The Role of the Weighted Voting System in Investments in Local Public Education: Evidence from a New Historical Database

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Abstract

In this paper, we analyze how a weighted voting system introduced in 1862, which shifted the distribution of political power from landowners to industrialists at local town meetings, affected investments in local public education. We use an event study design based on a newly constructed panel data set with annual observations of nearly 2,200 Swedish local governments over 28 years, i.e., more than 60,000 observations. Most importantly, there is no pre-trend in educational spending in our event study but rather a sharp change in the dynamic treatment effects exactly at the date when the treatment occurs, i.e., when industrialists receive more political power at town meetings. The estimated cumulative treatment effect is also economically substantial. For example, per capita spending on education increased by approximately 37% within 6 years in local governments where industrialists came to political power. Our findings are therefore consistent with the idea that political institutions are a key determinant of human capital accumulation and long-run economic development.

1. Introduction

Human capital, particularly attained through education, has been emphasized as a critical determinant of economic development and growth (e.g., Barro 1998, Barro and Lee 2015, and Krueger and Lindahl 2001). Nonetheless, there is still debate concerning the underlying mechanism behind the relationship between human capital accumulation and economic development. For example, Acemoglu et al. (2001) argue that institutions are the fundamental determinants of human capital and economic growth, while Glaeser et al. (2004) claim that the causal relationship is in the opposite direction, namely, that growth and human capital accumulation lead to institutional improvements.

In this paper, we provide new evidence on this important question by using newly constructed historical data on Swedish local governments in the 19th century. Sweden is an interesting testing ground since it was one of the poorest countries in Europe in 1860, but 100 years later, it was one of the richest countries worldwide, and human capital has been suggested as one explanation for this growth miracle (e.g., Ljungberg and Nilsson 2009, Sandberg 1979). In addition, Swedish local governments played a decisive role in investments in local public goods,[1] including primary education, since the central government provided very limited financial support; i.e., central governmental grants constituted only approximately 10% of total local government revenues. Instead, the bulk of revenues were raised through a local income tax, and local governments could set the tax rate with complete freedom.[2]

Most importantly, we have created a panel data set based on *yearly* data on the local government spending on primary education of approximately 2,200 local governments over 28 years (i.e., more than 60,000 observations), together with very detailed data on local politics. As a result, the annual data in combination with an event study design enable us to make a particularly compelling test of whether there exists a causal relationship between a change in political institutions and investments in education.

The political institution we will analyze is the Swedish weighted voting system that was in place between 1863 and 1908 at the local level. Historically, all local governments had the same town meeting form of government, a form of direct democratic rule, where only landowners were entitled to vote. However, after 1862, it was decided by the central government that all taxpayers, including companies, would have voting rights at these town

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[1] In a companion paper, Lindgren et al. (2020), we show that when industrialists receive more political power at town meetings, they also begin investing much more in local railways.

[2] For example, the average rate during the period 1907-09 was 7.5%, but the variation in the tax rate was very large since the range could between 1% and 32% in some years, Söderberg (1911).

meetings. Moreover, the number of votes was proportional to the taxes paid, with no restrictions on the maximum number of votes. As a result, a few tax payers, or perhaps even a single one, could have the majority of votes at these meetings.

In the Swedish political setting in the nineteenth century, as in many other European societies at that time, the main conflict of interest was between (feudal) landowners and emerging industrialists. Indeed, landowners tried to exercise their political power to keep labor tied to the land and reduce the power and profitability of industrialists (e.g., Acemoglu et al. 2005). Specifically, the industrialists, who were striving for an educated labor force, favored investment in the education of the people, while the landowners, whose interest lay in the reduced mobility of the rural labor force, favored policies that deprived the masses of education. This conflict of interest between landowners and industrialists is particularly stark in our setting since landowners were heavily dependent on cheap labor and competed with industrialists over the same pool of the rural labor force, as further discussed in the paper. Moreover, the weighted voting system contributed to a much more conflictual situation between landowners and industrialists since now a few industrialists could have more votes than many individual landowners.

Using an event study design, we find that when industrialists start gaining more political power at town meetings, they also begin investing much more in local public education. Most importantly, there is no pre-trend in educational spending in our event study but a sharp change in the dynamic treatment effects exactly at the date when treatment occurs, i.e., when industrialists receive more political power. The estimated cumulative treatment effect is also economically substantial. For example, per capita spending on education increased by approximately 37% within 6 years in local governments where industrialists came to political power. Moreover, we find that the effect of the political power of industrialists on school spending was of similar magnitude in places with a few large landowners and many small landowners. Thus, this result suggests that the conflict of interest is largely between industrialists and landowners and not among landowners themselves (i.e., via inequality in landownership), as found by Banerjee and Iyer (2005), Engerman and Sokoloff (1997), and Galor et al. (2009), for example.

This paper is related to a number of distinct studies. It is related to the literature that argues that political institutions are the fundamental cause of economic development and growth (e.g., Acemoglu et al. 2005, North 1981). Specifically, our research design is a within-country study that circumvents many of the empirical identification problems faced by cross-country studies, as discussed by Pande and Udry (2005). They argue that a within-country study

can better identify the channels of influence of a particular institution (i.e., the effect of the weighted voting system) and define the appropriate unit of analysis (i.e., local governments). Our paper is also related to the literature on education and growth (e.g., Barro 1998, Barro and Lee 2015). Specifically, it is related to the literature on mass schooling in the 19th century (e.g., Lindert 2004). We add to this literature by providing evidence on the importance of local politics in understanding the driving forces of mass schooling.[3] For example, our results that emerging industrialists in rural areas started to spend more on schooling provide one explanation for the apparent contradiction between the description of thrifty rural school districts (i.e., one-room school) and the remarkable increase in school spending in the U.S. and other Western countries before WWI. Finally, this paper is naturally related to studies of Sweden's primary education system during the 19th century. However, most of these studies are based on case studies (e.g., Westberg 2017) or aggregated time-series data (e.g., Ljungberg and Nilsson 2009), while our paper uses an event study design study, i.e., a quasi-experimental design, on the universe of all local governments.[4]

The rest of this paper is structured as follows. Section 2 describes the historical background, the weighted voting system, the primary education system, and the data used in the analysis. Section 3 presents the empirical design. Section 4 presents the results, while Section 5 concludes.

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[3] Lindert (2004) does not provide any statistical evidence on the importance of local politics for mass schooling. For example, in the Prussian context, he speculates on the reason for the large increase in mass education on p.121, i.e., "It was more the result of a spontaneous political will to levy local taxes in thousands of school districts."

[4] An important exception is Andersson and Berger (2019) since they also study the effect of local politics on school spending using local government data. However, they use spending data from only one cross-section, 1874, and cannot therefore use a difference-in-differences design or an event study design. Moreover, their results are completely different from ours; i.e., they find "that educational expenditure was higher where the distribution of political power was more unequal. In particular, areas governed by local landed elites—even those where a single landowner had de jure dictatorial powers—invested substantially more in mass schooling relative to areas where political power was more widely shared, or where it lay in the hands of capitalist elites".

2. Background

In this section, we provide a description of the Swedish setting in the 19th century (section 2.1). Additionally, we describe the weighted voting system (section 2.2), the primary education system (section 2.3), and the data used in the analysis (section 2.4).

2.1 Sweden in the 19th century

In the middle of the 19th century, Sweden, a predominantly rural and agricultural-based society, was one of the poorest countries in Europe. For example, almost 80% of its nearly 3.5 million inhabitants worked in the agriculture sector, while less than 10% worked in the industrial and handicraft sectors. In addition, it was not until 1943 that the share of employment in the industrial sector was larger than that in the agricultural sector (Edvinsson 2005).[5] Moreover, much of the early industrialization occurred in rural areas, not in cities. For example, as late as 1901, 64% of the total employment in the industrial sector was based in rural areas. The rural industrialization therefore implied that industrialists and landowners were competing for the same labor pool. The rural areas were also sparsely populated; only 10% of all Swedes lived in the country's 87 small towns in 1850.[6] The health situation was also poor since the life expectancy was only 41 years, and the average infant mortality rate was 15% in 1855 but could be as high as 40-50% in certain rural regions (e.g., Brändström 1984). Thus, overall, in the mid-1800s, Sweden was an economically and socially backward country. Nonetheless, Sweden became one of the richest, healthiest, and most industrialized countries worldwide 100 years later.

Regarding the political system, Sweden was, to a large degree, a semifeudal society in the middle of the 19th century. Specifically, it had a parliament (the Diet) consisting of four estates: nobles, clergy, burghers and landowning farmers.[7] As a result, approximately only 5% of the total Swedish population had some form of political rights in the feudal society. Notably, all types of landowning farmers had political rights, which was in sharp contrast to most other European feudal societies. However, the vast majority of Swedish landowners were smallholders. For example, 95% of all landowners had a farm size smaller than 30 hectares, while only 1% had a farm size above 100 hectares in 1870. Thus, the smallholder farms operated 70% of all arable land. In other words, the Swedish agricultural economy was largely

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[5] The value added from manufacturing was larger than that from agriculture only after 1920.
[6] There were only 87 towns, and they typically had very small populations, except for Stockholm city.
[7] The Parliament Act of 1866 introduced a new system of representation, namely, a bicameral legislature.

characterized by subsistence farming and production for the local market.[8] Nonetheless, both small and large landowners were dependent on a large supply of cheap labor for the very short harvest season. Thus, to ensure that landowners had a reliable supply of cheap labor, a repressive agricultural system was created by the Swedish feudal elites in the 17th century. As a result, Swedish feudalism could be characterized as a system of labor coercion since all types of landowners made extensive use of the Master and Servant Act, which established that farm servants (e.g., both farm hands and maids) should be contracted for one year at a time and were required to do whatever work the master (e.g., the farmer) deemed necessary.[9]

The institution of farm service was a crucial system for the supply of labor in agriculture. For example, in 1870, farm servants constituted more than 30% of the labor force in the agriculture sector. The Master and Servant Act also allowed for coercive measures, such as corporal punishment and police fetching, when servants did not show up for work. The Master and Servant Act also included strict anti-enticement clauses. Thus, a master had almost complete control over his farm servants (e.g., Eklund 1974, p. 227). It was only on October 24, 1926, that the Master and Servant Act was abolished.

A second important component of the labor-repressive agrarian system was that the common people, e.g., landless agricultural laborers, were required by law to be employed, typically as farm servants; otherwise, they could be imprisoned for life (Eklund 1974, p. 211). In other words, it was forbidden for rural landless people to be unemployed.[10]

A third component of the labor-repressive agrarian system was that a large share of tenant farmers were required by law to perform corvée labor, i.e., unpaid labor demanded by the landowner. The amount of corvée labor also depended on the size of the tenant farm, with larger farms having more corvée obligations than smaller farms (e.g., Morell 2001). Tenant farmers were typically required to work 3-4 days per week, but in some areas, corvée labor could run as high as 700-800 days of work per year,[11] implying that the household of the tenant farmer either had to be large enough to provide this labor itself or had to subcontract this labor by hiring agricultural laborers and maids. In addition, tenant farmers were required to perform extra work whenever requested by the landowners. This additional work was paid but typically far below the "market" wage. The system of corvée labor was abolished only in 1944, and as

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[8] The typical smallholding was a family farm with permanent hired labor, primarily unmarried farm hands and maids, employed by the year and paid in kind (e.g., free lodging and food), with a very small cash wage (Morell and Myrdal (2011, p. 174)).
[9] Acemoglu and Wolitsky (2011), for example, also argue that European feudalism was primarily a system of labour coercion.
[10] This law was abolished in 1885.
[11] See Olsson (2006).

late as 1920, nearly 30% of all Swedish farmers were tenant farmers and were therefore basically required to perform corvée labor or extra work at a very low wage.[12]

The labor-repressive element of the Swedish agrarian system was also reinforced by the fact that labor mobility (domestic movements) was severely restricted since Sweden maintained a rigid system of internal passport control until 1860. The poor relief law ("hemortsrätt") further restricted labor mobility among the poorer segments of society until 1956. In addition, freedom of trade was heavily circumscribed until the mid-19th century, when the craft guilds were abolished in 1846 and a more general freedom of trade act for men and unmarried women was introduced in 1864.

To conclude, Sweden had a very labor-repressive agricultural system, and from a European perspective, labor coercion was abolished extremely late. Moreover, Swedish landowners were heavily dependent on cheap labor and had very strong incentives to block the out-migration of labor and industrialization since otherwise they would become economic losers, as discussed by Acemoglu et al. (2005).

2.2 The weighted voting system

Sweden has a long history of local self-government in rural areas. Historically, there existed approximately 2,400 rural local governments, and their decision-making body was the town meeting, i.e., a direct democratic form of government (e.g., see Hinnerich and Pettersson-Lidbom 2014 and Mellquist 1974).[13] Thus, eligible voters were gathered at town meetings—at least three times per year—to determine matters of economic importance. The town meeting regulation from 1817 stated that, effectively, only landowners had voting rights at the town meetings (Sörndal 194)). Typically, the decisions at the meetings were made by unanimity; sometimes, however, in cases of disagreement, a weighted voting scheme, where voters received votes in relation to their farm size, was used. The size of the farm was measured in terms of the "mantal", which was the basic tax assessment unit of land in use since the 16th century. This type of weighted voting system gave landowners with a large farm only a few more votes than those with a small farm.[14]

In 1862, the four-estate parliament decided to extend suffrage rights at the local level to other groups, including industrialists, in a new Local Government Act. The rationale behind this new law was the private property principle, i.e., all local taxpayers, including companies,

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[12] For a description of the Swedish corvée labour system, see Morell (2011).

[13] Sweden also had 87-94 urban towns or "cities" in the latter part of the 19th century. The cities had a different political system from the rural local governments.

[14] For a description of the mantal and how it was used in the local governments, see Lagerroth (1928).

should have voting rights in the local government (e.g., Norrlid 1970). Moreover, one year later, the four-estate parliament decided that all local taxpayers should receive voting rights in proportion to their taxes paid, without any restrictions on the maximum number of votes.[15] Thus, a single taxpayer could have the majority of votes at town meetings.[16] Interestingly, there was no debate among the four estates in the Diet regarding the extension of suffrage rights to industrialists at the local level in 1862, Mellquist (1974, p.52). Similarly, the decision to make votes proportional to taxable income in 1863 was also accepted with unanimity, Mellquist (1974, p. 71). Mellquist (1974) provides an explanation for these nonconflictual decisions: "because companies were so small and few at that time, it was impossible to foresee the subsequent economic development and industrialization."

Most importantly, the taxable income of a local taxpayer was determined by a uniform nationwide regulation.[17] Specifically, for landowners, taxable income was set to 3% of the assessed agricultural property value, and they received 2 votes for every 0.10 krona of taxable income. Thus, the fixed rule that determined the votes of landowners was as follows:

(1) $V_t^L = f(\text{taxable income}_{t-1}) = 2*(\text{Property value}_{t-1}*0.03)/10)$

where V_t^L represents landowners' votes in period t. For industrialists, the taxable income was based on the operating profits, and they only received 1 vote for every 0.10 krona of taxable income. As a result, the fixed rule that determined the votes of industrialists was as follows:

(2) $V_t^I = g(\text{taxable income}_{t-1}) = 1*(\text{Operating profits}_{t-1}/10)$

where V_t^I represents industrialists' votes in period t. Equally importantly, the number of votes each taxpayer would receive, which could be used for voting at town meetings, was updated each year.

The relative strength of the political power of landowners versus industrialists depends on both the assessed agricultural property value and the operating profits of industrial firms. Indeed, the votes of landowners changed comparatively minimally over time, while those of industrialists fluctuated enormously. The reason for the stability of the votes of landowners was that the central government regulated the assessment of the value of agricultural property

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[15] For example, one industrial firm (Ljusne Woxna AB, Söderala) had 87,974 votes in 1900; in comparison, the average number of votes per taxpayer was approximately 50.

[16] For example, a single taxpayer had the majority of votes in 54 local governments in 1871 and in 44 local governments in 1892.

[17] Article II in Bevillningsstadgan.

and performed strong oversight over this process at the local level.[18] In sharp contrast, the votes of industrialists were extremely volatile because the operating profits of firms were related to the boom and bust of industrial business cycles.

To illustrate these facts, we use data from the local government of Ytterlännäs, which was dominated by one industrialist (Janne Gavelius) who was in control of all the votes from a large sawmill company (Graningeverken). Figure 1 shows the evolution of the total votes for the landowners in Ytterlännäs for the period 1864-1908 and of the sawmill company for the shorter period 1871-1899.[19] The number of votes of landowners in Ytterlännäs was 6,940 in 1864, slowly decreased to approximately 6,100 in the early 1870s, and thereafter slowly increased to 10,841 in 1908. Thus, over the course of almost 50 years, the number of votes of landowners had increased by a factor of only 1.5. This somewhat smooth evolution in the number of votes due to landownership can be compared with the very sharp, year-to-year changes in the number of votes of the sawmill company. The largest number of votes that the company had was 31,263 in 1875, while the lowest number was 3,569 in 1880. Thus, over a very short period of time, the number of votes of the industrialist varies by a factor of almost 9. The extremely large swings in the number of votes allotted to the company were caused by the high volatility in the international wood market. In summary, the variation in the political power of landowners over time was largely driven by idiosyncratic period-specific shocks, i.e., external factors outside the control of landowners and industrialists in the local government of Ytterlännäs.

We can also illustrate these relationships at the aggregate level of the universe of local governments. Figure 2 shows the development in the total number of votes (millions) during the 1864-1908 period for both landowners and industrialists. In 1864, the total number of votes was 4.3 million for landowners and 10.1 million for industrialists. Thus, landowners had more than twice as many votes at the aggregate level directly after the change in the suffrage reform in 1862. However, in 1908, this relationship had completely reversed since votes for the industrialists had increased to 30.5 million, while for landowners, votes had increased only to 15.2 million. Thus, over the 1864-1908 period, the total number of votes increased by 50% for landowners, while it increased by more than 600% for industrialists. In addition, Figure 1 shows that the local government of Ytterlännäs had almost exactly the same trend in the votes

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[18] For a discussion of the process of assessing the value of agricultural property in the 19th century, see Lindgren (2017).

[19] We are grateful to Erik Nydahl for providing us with these data.

of landowners over time as the corresponding aggregated time series in Figure 2. Specifically, the correlation coefficient between the two time series is as high as 0.96.

In summary, the weighted voting system dramatically shifted political power from landowners to industrialists. Thus, local landowners had strong incentives to block industrialization since they would otherwise become political losers, as discussed by Acemoglu et al. (2005).

2.3 The primary education system[20]

Historically, basic education in Sweden was organized through a system of household instruction, i.e., home schooling, based on the Church Law of 1686, which gave the head of the household the responsibility for educating children and farm workers. Home education was conducted by a household member, and the focus of instruction was on reading and catechetical knowledge. The principal role of the church was to verify and register the level of knowledge via examinations.

In 1842, after a long and complicated political process, a school act was initiated that created the main structure for Sweden's primary school system. The school act made it mandatory for each of the 2,308 local governments to organize a school district that operated at least one permanent school within five years.[21] For poor or sparsely populated local governments, the act allowed for an ambulatory school that moved between villages. These ambulatory schools became a main feature of the Swedish school system. The act also stipulated that local governments should establish a school board, which comprised between five and 12 individuals and was led by the parish priest. Moreover, the school board was responsible for the schools within the local government. The board should inspect schools and issue local regulations regarding instruction methods, disciplinary measures, and other school management and organizational issues. The school board was placed under the governance of the town meeting. The town meeting audited its account books and had the final say in issues regarding school expenditures. Thus, the school act placed primary schools in the hands of the local government.

The funding of the primary education system was also largely the responsibility of the local governments since the central government contributed less than 30% to the revenues for

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[20] This section is mainly based on Westberg (2017, 2019).
[21] The administrative system at the local level is complicated since it consists of at least 5 entities: local governments (borgerliga kommuner), parishes (kyrkliga kommuner), school districts (skoldistrikt), cadastral units (jordebokssocken), and poor relief societies (fattigvårdssamhällen). However, in most cases, these administrative entities are identical; thus, I use the word local governments for all these entities.

the period 1865 to 1900. The main source of funding during this period was based on a local income tax that local governments could set with complete freedom.

Importantly, the school act did not make schooling compulsory for school-aged children. Indeed, it only stated that all local governments should have had established schools by the 1850s. Moreover, the act stipulates that children should start school by age 9, but it did not otherwise regulate the terms of school years or school days. As a result, only approximately 21% of children between 7 and 14 years of age were enrolled in primary schools in 1843. The attendance rate of enrolled children was low, on average, 34%. However, in rural areas, it could be as low as 10% (Johansson 1972). Moreover, the average actual school year consisted of only 60 school days in 1843. However, by 1910, the primary education system had improved considerably since the enrolment rate was 75%, the attendance rate was 80%, and the school year had increased to 166 days.

The quality of the early primary education system was also in a very poor state.[22] For example, in 1843, the number of teachers was only 2,800, i.e., one teacher per 130 children (Richardsson 1992, p. 31).[23] Moreover, half of the teachers were not examined regarding their qualifications. In addition, local landowners (i.e., taxpayers) showed little or no interest in supporting spending on primary schools (Richardsson 1992, p. 32). As a result, children in primary schools received a very limited education in the mid-19th century.

As in many countries, the central government started to take a more active part in providing incentives for the development of primary education in the second half of the 19th century. For example, state school inspectors were installed 1861, and new school standards were issued in 1878, 1889, 1897, and 1900. The standards were a set of recommendations for the number of school types and curricula. To increase the quality of school buildings, national building plans were also issued. Nevertheless, these new regulations could not alter the decentralized organization of the primary school system. Thus, the power of the Swedish primary school system largely remained in the hands of the local governments in the beginning of the 20th century.

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[22] Sandberg (1979), however, comes to a completely different conclusion about Sweden's educational system since he argues that Sweden had a "strikingly large stock of human and social capital" in the mid-19th century. His conclusion is, however, based on secondary sources and aggregated data. A completely different picture emerges once one analyzes the primary micro data stored in the National Archives. Moreover, Resnick and Resnick (1977) argue that the literacy criterion used by the Swedish church is flawed and cannot be used to assess the literacy of the population as is done in Sandberg (1979). Indeed, Nilsson (1999) demonstrates with Swedish data that, depending on the measurement used, it is possible to obtain estimates of almost any level of literacy.

[23] In the beginning of the 1880s, the teacher-student ratio had improved to one teacher per 60 children.

Spending on primary education was also the largest and most important spending program of Swedish local government since it made up 43% of total spending in 1908. The two other spending programs were spending on poor relief (23%) and spending on clergy (24%).

2.4 Data

Our data come from a newly constructed Swedish historical database that includes extremely rich data on local governments, villages, firms, individuals, etc. The database mainly covers the period 1860-1950. The finished database will include approximately 1 billion observations.

In this paper, we use data from the universe of rural local governments, i.e., more than 2,400 local governments. We have yearly data on the population and the spending on primary education covering the period 1874-1908. We also have annual data on the weighted voting system for the period 1881-1908. In addition, we have data on the weighted voting system for the year 1872.

With these data, we can construct annual data on the real per capita spending on primary schooling. We can also create data on the yearly distribution of political power between landowners and industrialists, as further explained in the next section.

The maximum number of rural local governments in our data set is 2,405, but we can use the data from only 2,191 governments in our main analysis since sometimes, the local government did not report data to Statistics Sweden. Moreover, there were changes in the jurisdictional boundaries of the local governments, which makes it impossible to follow the same local government over time.

Figure 3 shows the development of real per capita spending during the period 1874-1908. Figure 3 reveals that there is no trend in school spending between 1874 and 1890 but that there is a strong upward trend after 1896. Figures 4 and 5 show the distribution of the share of industrialist votes for the years 1872 and 1908, respectively. Figure 4 reveals that there were very few local governments in 1872 where the industrialists had more than 50% of the votes, i.e., 206 out of 2,336. Figure 5 shows that the number of local governments where industrialists had more than 50% of the votes increased significantly in 1908, i.e., 781 out of 2,354.

Table 1 displays the summary statistics of the variables we use in our analysis.

3. Empirical design

In this section, we describe the empirical design, but first, we need to define the treatment variable, i.e., the political power of the industrialists, in our setting of town meetings with weighted voting. The decision rule in this system was that the group of attendants who had the majority of votes determined the outcome at that particular meeting. Thus, one could potentially use the roll calls from these meetings to measure the strength of the political power of industrialists. We do not have data from meetings, but even if we did, the attendance at meetings was arguably endogenous. Thus, we instead use the yearly updated voting list of all eligible voters that determined the number of votes each voter possessed during the subsequent year. We then divide all voters into two groups depending on whether they received votes based on landownership or not. Then, we use the ratio of non-agrarian votes to total votes as our measure of the *potential* power of industrialists. This measure allows industrialists to potentially influence the outcome at meetings even if they have less than 50% of the total votes, which is possible in our setting since attendance rates were very far from 100%.[24] Indeed, in the empirical analysis, we find evidence that industrialists could affect the outcome even if they had less than 50% of the total votes.

We use an event study design, which is an extension of a difference-in differences design (DiD) with leads and lags of a treatment variable. Traditionally, this type of model, where the treatment variable is continuous, is framed as a distributed lag model rather than an event study design. However, Schmidheiny and Siegloch (2019) show that event study designs and distributed-lag models are equivalent and lead to numerically identical parameter estimates.

As a starting point, a standard DiD regression specification in our setting is

(3) $Y_{it} = \alpha_i + \lambda_t + \beta X_{it} + v_{it},$ $i=1, 2, \ldots, 2191, t=1881, 1882, \ldots, 1908;$

where i indexes local governments and t time. Y_{it} is the log of per capita spending on primary schooling and X_{it} is a continuous treatment variable, i.e., the potential power of industrialists (i.e., the share of non-agrarian votes).

If we add the leads and lags of X_{it} to specification (3), then this becomes an event study design, i.e.,

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[24] The possibility for a group of voters to affect the outcome even if they have less than 50% of the total votes makes it problematic to use a regression-discontinuity design since there is no theoretical or practical reason why there should be a discontinuity in the political power at 50% of the vote shares.

(4) $$Y_{it}=\alpha_i + \lambda_t + \beta_{t+1}X_{i,t+1} + \beta_t X_{it} + \beta_{t-1}X_{i,t-1} + v_{it},$$

where we have added one lead term, $X_{i,t+1}$, and one lag term, $X_{i,t-1}$. With equation (4), it is possible to test whether a DiD design is valid since there should be no effect before the treatment (event), X_{it}, occurs, i.e., $\beta_{t+1}=0$, which is also known as a test of "parallel trends". Moreover, equation (4) shows whether there is a dynamic effect of the treatment, i.e., $\beta_{t-1}\neq0$, since the cumulative effect of the treatment is $\beta_t + \beta_{t-1}$.

It is also possible to re-specify equation (4) and directly estimate the cumulative dynamic effects of the treatment, i.e.,

(5) $$Y_{it}=\alpha_i + \lambda_t + \pi_1\Delta X_{i,t+1} + \pi_2\Delta X_{it} + \pi_3 X_{i,t-1} + v_{it},$$

where Δ denotes a first-difference transformation of X_{it}, i.e., $\Delta X_{it}=X_{it}-X_{i,t-1}$. π_1, π_2 and π_3 are the cumulative effects of the treatment, i.e., $\pi_1=\beta_{t+1}$, $\pi_2=\beta_{t+1}+\beta_t$, and $\pi_3=\beta_{t+1}+\beta_t+\beta_{t+1}$. Naturally, it is possibly to add more leads and lags to equations (4) and (5). However, we would then lose one year of data for every lead and lag we added. Thus, we need to restrict the number of leads and lags. Nonetheless, we will show the results from specifications with up to 7 leads and 7 lags since we have a maximum of 28 years of data.

Moreover, we estimate a long DiD specification in order to test whether we have correctly estimated the long-run dynamic cumulative effect (i.e., π_3) in equation (5). Specifically, we estimate the difference between the first year we have data on the weighted voting system, 1872, and the last year, 1908, i.e.,

(6) $$Y_{i,1908} - Y_{i,1872} = \delta_0 + \delta_1(X_{i,1908} - X_{i,1872}) + v_{i,1908} - v_{i,1872},$$

and compare the estimate of π_3 in equation (5) with δ_1 since they should be of similar magnitude if the dynamics of the treatment effect are correctly specified in equations (4) and (5).

4. Results

In this section, we report the results of our empirical design. Section 4.1 reports the results from the main specifications, while Section 4.2 and Section 4.3 report the results from two important extensions.

4.1 Main results

We start by displaying the result from a standard DiD specification, i.e., equation (3). Column 1 in Table 2 shows this result. The estimated effect is 0.26, which means that per capita school spending is 26% higher in local governments where industrialists have all the political power, i.e., $X_{it}=1$, compared to local governments where landowners hold all the power, i.e., $X_{it}=0$.

Turning to the event study design, Column 1 in Table 3 shows the results from the dynamic treatment effect specification, i.e., equation 4, while Column 2 presents the corresponding cumulative treatment effects specification. Both specifications include 7 leads and 5 lags. Most importantly, both specifications strongly suggest that there are no pre-trends in the outcome before the treatment occurs in period 0. Indeed, all 7 leads in the dynamic treatment effect in Column 1 are very small and not statically different from zero. Moreover, Column 1 in Table 3 also shows that a joint F-test according to which all 7 pretreatment effects are zero is not rejected. The cumulative treatment effects specification in Column 2 corroborates these results since the cumulative effects are very small and not significantly different from zero before period 0.

To graphically illustrate the results from our event study design, Figure 6 displays the estimates from the cumulative dynamic specification in Column 2 together with 95% confidence intervals. Figure 6 reveals that the cumulative effects before the treatment occurs in period 0 are all close to zero, which again lends strong support that the parallel trend assumption is likely to be valid. Equally important, Figure 6 also reveals a sharp change in the treatment effect, from 0 to 0.14, exactly when the treatment occurs in period 0. Then, there is an increase in the cumulative treatment effect over 4 years, where the estimated long-run cumulative effect is 0.27.

We next impose the restriction that all leads are zero and estimate the cumulative treatment effect specification with different lag lengths to test whether the long-run cumulative treatment effect is correctly estimated. Table 4 displays the results from specifications with five (column 1), six (Column 2), and seven (Column 3) lags. The estimates of the long-run cumulative treatment effect are 0.35, 0,37, and 0.37, suggesting that six lags are sufficient to capture the long-run effect.

To further investigate whether the long-run cumulative effect is correctly estimated, we estimate a long difference specification, i.e., equation (6). Table 5 shows this result. The estimated effect is 0.37. This again suggests that a specification with 6 lags is enough to estimate the long-run treatment effect correctly.

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4.1 Variation in the treatment effect

In this subsection, we report results where we relax the common treatment effect and investigate how the treatment effect varies with the political strength of the industrialists, or their share of the votes. In other words, we estimate a dose-response relationship of the treatment variable X_{it}. Specifically, we estimate 10 different treatments, each within equally spaced intervals of 10 percentage points of the treatment variable. That is, we estimate one treatment effect when values of X_{it} belong to the interval [0, 10%), another treatment effect when values of X_{it} belong to the interval [10%, 20%), and so forth. In so doing, we need to create 10 mutually exclusive indicator variables and interact them with the treatment variable. Thus, we estimate the following modified DiD specification:

$$(7) \quad Y_{it} = \alpha_i + \lambda_t + \beta_1\{X_{it} \times 1[X_{it} < 0.1]\} + \beta_2\{X_{it} \times 1[0.1 \leq X_{it} < 0.2]\} + \ldots + \beta_{10}\{X_{it} \times 1[X_{it} > 0.9]\} + v_{it},$$

where β_1, β_2, …, β_{10} are the 10 different treatment effects and 1[.] is an indicator function.

Column 1 in Table 6 reports the results from this regression. It shows that the estimated treatment effects are *monotonically* increasing in the power of the industrialists when the industrialists have more than 40% of the votes, while they have no or little effect on school spending if the industrialists have less than 40% of the votes. Indeed, Column 1 shows a joint *F*-test of whether the absence of treatment effects below 40% can be rejected. Column 2 shows the results when we impose this restriction. It reveals that the treatment effects estimates are 0.05, 0.12, 0.17, 0.20, 0.30, and 0.39.

It is noteworthy that the industrialists have an effect, albeit a small one of 5%, even if they have slightly less than 50% of the votes in the weighted voting system. Thus, this shows why an RD design, which uses the threshold of 50%, is not applicable in the Swedish weighted voting system.

4.2 Inequality of landownership

It has been argued that inequality in the distribution of landownership affects investments in human capital and education negatively since there is conflict of interest between the entrenched landed elite and the emerging capitalist elite (e.g., Banerjee and Iyer 2005, Engerman and Sokoloff 1997, Galor et al. 2009). However, in the Swedish historical setting, the entrenched landed elite did not consist only of landed aristocracy, as in most other European countries at that time, since all types of landowners, even small ones, had political rights (at both the central and local levels), as discussed previously. Moreover, both large and small

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landowners relied on the supply of cheap labor provided by the Master and Servant Act and the corvée requirements.

To test whether inequality in the distribution of landownership matters for school spending, we need to have a measure of inequality that is determined before the weighted voting system to avoid endogenous sample selection issues. We use the distribution of the assessed value of agricultural property compiled by Wohlin (1912).[25] He classifies a local government where a landowner has at least 10% of the total agricultural property value as being dominated by large landowners. There are 1,234 such local governments out of a total of 2,191 in our data. Consequently, there are 957 local governments with smaller landowners.

Table 7 presents the results from DiD and long-difference specifications. Panel A shows the results for local governments with large landowners, while Panel B displays the results for local governments with small landowners. The estimated treatment effects from the DiD specifications are 0.23 and 0.29 for local governments with large and small landowners, respectively. Thus, the effect is somewhat larger for local governments with small landowners. We also find a similar result in the long-difference specification; i.e., the effect is 0.35 for large landowners and 0.41 for small landowners. Consequently, our setting does not suggest that a larger concentration of landownership negatively affects school spending.

5. Conclusion

In this paper, we analyzed the effect of a weighted voting system, which was in place between 1863 and 1908, on primary school spending at the local level. The weighted voting system changed the distribution of political power from landowners to industrialists at town meetings since all taxpayers, including industrialists, received votes in proportion to the taxes paid.

Using annual panel data from approximately 2,200 local governments over 28 years, we show that when industrialists gain more votes at these town meetings, they also start spending much more on education. Using an event study design, we can also show that there is no pre-trend in educational spending seven years before the treatment occurs, while there is an immediately noticeable treatment effect of 13%, which increases to 37% within six years. Thus, local governments where industrialists control all the votes spend 37% more on primary education than local governments where landowners have all the votes. We also find a larger treatment effect when the political power of the industrialists is greater. Perhaps surprisingly,

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[25] Wohlin uses data from 1865 but this data is identical to the data from 1862 since there was no change in the assessment of agricultural property between these years.

and in contrast to other studies, the size of the treatment effect does not seem to depend on the inequality of landownership.

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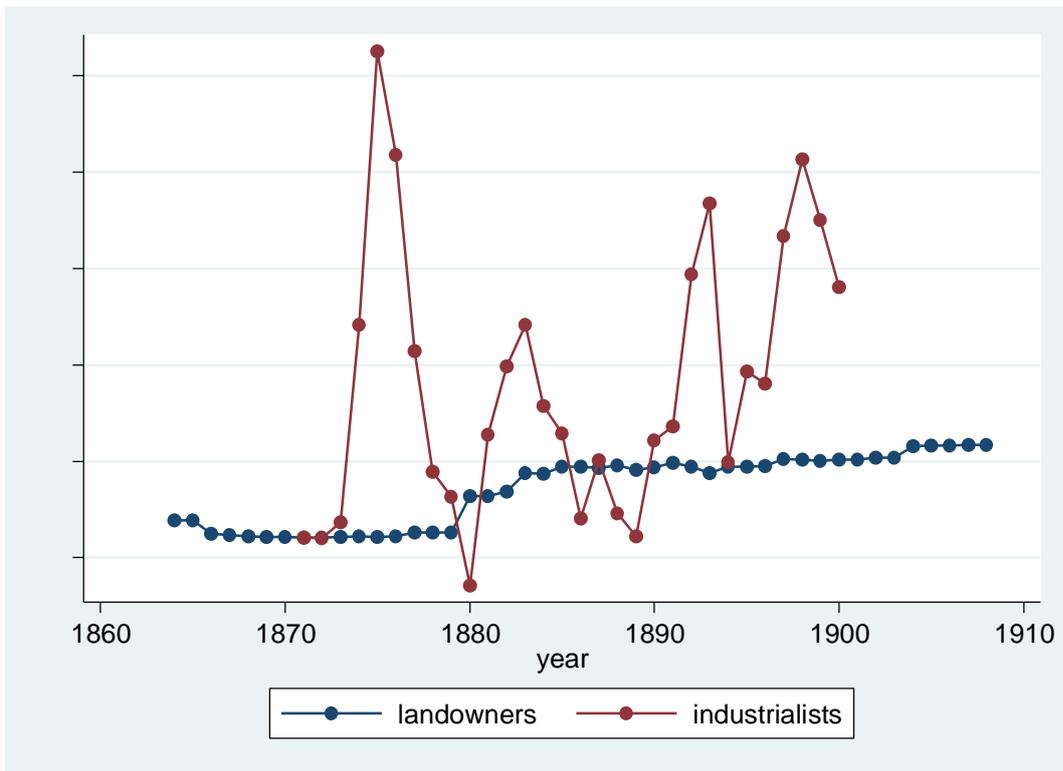Figure 1. Number of votes in the local government of Ytterlännäs

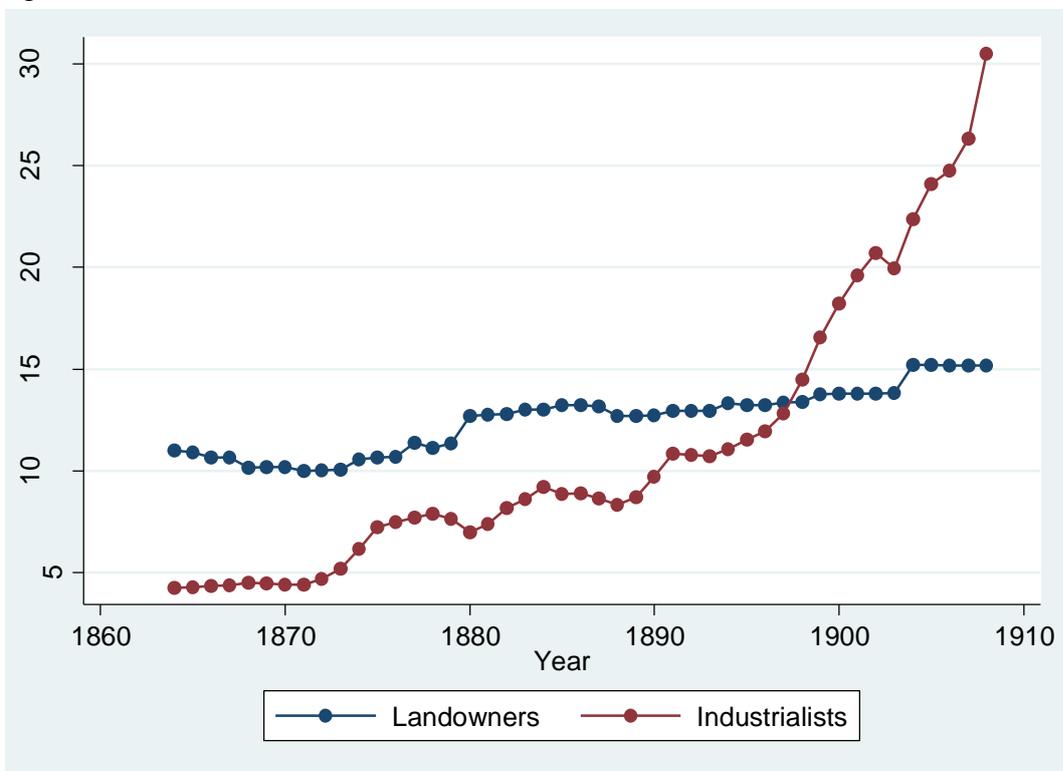Figure 2. Total number of votes (million)

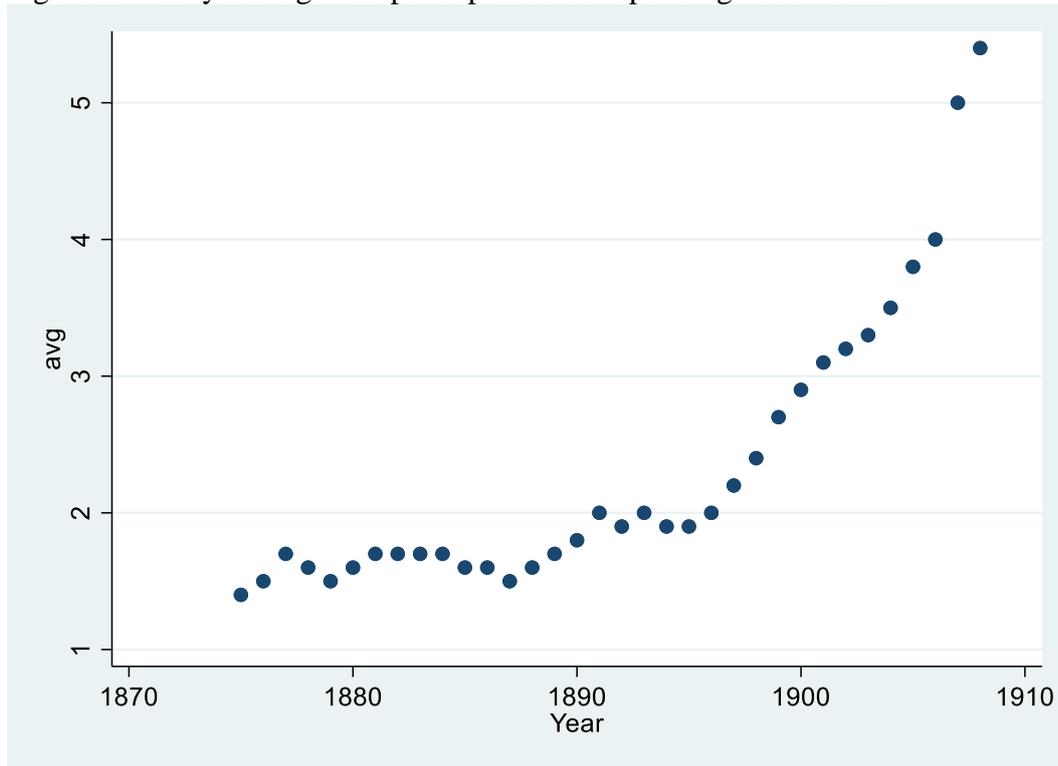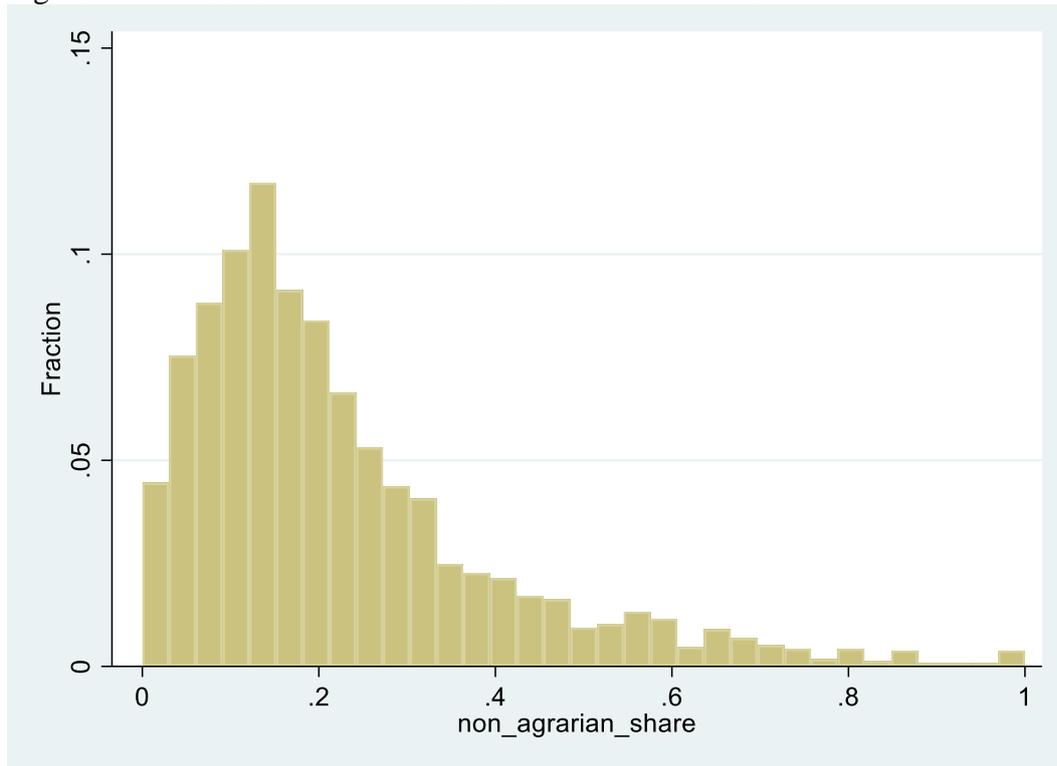Figure 3. Yearly average real per capita school spending 1875-1908.

Figure 4. Distribution of vote shares for industrialists in 1872

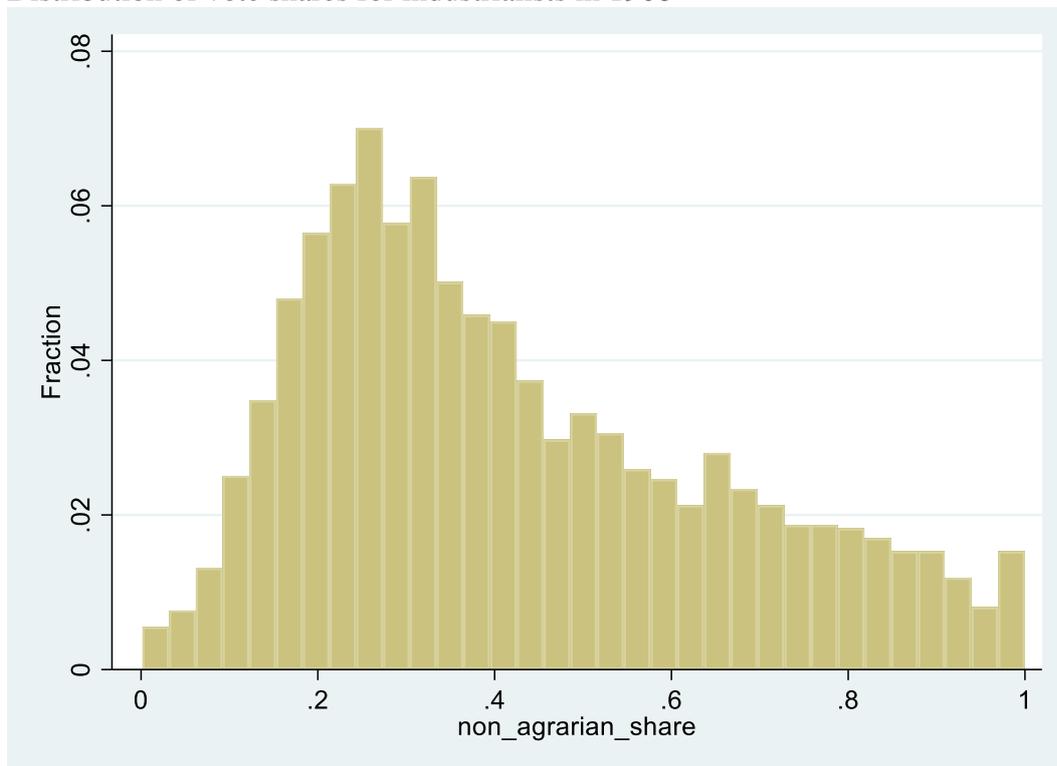Distribution of vote shares for industrialists in 1908

Figure 6. Dynamic cumulative effects: 7 leads and 4 lags
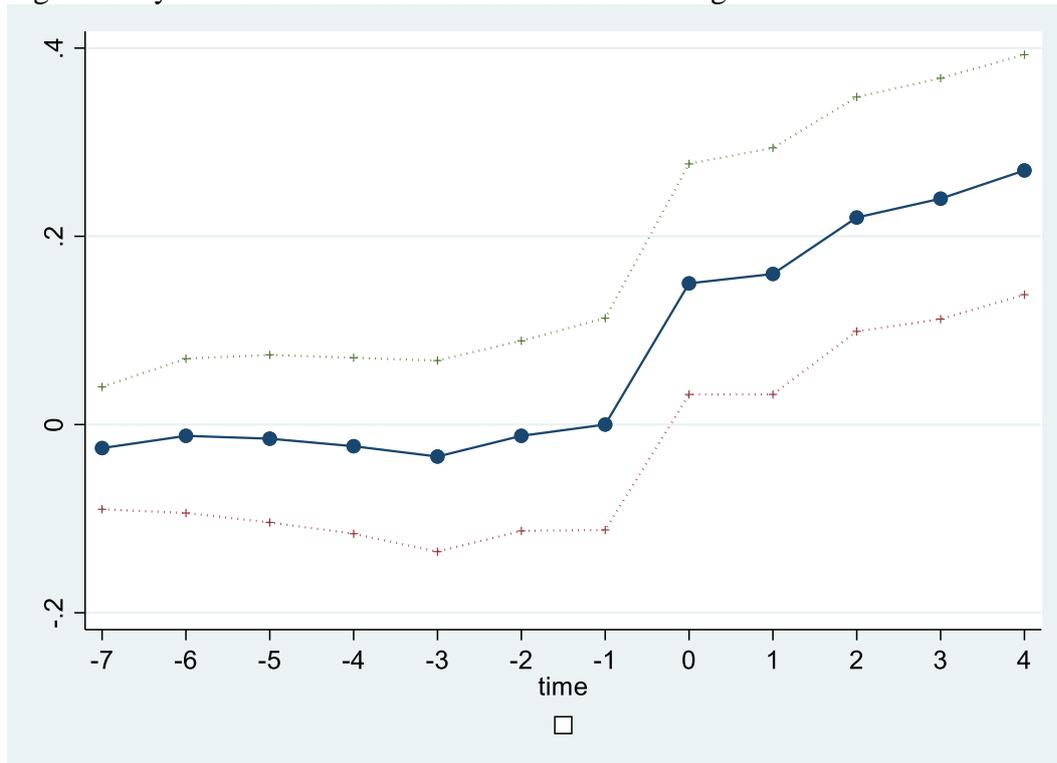
Table 1. Summary statistics

	Mean	St. Dev.	Observations
Real per capita school spending	2.50	2.11	61,042
Potential political power of industrialists: share of votes of industrialists	0.31	0.22	65,309

Notes: These data consist of 2,361 local governments for the period 1881-1908.

Table 2. Estimates from a standard DiD

	Treatment effect
Potential political power of industrialists	0.26
	(0.04)
Number of observations	59,526

Notes: The dependent variable is the log of per capita spending on primary education. The potential political power of industrialists is the vote share of all non-agrarian voters. The standard errors are clustered at the local government level.

Table 3. Dynamic and cumulative treatment effects

Lead (negative) and lag (positive) number	Dynamic treatment effects	Cumulative treatment effects
-7	-0.02	-0.02
	(0.03)	(0.03)
-6	-0.00	-0.02
	(0.04)	(0.04)
-5	0.03	0.00
	(0.04)	(0.05)
-4	-0.02	-0.02
	(0.04)	(0.05)
-3	-0.01	-0.02
	(0.04)	(0.05)
-2	0.01	-0.01
	(0.04)	(0.05)
-1	0.01	-0.01
	(0.04)	(0.06)
0	0.14	0.13
	(0.04)	(0.06)
1	0.01	0.14
	(0.05)	(0.07)
2	0.07	0.21
	(0.04)	(0.07)
3	0.03	0.24
	(0.04)	(0.07)
4	-0.00	0.24
	(0.04)	(0.07)
5	0.03	0.27
	(0.04)	(0.07)
F-test: all leads=0	$F_{(7, 2150)} = 0.15$	
	$\text{Prob} > F = 0.99$	
F-test: all lags + impact effect =0	$F_{(6, 2150)} = 4.22$	
	$\text{Prob} > F = 0.0003$	
Number of observations	38,090	38,090

Notes: The dependent variable is the log of per capita spending on primary education. The potential political power of industrialists is the vote share of all non-agrarian voters. The standard errors are clustered at the local government level.

Table 4. Cumulative treatment effects: different lag lengths

Lag number	(1)	(2)	(3)
0	0.14	0.14	0.14
	(0.04)	(0.04)	(0.05)
1	0.14	0.14	0.14
	(0.05)	(0.05)	(0.05)
2	0.21	0.20	0.19
	(0.05)	(0.05)	(0.06)
3	0.24	0.25	0.24
	(0.06)	(0.06)	(0.06)
4	0.23	0.22	0.23
	(0.05)	(0.06)	(0.06)
5	0.35	0.25	0.23
	(0.05)	(0.06)	(0.06)
6		0.37	0.30
		(0.05)	(0.06)
7			0.37
			(0.06)
Number of observations	48,992	46,792	44,564

Notes: The dependent variable is the log of per capita spending on primary education. The potential political power of industrialists is the vote share of all non-agrarian voters. The standard errors are clustered at the local government level.

Table 5. Long-difference specification

	Treatment effect
Potential political power of industrialists	0.37
	(0.08)
Number of observations	2,007

Notes: The dependent variable is the log of per capita spending on primary education. The potential political power of industrialists is the vote share of all non-agrarian voters. The standard errors are clustered at the local government level.

Table 6. Heterogeneity in the treatment effect

Potential political power of industrialists	(1)	(2)
0-10%	0.20	
	(0.14)	
10-20%	0.05	
	(0.08)	
20-30%	0.02	
	(0.06)	
30-40%	0.01	
	(0.05)	
40-50%	0.06	0.05
	(0.05)	(0.02)
50-60%	0.13	0.12
	(0.04)	(0.02)
60-70%	0.18	0.17
	(0.04)	(0.03)
70-80%	0.21	0.20
	(0.04)	(0.03)
80-90%	0.30	0.30
	(0.04)	(0.04)
90-100%	0.39	0.39
	(0.05)	(0.05)
F-test: all the treatment effects<40% =0	$F(4, 2190) = 0.73$	
	$Prob > F = 0.5716$	
Number of observations	59,526	59,526

Notes: The dependent variable is the log of per capita spending on primary education. The potential political power of industrialists is the vote share of all non-agrarian voters. The standard errors are clustered at the local government level.

Table 7. Inequality in landownership

	DiD (1)	Long DiD (2)
Panel A: Large inequality in landownership		
Potential political power of industrialists	0.23	0.35
	(0.04)	(0.10)
Number of observations	33,693	1,148
Panel B: Small inequality in landownership		
	0.29	0.41
	(0.06)	(0.11)
Number of observations	25,833	859

Notes: The dependent variable is the log of per capita spending on primary education. The potential political power of industrialists is the vote share of all non-agrarian voters. The standard errors are clustered at the local government level.