation, tax revenues, and the industrial structure. Despite our rich set of control variables, omitted variables and reverse causality might bias the OLS estimates. It is reasonable to assume that a persistently underfunded school system contributed to the maintenance of a high level of linguistic polarization. Additionally there could be an unobserved variable that affects both local spending in education and the linguistic composition of the population. A cultural or institutional factor affecting both spending in education and the linguistic composition of the population could be such an omitted variable.

We propose an instrumental variable approach which exploits the geographic distribution of the non-German speaking groups driven by the territorial acquisitions of Prussia towards East.

²⁰ We decided to drop from the specification the interaction term between linguistic polarization and religious fractionalization as the coefficient turns insignificant.

²¹ If we restrict the analysis to the sample west of the river Elbe, we find a positive coefficient that is statistically significant. Linguistic polarization in this sample is very low, averaging 0.005. The result is driven by the outlier county of Malmédy (today Belgium) where the linguistic polarization index is as high as 0.79 and local educational spending is relatively high. The positive coefficient turns negative and insignificant when excluding the county of Malmédy. Results are not shown, but available upon request.

As displayed in Figure 1 linguistic polarization increases as we move towards the eastern border. Thus our instrument is the geodesic distance from the county centroid to the eastern border. The straightforward logic of our identification strategy is that the closer a county is to the eastern border, the lower is the share of German-speaking people, *i.e.* the higher is linguistic polarization. Our instrumentation relies on the assumption that distance to the eastern border has an impact on local school spending only through linguistic polarization. A similar identification strategy based on distance to borders or “gateways” is adopted in the migration literature (Ottaviano and Peri, 2005, 2006; Peri, 2012).

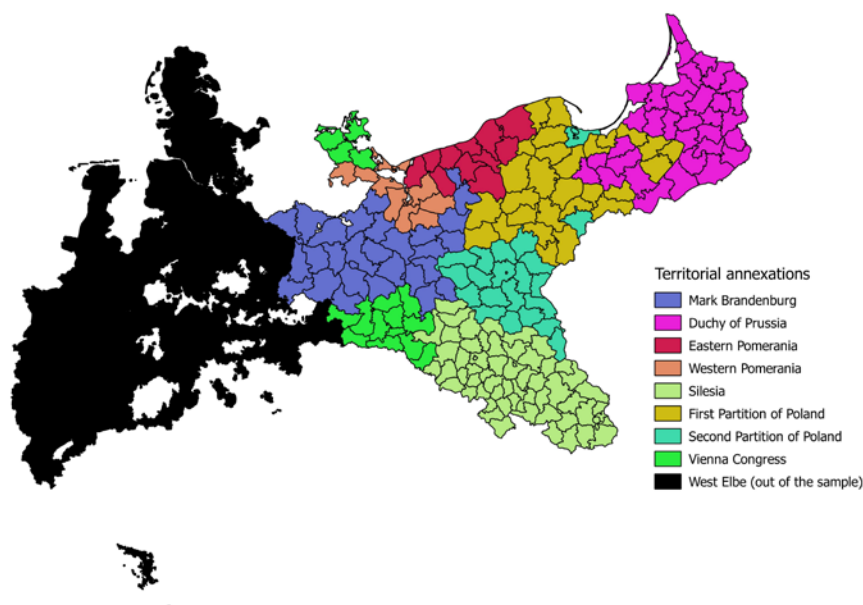


Figure 2: Territorial annexations of the Kingdom of Prussia

Note: County borders 1871

In order to make the exogeneity assumption more stringent, we include in the baseline specification binary indicators for the territorial annexations that occurred at different points in time (Figure 2). In particular we distinguish between the Margraviate of Brandenburg, the Duchy of Prussia, Magdeburg, Eastern and Western Pomerania, Silesia, the First and Second Partitions of Poland, and the territories acquired with the Vienna Congress. It is important to include such controls since the different annexations had different “settlement policies” (*Ansiedlungspolitik*) which might be related to both polarization and local spending in education. In addition to that,

we include also a variable which accounts for the number of years under the Prussian rule. We include also measures for latitude and longitude to account for different geographic locations.

Non-German speaking people were mostly prevalent in counties east of the river Elbe. To assure the validity of our identification strategy, we restrict our analysis to the counties east of the river Elbe, excluding also the province of Schleswig-Holstein. In this way we exploit variation across 214 counties. Formally our first stage regression is the following:

$$Polarization = \alpha_1 + \beta_1 DistEastBorder + X'\gamma + \varepsilon \quad (2)$$

where *Polarization* denotes the linguistic polarization index in 1886; *DistEastBorder* is the geodesic distance (in 100 km) from the county centroid to the eastern border. The vector \mathbf{X} includes the control variables as in equation (3) as well as eight annexations fixed effects,²² a variable for the number of years under the Prussian rule, latitude and longitude. Figure 3 shows graphically the significant negative relationship between polarization and distance to the eastern border in the first stage of our instrumental variable approach.

5.2 Instrumental variable estimates

Second stage estimates are presented in Table 3. In column 1 we report OLS estimates in the sake of comparison²³. Results from two-stage least squares confirm the negative impact of linguistic polarization on local spending on education and suggest a causal interpretation of the results. The first-stage F-statistics reported at the bottom of the table are consistently above the threshold level of ten, thus indicating the strength of our instrument. In column 2 we report our baseline estimates. The magnitude of the IV coefficient indicates that OLS estimates strongly underestimate the effect of polarization on local spending. On one side it is likely that distance to the border identifies high-conflict areas where the impact of linguistic polarization is more salient, granting then a LATE interpretation of the IV estimates. In addition to that, linguistic polarization at the county level might hide important differences within the county, for example

²² As the counties in Magdeburg east of the river Elbe are only 4, in the empirical analysis we merge these counties with the Margraviate of Brandenburg.

²³ Differently from the previous OLS estimates, here we include annexation fixed effects, the number of years under Prussian rule, latitude and longitude.

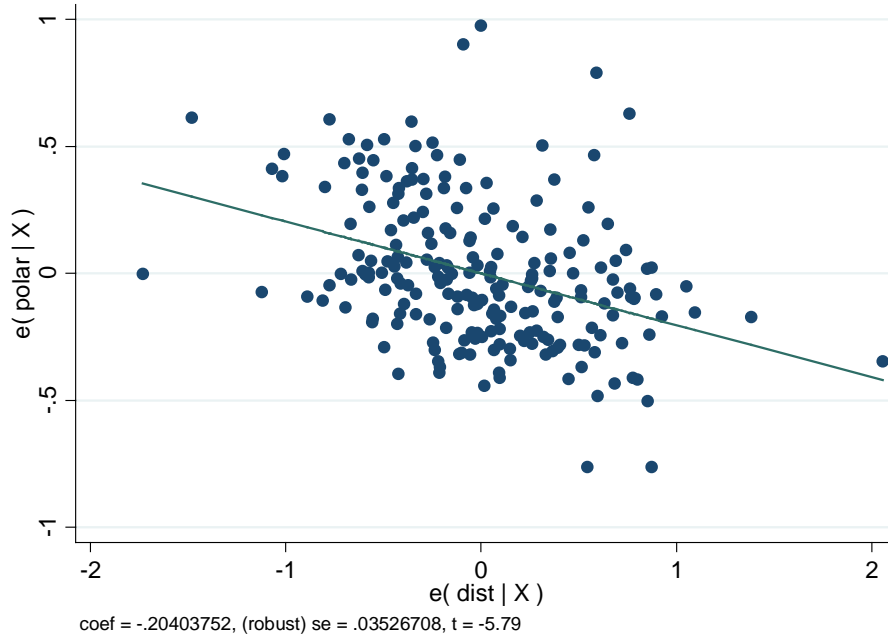


Figure 3: Conditional relationship between polarization and distance to the eastern border

between urban and rural areas. Our instrumentation possibly alleviates this measurement error issue. Indeed, we will see from a specification below that the IV estimates are very similar in magnitude to OLS estimates when using counties with a single urban municipality, where this measurement error issue is expected to be negligible.

In column 3 we include a dummy variable for 25 those counties located on the eastern border. At the same time we control for distance to the main provincial city²⁴ and distance to Berlin. It can be argued that educational policies were more strictly enforced, the closer a county to the capital Berlin, or to the main provincial city. Only distance to the main provincial city is weakly significant but with a positive sign. The coefficient of interest remains unchanged.

In column 4 we include the share of Polish-speaking pupils in the county. The OLS specifications in Table 2 (columns 8-10) did not show any significant relationship between the share of Polish and local educational spending. The IV estimates instead show a significant positive relationship. This is an important result as it suggests that, once we account for an arguably exogenous variation in linguistic polarization and for the size of municipal tax revenues, the share of Polish-speaking people has a significant positive relationship with local educational spending. This seems to contradict the notion that Polish people had, in general, a lower preference for education. In column 5 we restrict the sample to counties with strictly positive

²⁴ The cities are: Breslau, Danzig, Koenigsberg, Magdeburg, Posen, Potsdam, and Stettin.

polarization. The coefficients for linguistic polarization and the share of Polish pupils are basically unchanged.

Table 3: Linguistic polarization and local spending on education: IV estimates

Dependent variable:	OLS	Instrumental variables				
Log (local spending in education p.c.)	(1)	(2)	(3)	(4)	(5)	(6)
Linguistic polarization	-0.168*** (0.047)	-0.554*** (0.133)	-0.615*** (0.139)	-0.639*** (0.135)	-0.500*** (0.131)	-0.803*** (0.197)
Log municipal tax p.c.	0.164*** (0.030)	0.212*** (0.038)	0.234*** (0.040)	0.237*** (0.038)	0.215*** (0.039)	0.261*** (0.053)
Protestant	0.027 (0.063)	-0.043 (0.081)	-0.060 (0.091)	0.034 (0.084)	0.047 (0.083)	0.150* (0.082)
Urbanization	0.003*** (0.001)	0.001 (0.001)	0.001 (0.001)	0.002 (0.001)	0.001 (0.001)	0.001 (0.002)
Population density	0.002*** (0.001)	0.002*** (0.001)	0.003*** (0.001)	0.002*** (0.001)	0.003*** (0.001)	0.002*** (0.001)
Landownership conc.	-0.003 (0.011)	-0.024 (0.015)	-0.021 (0.016)	-0.026* (0.016)	-0.016 (0.019)	-0.032* (0.019)
Emp. in agriculture	0.008 (0.005)	-0.000 (0.006)	-0.001 (0.006)	0.006 (0.005)	0.007 (0.006)	0.004 (0.006)
Emp. in manufacturing	0.007 (0.006)	-0.006 (0.008)	-0.008 (0.008)	0.002 (0.008)	0.004 (0.008)	-0.003 (0.009)
Dummy border county			0.032 (0.055)	-0.030 (0.060)	-0.027 (0.053)	-0.053 (0.071)
Distance to main city			0.001* (0.000)	0.001 (0.000)	0.001 (0.000)	0.001 (0.001)
Distance to Berlin			-0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)	0.000 (0.000)
Polish				0.265*** (0.091)	0.153** (0.078)	0.358*** (0.118)
Add. controls	Yes	Yes	Yes	Yes	Yes	Yes
Annexation FE	Yes	Yes	Yes	Yes	Yes	No
Province FE	No	No	No	No	No	Yes
Observations	214	214	214	214	167	214
Kleibergen-Paap rk Wald F statistic		25.0	20.3	21.4	22.7	13.4

Note: OLS and IV estimates. Column 5 includes only counties with positive polarization. Additional controls include: number of years under Prussian rule, latitude, and longitude. Robust standard errors are reported in parentheses. ***, ** and, * denote significance at 10%, 5% and 1%, respectively.

In column 6 instead of having annexation fixed effects we include in the regression six province-fixed effects. The inclusion of province-fixed effects shows to be econometrically demanding for our instrumentation as witnessed by the lower first-stage F-statistics reported at the bottom of the table. Accordingly the IV coefficient becomes larger and is less precisely estimated. Yet, the coefficient for polarization remains highly significant, supporting the notion that linguistic polarization has a negative effect on local spending on public primary education.

5.3 Further robustness checks

The rich specifications in Table 3 already provided some tests about the validity of our instrumentation. In this section we test the robustness of our main results accounting for further confounding variables. The estimates are shown in Table 4.

As discussed previously, the state subsidized primary education in fiscally-challenged municipalities (Neugebauer, 1992). Relying on state grants or state funds might have decreased local spending on education. This reliance on state funding might be also related to linguistic polarization and thus explain our results. In column 1 we include log state expenditure in education per 1,000 children in school age. The sign of the coefficient suggest a “substitution” between state and local spending on education, yet the coefficient is not significant.

Different linguistic groups might have different fertility levels which, in turn, could affect local educational policy. To account for differences in fertility we use the child-woman ratio constructed as the ratio of children in the age-group 0-15 over the number of married women.²⁵ This variable is included in our regression in column 2. There is no significant relationship between our fertility measure and local spending in education. The inclusion of this variable does not affect the coefficient of interest.

The size of the bureaucracy could have an impact on the enforcement of rules and thus also on local spending on education. The size of the bureaucracy, in turns, could also be related to different levels of linguistic polarization. In column 3 we include the share of people employed in the public administration (including the military) as reported in the occupational census in 1882. We find that the size of the bureaucracy is not significantly related to local spending in education and does not affect our coefficient of interest.

The Prussian state also aimed at monitoring primary schools by replacing clerical school inspectors with secular ones who were required to report directly to the Prussian authorities in Berlin (Lamberti, 1989). One could argue that a higher share of secular school inspectors increased local school spending as secular school inspectors would report to the Prussian state authorities on deficiencies in both personnel and buildings, thereby putting pressure on the municipalities to invest in their school systems. Extrapolating information from the Prussian *Zentralblatt*, a monthly publication of the Prussian Ministry of Ecclesiastical and Education Affairs, we have been able to construct the share of central school inspectors over all school inspectors in 1886. By including this variable in the model our main result does not change

²⁵ Using the number of births at the numerator, or using the crude birth rate as a control variable provides virtually the same results (available upon request).

Table 4: Linguistic polarization and local spending on education – robustness checks

Dependent variable:	Log (local spending in education p.c.)					Log (local spending transport infrastructure p.c.)	Log (local spending poor relief p.c.)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Linguistic polarization	-0.587*** (0.132)	-0.531*** (0.140)	-0.540*** (0.129)	-0.565*** (0.141)	-0.698*** (0.184)	0.003 (0.112)	-0.118 (0.182)
Log state exp. in educ. (per child)	-0.069 (0.050)						
Child/married women ratio		-0.209 (0.264)					
Perc. employed in military or administration			0.013 (0.009)				
Share school inspectors				0.031 (0.047)			
German minority (dummy)					0.198*** (0.076)		
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Annexation FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	214	214	214	214	214	214	214
Kleibergen-Paap rk Wald F statistic	28.4	21.5	25.3	23.8	20.7		

Note: IV and OLS estimates. Log state exp. in educ. (per child) denotes school funding provided by the state. The child/married women ratio is computed as the ratio of children in the age-group 0-15 over the number of married women. The percentage of people employed in administration captures the number of people employed in administration and military over the total population in 1882. The share of central school inspectors denotes the number of central school inspectors over total school inspectors. German minority is a dummy variable taking the value 1 if the share of Germans is below 50 percent. Additional controls include: Share of Protestant, log of municipal taxes per capita in 1883/1884, urbanization rate, population density, share of people employed in agriculture, share of people employed in manufacturing, landownership concentration, latitude, longitude, and years under Prussian rule. Robust standard errors are reported in parentheses. ***, ** and * denote significance at 10%, 5% and 1%, respectively.

(column 4). When controlling for the number of inspectors per school the results are also virtually unchanged (not shown).

Low levels of polarization arise if there is a large linguistic majority. In our case this can be due to a majority of German-speaking people or of Polish-speaking people. In column 5 we allow counties with a German-speaking minority (27 percent of the counties) to have a different intercept. Counties with a German-speaking minority display a significantly higher local spending in education. This is related to the previous finding about the share of Polish-speaking pupils (Table 3, column 4). Importantly, the coefficient for linguistic polarization remains unchanged. Furthermore, if we interact the dummy for German-speaking minority with polarization we do not obtain significant results for the interaction term (not shown). This suggests that the negative effect of linguistic polarization on local spending is independent from the identity of the major linguistic group.

5.4 Other public goods

Our hypothesis is that linguistic polarization between German and Polish-speaking people led to underprovision of public primary education as the German educational policy undermined Polish identity. This is also witnessed by the Polish school strikes in 1901 and 1906, where in 1906 46,886 children in 755 schools boycotted school attendance after German had been introduced as the only language of instruction in additional 200 primary school (Unruh, 1992). If our hypothesis is correct, the provision of other public goods which do not threaten the identity of the minority group should not be correlated with linguistic polarization.

We can test this hypothesis looking at local spending on transport infrastructure such as roads, canals, bridges, harbors, railways, street cleaning, surveying and mapping, gardening, and other related tasks which also fell within the ambit of the municipal administration (Hühner, 1998). Information on local spending on infrastructure is drawn from the dataset on municipal taxes from 1883-84 (Königliches Statistisches Bureau in Berlin, 1884). The same source provides data also on local spending on poor relief. Poor relief was regulated through the *Allgemeines Landrecht*. Groups of municipalities or land estates were responsible for the local poor and set the level of financial support. Poor relief encompassed preventive and direct support. Preventive support included the allocation of labor, the education of disadvantaged children,²⁶ and free

²⁶ Therefore spending on poor relief also included educational items.

healthcare. Direct support included the provision of working houses and orphanages as well as monetary and nonmonetary contributions (Hühner, 1998).²⁷

We expect linguistic polarization to have a zero effect on transport infrastructure as both linguistic groups benefited equally from the provision of such public good. The expected impact of linguistic polarization on spending on poor relief is instead ambiguous. In a polarized society, spending on poor relief might have been kept low not to favor the rival speaking-group. We also have to bear in mind that part of the poor-relief expenditure was devoted to educational items.

In columns 6 and 7 of Table 4 we provide OLS estimates using as dependent variable log local spending on transport infrastructure and poor relief per capita, respectively.²⁸ The estimates in column 6 provide support to our hypothesis that the provision of public goods not threatening the identity of a linguistic group is not related to linguistic polarization. Local spending on transport infrastructure is not significantly related to linguistic polarization. Spending on poor relief is negatively related to polarization, yet the coefficient is not significant.

To assess the magnitude of the effect, we focus on the coefficient estimated in column 1 of Table 4. The coefficient implies that an increase in linguistic polarization by one unit, namely shifting the share of non-German speaking people from zero to 50 percent, decreases local spending in primary education by about 59 percent. As we will see below, this has important implications also in terms of “real” schooling inputs.

5.5 Aggregation bias: urban and rural municipalities

Funding decisions on primary public education were taken at the municipal level (Kuhlemann, 1991). Our empirical analysis focused so far on the county level which encompasses several municipalities and could therefore hide important differences. Unfortunately data on pupils’ language *directly* at the municipal level for the period under investigation do not exist. However, the data from the educational census of 1886 and the financial statistics of 1883/1884 are reported separately for urban and rural municipalities, though always aggregated by county.²⁹ In the case of urban municipalities we can look at counties with a single, two, three, or more municipalities and investigate the impact of linguistic polarization on local education spending. In

²⁷ Spending on transport infrastructure and poor relief constitute a non-negligible part of the total budget spending: the share of spending on poor relief in the period 1883-84 was 5 percent of the overall budget; the share spent on infrastructure was about 13 percent; the share spent on primary education was 22 percent.

²⁸ For these dependent variables we estimate an OLS model as the instrumentation based on distance to the eastern border is arguably not valid. In fact, the Prussians fostered the expansion of roads, channels, and other infrastructure early on in newly acquired provinces, which violates the exclusion restriction as the geography of annexations had a direct impact on infrastructure investments (Müller, 1999). Therefore the estimates are simply suggestive and should not be interpreted causally.

²⁹ A municipality is defined as urban when the residing population is larger than 10,000 inhabitants.

this way we can investigate whether and to what extent the estimates at the county level suffer from aggregation bias.³⁰

Linguistic polarization does not differ systematically between urban and rural municipalities: average polarization is 0.26 (s.d. 0.38) in the urban sample and 0.28 (s.d. 0.36) in the rural one. In the regression analysis by urban and rural municipalities only the following control variables are available at that level of aggregation: the share of Protestants and municipal tax revenues. Since the state subsidized primary education in fiscally-challenged municipalities (Neugebauer, 1992), we include also the log of state expenditure in education per child in school-age. IV estimates with weak instruments and small sample size are biased and highly inconsistent. Due to the very low number of observations by subgroup we only report OLS estimates (Table 5). Since we are not interested in estimating the causal effect here but we want to understand the direction of the bias, OLS estimates will be also informative.³¹

In column 1 we report the estimates for urban municipalities across counties. Linguistic polarization has a significant negative relationship with local school spending. The average number of urban municipalities per county is about 3. The number of municipalities is included as an additional control in column 1.³² In column 2 we restrict the sample to counties with a single urban municipality. In this case linguistic polarization and spending on education are observed at the “right” level, i.e. the estimates should not suffer from aggregation bias. The coefficient for linguistic polarization is comparatively large and significant at 10 percent level. In column 3 we restrict the sample to counties with up to 2 urban municipalities. The negative coefficient for polarization has a smaller size compared to the case with a single municipality and is more precisely estimated. By progressively enlarging the sample with additional urban municipalities (columns 4 and 5) we obtain smaller coefficients. Thus it appears that, at least for urban municipalities, by aggregating the data at the county level the estimates are biased towards zero. Interestingly, the IV estimates in Table 3 and 4 are in line with the OLS estimates using one or two urban municipalities. This seems to suggest that our instrument addresses also the

³⁰ In principle we could estimate a model with county-fixed effects which exploits variation between urban and rural municipalities. Yet the variation in polarization between urban and rural municipalities within a county is too low to obtain any significant result. We will account for county-fixed effects in Section 7.

³¹ The urban sample declines from 214 to 203 observations as there are six counties that are solely constituted of rural municipalities which are Koenigsberg Landkreis, Zarbze, Niederung, Heydekrug, Karthaus and Breslau Landkreis and another five counties with missing information on the municipal taxes which are Danzig Landkreis, Pillkallen, Preussisch Stargard, Preussisch Holland and Mohrungen. The rural sample is reduced by nine counties as the city counties of Berlin, Danzig Stadtkreis, Potsdam, Breslau Stadtkreis, Stettin, Frankfurt/Oder, Posen Stadtkreis, Liegnitz Stadtkreis and Koenigsberg Stadtkreis do not comprise rural parts.

³² We have also run a specification with separate dummy variables for the number of counties. The results are virtually the same (available on request).

aggregation bias. It is possible that distance to the eastern border is able to identify variation in linguistic polarization across municipalities.

Table 5: Linguistic polarization and spending on education by number of municipalities

Dependent variable:	Urban					Rural
Log (local spending in educ. p.c.)	(1)	(2)	(3)	(4)	(5)	(6)
	Full sample	Single mun.	≤ 2 mun.	≤ 3 mun.	≤ 4 mun.	Full sample
Linguistic polarization	-0.346*** (0.078)	-0.570* (0.314)	-0.495*** (0.115)	-0.346*** (0.094)	-0.312*** (0.082)	-0.172*** (0.037)
Log state exp. in educ. (per child)	-0.118*** (0.041)	0.052 (0.118)	-0.015 (0.074)	-0.061 (0.051)	-0.087* (0.046)	-0.055 (0.035)
Log municipal tax p.c.	-0.001 (0.052)	0.197 (0.208)	0.027 (0.085)	-0.020 (0.060)	-0.029 (0.057)	0.155*** (0.024)
Protestant	-0.261*** (0.091)	-1.248*** (0.359)	-0.684*** (0.175)	-0.350*** (0.117)	-0.311*** (0.099)	0.202*** (0.038)
Number of municipalities	0.016 (0.013)					
Observations	203	41	86	134	161	206
R-squared	0.14	0.22	0.17	0.10	0.10	0.47

Note: OLS estimates. Robust standard errors are reported in parentheses. ***, ** and * denote significance at 10%, 5% and 1% respectively.

In column 6 we report the specification for rural municipalities. Also in this case the coefficient for linguistic polarization is negative and highly significant. Since a county generally encompasses a large number of rural municipalities, data for the single rural municipalities are not provided in the original sources. Therefore we cannot perform an analysis similar to the one carried out for the urban municipalities addressing the issue of aggregation bias. We cannot thus clarify whether the smaller coefficient estimated for rural municipalities (column 6) compared to the urban ones (column 1) is ascribable to a larger aggregation bias or to the fact that coordination costs between different linguistic groups were less salient in smaller rural communities.

6. Linguistic polarization and school inputs

We now shift our attention to the effect of linguistic polarization on schooling variables such as school density, measured as the number of schools per 1,000 children of school-age (6-14), and the number of teachers. We use our instrumental variable approach which exploits variation in linguistic fractionalization stemming from the distance to the eastern border. Our standard set of control variables is also included. The results are presented in Table 6. In general we find that linguistic polarization affects negatively all school inputs with a similar magnitude. In column 1 we consider the number of schools per 1,000 children of school-age (6-14). The negative effect of linguistic polarization is large and highly significant. The size of the coefficient indicates that

moving from a county with zero polarization to a county with unit polarization decreases the number of schools per 1,000 children by almost 4 units. This corresponds to about 60 percent of the mean.

Table 6: Polarization and schooling inputs

Dependent variable:	Schools per 1,000 children (1)	Schools per 1,000 children w/o cities (2)	Teachers per 1,000 children (3)	Student-teacher ratio (4)
Linguistic polarization	-3.739*** (0.996)	-4.623*** (1.221)	-5.264*** (1.051)	29.405*** (6.458)
Log municipal tax p.c.	0.527* (0.278)	0.594* (0.307)	1.085*** (0.310)	-9.898*** (2.115)
Protestant	0.004 (0.576)	0.116 (0.635)	-1.815*** (0.675)	7.213* (4.198)
Urbanization	-0.029*** (0.011)	-0.015 (0.013)	-0.009 (0.010)	-0.104 (0.069)
Population density	-0.007* (0.004)	0.418*** (0.144)	0.003 (0.005)	-0.003 (0.029)
Landownership conc.	-0.152 (0.139)	-0.295* (0.150)	-0.282** (0.137)	1.403 (0.891)
Emp. in agriculture	0.189*** (0.045)	0.180*** (0.052)	0.050 (0.048)	-0.012 (0.288)
Emp. in manufacturing	-0.021 (0.058)	-0.110 (0.075)	-0.096 (0.066)	1.038** (0.406)
Add. controls	Yes	Yes	Yes	Yes
Annexation FE	Yes	Yes	Yes	Yes
Observations	214	205	214	214
Kleibergen-Paap rk Wald F statistic	25.0	21.1	25.0	25.0
Mean dep. var.	6.6	6.9	10.6	78.1

Note: IV estimates. Additional controls are: number of years under Prussian rule, latitude (radius), and longitude (radius). Robust standard errors are reported in parentheses. ***, ** and * denote significance at 10%, 5% and 1%, respectively.

Fewer schools per children do not mean necessarily lower quality of schooling. Large urban schools in particular benefited from school standardization in ensuring a certain quality, school-based diversification and economies of scale (Kahlert, 1978). However, if we exclude nine city-counties from our regression, the negative effect of polarization increases to 4.6 schools (column 2). Furthermore, we control for the urban share of each county which should account for the higher likelihood of larger schools in the cities. In column 3 we use the number of teachers per 1,000 children in school-age as dependent variable. Also in this case the coefficient is negative and highly significant. The size of the coefficient indicates a reduction of circa 50 percent with respect to the mean value.

In column 4 we standardize the number of teachers by the number of students, computing the so-called student-teacher-ratio. This variable can be interpreted as a measure of the quality of teaching as it broadly captures class size. In our regression sample the average number of

students per teacher is 78. A unit change in polarization is associated with an increase in the number of students per teacher equal to 29, which is equal to 37 percent of the mean value.

7. From decentralization to centralization

The hypothesis of this paper is that a decentralized education system can lead to underprovision of public education in highly polarized counties. We have shown that cross sectional variation in linguistic polarization has a robust negative impact on local spending in primary education and on different schooling variables. Instrumental variable estimates, by addressing reverse causality and omitted variable bias, suggest a causal effect.

In this section we exploit a change in education policy occurred in 1888/89 which determined a partial centralization of public expenditure on teachers. This new law (*Schulunterhaltungsgesetz*) introduced a fixed financial support from the state for each full employed teacher which amounted to 500 Marks for the first teacher of each school, 300 Mark for every other teacher (150 Marks for every female teacher), and 100 Marks for supplementary teachers. The state contributions for each municipality were calculated on the basis of the number of teachers reported in the previous education census (*i.e.* in 1886 for 1891, 1891 for 1896 etc.). The objective of the law was to relieve municipalities from the fiscal burden to fund primary school. The same law established that school fees would be abolished and that landlords were exempted from their duty to fund schools. In addition, the teacher-pay law of 1897 introduced a uniform minimum wage for teachers of 720 Marks. The state guaranteed a basic funding of teacher wages which meant a further relief for the municipalities and thereby made schools more independent of the local economy.

As a result of this policy change, state spending on primary education increased on average from 10 percent to 35 percent of the total spending between 1886 and 1891. Figure 4 compares the distributions of the share of state spending in 1886 and 1891. We can see that not only the average level of central spending increased significantly, but also the distribution is much less skewed in 1891. The shift to centralization is particularly accentuated if we consider the expenditure on teachers: the state contribution went in that case from 14 percent to 50 percent.

According to our hypothesis this policy change towards centralization of public spending, by attenuating coordination problems, should have benefited high polarized counties the most. To test this hypothesis we estimate a reduced-form model similar in logic to a difference-in-differences approach. Including county and year fixed effects we estimate whether changes of our outcome variables are significantly different after 1886 in polarized counties. A clear advantage of

this approach is that by including county-fixed effects we can account for unobserved heterogeneity across counties. The model estimated is the following:

$$Y_{it} = \alpha_i + \delta_t + \sum_{t=1886}^{1901} \beta_t \cdot polar_{it} \cdot D_t + \sum_{t=1886}^{1901} X'_{it} \cdot \gamma_t \cdot D_t + \epsilon_{it} \quad (5)$$

where α_i and δ_t denote, respectively, county and year fixed effects; $polar$ is our variable for linguistic polarization which varies across counties and over time;³³ D_t is an indicator for each year (1886, 1891, 1896, 1901); X_{it} is a vector of covariates which includes the share of Protestants, urbanization rate, population density, landownership concentration, share of people employed in agriculture, and the share of people employed in manufacturing; ϵ_{it} is the error term. The coefficients of interest are β_t which capture the difference in outcomes for polarized counties, relative to non-polarized counties, in each year t .

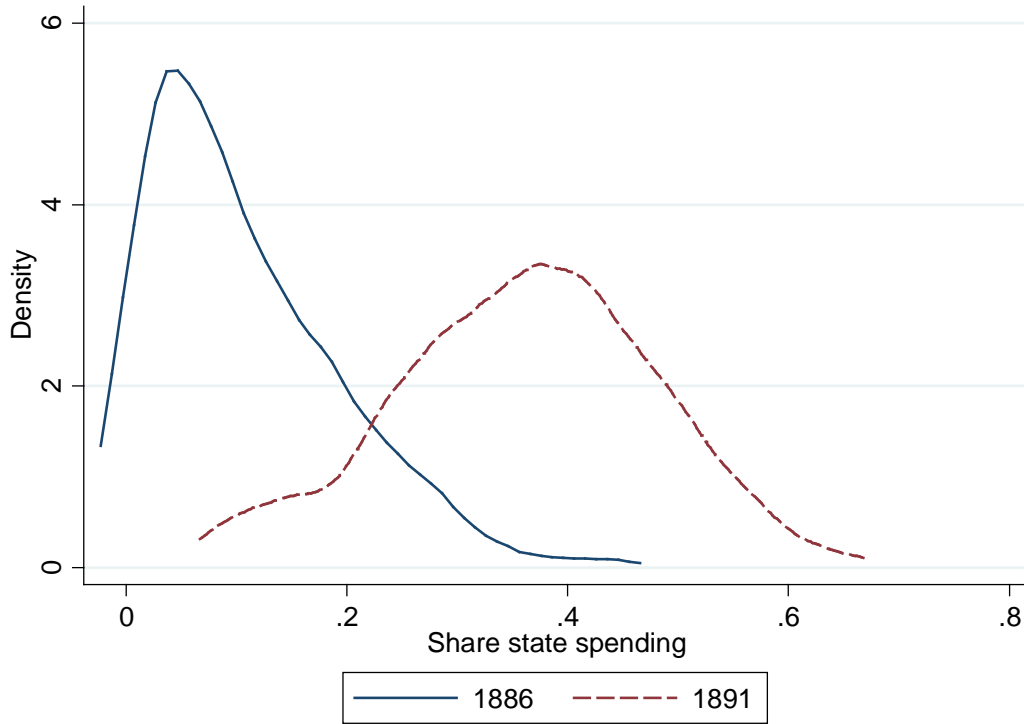


Figure 4: Density function of the share of state spending in 1886 and 1891

As dependent variable we consider the log of total expenditure on primary education, the number of teachers per 1,000 children aged 6-14, and the student teacher ratio. Consistently with

³³ It is important to note that the time-variation of linguistic polarization is extremely low.

our hypothesis we expect the provision of teachers to increase comparatively more in linguistically polarized counties after the policy change in 1888/89. The identification relies on the assumption that there are no other changes beyond those we have controlled for that occurred between 1886 and 1891 which affected total expenditure in education and the provision of teachers. It is also crucial that the increased state contributions were not targeted to counties with a high linguistic polarization. We control for selection into treatment by including the “initial” local expenditure on teachers in 1886 interacted with year fixed effects. Even though the computation of the state contributions was based on the number of teachers of the previous census-year, by fixing the local spending on teachers at 1886 we identify those counties which benefited the most from the state contributions. In this way we estimate the impact of centralization on school inputs in linguistically polarized counties, levelling out initial differences in local expenditures on teachers.

Counties with a high share of Slavic people might have also been the target of such public policy. Therefore we will include also the share of Slavic people interacted with year fixed effects to separate it from the impact of centralization on polarization. Finally we will also include province-specific time trends for West Prussia and Posen as in that case the central state decided also about the recruiting and hiring of teachers. The county-fixed effect estimates are presented in Table 7 and 8.

Table 7: Centralization, polarization, and total expenditure on education

Dependent variable:	(1)	(2)	(3)	(4)	(5)
Log (total expenditure in education)					
Linguistic polarization	-0.172 (0.260)	-0.247 (0.257)	-0.175 (0.247)	-0.191 (0.249)	-0.183 (0.265)
Linguistic polarization x 1891	0.088*** (0.022)	0.101*** (0.026)	0.080*** (0.025)	0.121*** (0.034)	0.048* (0.026)
Linguistic polarization x 1896	0.070*** (0.022)	0.075*** (0.024)	0.033 (0.023)	0.069* (0.038)	-0.027 (0.027)
Linguistic polarization x 1901	0.085*** (0.031)	0.099** (0.041)	0.037 (0.038)	0.094* (0.053)	0.050 (0.053)
County FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Controls * Year FE	No	Yes	Yes	Yes	Yes
Loc. spending 1886 * Year FE	No	No	Yes	Yes	Yes
Share Slavic * Year FE	No	No	No	Yes	No
West Prussia & Posen * Year FE	No	No	No	No	Yes
Observations	1806	1806	1806	1806	1806
R-squared (within)	0.82	0.84	0.84	0.84	0.84

Note: Panel estimates. All the controls are interacted with year dummies. Linguistic polarization in 1886 is the reference year. Controls include: share of Protestant, urbanization rate, population density, landownership concentration, share people employed in agriculture, and share of people employed in manufacturing. Robust standard errors reported in parenthesis are clustered at the county level. ***, ** and * denote significance at 10%, 5% and 1%, respectively.

In Table 7 we use the log of total expenditure in public primary education as dependent variable. In column 1 we include only county and time fixed effect, without additional controls. The coefficients for polarization interacted with the year fixed effects indicate that after the policy change towards centralization total expenditures on education increased relatively more in polarized counties. The same pattern emerges from column 2 where we include our set of control variables interacted with year fixed effects. The results change in column 3 where we include the local expenditure for teachers in 1886 interacted with year dummies. In this case we observe an increase in log total expenditure for polarized counties only in the period immediately after the policy change in 1891. The coefficients for 1896 and 1901 are lower in magnitude and not significant, which means that in those years total expenditure in polarized counties was not significantly different compared to the reference year 1886. In column 4 we account for the share of Slavic people. Also in this case we find a large increase in 1891, whereas the advantage is reduced in the successive two periods. Finally accounting for the trend in the provinces of Posen and West Prussia which had a more restrictive legislation makes the positive impact of centralization on polarization smaller in size and only marginally significant in 1891. In sum, the estimates in Table 7 indicate that more state contributions to cover teacher costs did not cause a significant increase in total spending on primary education in polarized counties in the “long-run”. An increase in total spending on education is detectable for polarized counties only in 1891 when we account for the trend in West Prussia and Posen, where total spending in education increased significantly until 1896.

The results when using teachers as dependent variable in Table 8 are more clear-cut. Columns 1-5 report estimates using the number of teachers per 1,000 children as dependent variable. The coefficients for polarization in the baseline year are negative and highly significant, confirming the cross-sectional evidence in Table 6 about the negative effect of polarization on the number of teachers per 1,000 children. After the policy change towards centralization, highly linguistically polarized counties experience a significant increase in the number of teachers per 1,000 children relative to non-polarized counties. The increase is larger in 1891 and tends to decrease in magnitude in the successive years. However the size of the coefficients for 1891 indicates that the initial gap in teachers in polarized counties is closed after the policy change. The impact in 1891 is reduced once we additionally account for the share of Slavic people in the county (column 4). However, also in that specification, 60 percent of the initial gap in 1886 is closed after the policy change in 1891. The inclusion of West Prussia and Posen specific trends in column 5 makes the impact of the policy change in 1891 larger.

Table 8: Centralization, polarization, and number of teachers

Dependent variable:	Teachers per 1,000 children					Student-teacher ratio				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Linguistic polarization	-2.219*** (0.667)	-2.270*** (0.708)	-1.776** (0.687)	-1.497** (0.686)	-1.748** (0.696)	14.884*** (3.116)	14.127*** (3.800)	9.680*** (3.415)	7.414* (3.824)	9.062*** (3.454)
Linguistic polarization x 1891	1.893*** (0.258)	2.393*** (0.266)	2.073*** (0.270)	0.901*** (0.251)	2.104*** (0.336)	-13.177*** (1.300)	-14.870*** (1.354)	-11.187*** (1.166)	-4.644*** (1.247)	-10.740*** (1.497)
Linguistic polarization x 1896	0.787*** (0.196)	1.049*** (0.251)	0.652*** (0.217)	0.615*** (0.237)	0.416* (0.229)	-9.153*** (3.322)	-12.008** (5.493)	-8.278** (4.190)	-6.071** (2.831)	-5.939* (3.491)
Linguistic polarization x 1901	0.634*** (0.157)	1.063*** (0.201)	0.685*** (0.193)	0.771*** (0.211)	0.698*** (0.188)	-6.675*** (1.055)	-8.699*** (1.208)	-5.432*** (1.048)	-4.749*** (1.412)	-5.190*** (1.120)
County FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls * Year FE	No	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
Loc. spending 1886 * Year FE	No	No	Yes	Yes	Yes	No	No	Yes	Yes	Yes
Share Slavs * Year FE	No	No	No	Yes	No	No	No	No	Yes	No
West Prussia & Posen * Year FE	No	No	No	No	Yes	No	No	No	No	Yes
Observations	1806	1806	1806	1806	1806	1804	1804	1804	1804	1804
R-squared (within)	0.53	0.58	0.58	0.60	0.59	0.11	0.12	0.13	0.13	0.13

Note: Panel estimates. All the controls are interacted with year dummies. Linguistic polarization in 1886 is the reference year. Controls include: share of Protestant, urbanization rate, population density, landownership concentration, share people employed in agriculture, and share of people employed in manufacturing. Robust standard errors reported in parenthesis are clustered at the county level. ***, ** and * denote significance at 10%, 5% and 1%, respectively.

In columns 6-10 we use the student-teacher ratio as dependent variable and the same pattern emerges: after the change towards partial centralization of public spending for teachers, polarized counties tend to close the initial gap in student-teacher ratios. This result is consistent across the different specifications. As in the previous estimates, the inclusion of the share of Slavic people diminishes the coefficient for 1891 (column 9). Yet, also in that case about 60 percent of the difference in student-teacher ratio in polarized counties (7 students per teacher) is closed after the policy enactment.

The evidence shown in Tables 7 and 8 provides support to our hypothesis that centralization of public spending can reduce inefficiencies caused by coordination problems in linguistically polarized counties. Yet, whether the increase of German-speaking teachers was beneficial for the Polish-speaking population is debatable and is a question that cannot be addressed in this paper. Since we do not observe educational outcomes such as literacy rates, educational attainment in years, or test scores, we cannot evaluate whether the higher number of teachers and the lower student-teacher ratio translated into higher educational achievements. It is also possible that returns to education in the labor market were different between German and Polish-speaking people.

In addition, our evidence should not be interpreted as a general case against decentralization of public education spending. Our findings indicate that an increase in state contributions to cover teachers' costs has a significant impact on the provision of teachers in linguistically polarized counties. From a theoretical perspective, more accentuated school autonomy may have reached the same goal. Yet recent evidence from a panel of 42 countries suggests that school autonomy affects student achievements negatively in low performing countries (Hanushek et al., 2013). Galiani et al. (2008) also finds that the benefits of secondary school decentralization did not reach the poor in Argentina. As we show in our paper, different preferences for education policies can be the source of such heterogeneous effects of decentralization.

8. Conclusion

Recent literature has shown that fiscal decentralization is positively related to education outcomes (Barankay and Lockwood, 2007; Faguet, 2004; Galiani et al., 2008). In these studies preferences for education are generally homogeneous within localities. In our study we examine a particular case in which there are conflicting preferences for education policy within localities, in a context of strong decentralization of education spending. We argue that in the presence of divergent interests for education, decentralization of education spending can lead to lower outcomes.

Nineteenth century Prussia is an ideal laboratory to study this issue because of a highly decentralized education system and, at the same time, a linguistically polarized society in many regions. Exploiting unique county level data on local and central expenditure on public primary education in 1886 we show that for a given level of development and municipal tax revenues, linguistically polarized counties invested fewer resources in primary education. We show that this result is not due to different levels of demand for education, religious fractionalization, or the subsidiary role of the central state. Instrumental variable estimates using distance to the Eastern border, motivated by the eastward territorial annexations of the Kingdom of Prussia suggest a causal interpretation of these results. Consistently, we find that linguistic polarization has a negative impact also on the number of schools and teachers per children in school age.

We also exploit a change in education policy which increased the state contribution to cover teachers' costs. By estimating a model similar to a difference-in-difference approach we show that, after the change in policy towards centralization, in polarized counties the number of teachers per child 6-14 increased significantly, and the student-teacher ratio decreased. About 60 percent of the gap in the number of teachers in polarized counties was closed after the policy change.

These results shed new light on some conditions under which centralization can lead to more efficient outcomes. In a society characterized by high levels of diversity in terms of culture, ethnicity, and language, heterogeneity of preferences and coordination problems in a context of high decentralization can lead to a standstill or a less efficient provision of public goods. Our study adds to the literature on the heterogeneous effects of decentralization and presents a case where centralization can improve the efficiency of public good provision.

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