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ABSTRACT

Proportional Representation, Political Responsiveness and Child Mortality*

There has been a longstanding debate about the link between political representation and health. In this article, I provide novel evidence that electoral reforms that shifted from a majoritarian to a proportional system of voter representation generated substantive health benefits for the general population. Using the exemplary case of Switzerland, I first show that the spread of proportional representation between 1890 and 1950 increased political participation and gave the working class, represented by left-wing parties, greater weight in the political process. Consistent with theories of the electoral system, proportional representation increased public investments, esp. in basic education, with few effects on redistribution or total spending. Based on comprehensive archival mortality statistics since 1890, I then demonstrate that the observed shifts in representation and public finances were associated with substantial declines in child mortality by 15% and in mortality from infectious diseases, the major killer of the time, by 10-15%.

JEL Classification: N33, N34, I14, H51, D72

Keywords: electoral system, proportional representation, mortality, health, Switzerland

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1. Introduction

Electoral systems typically fall into two broad categories: majoritarian or proportional systems. In majoritarian elections – like in the United States or the United Kingdom – members of parliament are elected in single-member districts with plurality voting. In proportional elections – like in the Netherlands, Spain and other countries – candidates from party lists compete for votes in multi-member districts, and seats are allocated according to vote shares.¹

Economic theory suggests at least two explanations why the electoral system affects policy-making. The first channel works through the electoral incentives of *all* candidates (Lizzeri and Persico, 2001; Milesi-Ferretti et al., 2002; Persson and Tabellini, 2003; 2004). Candidates running in a plurality system maximize the majority in their local district (winner-takes-all or first-past-the-post system). Hence, they favor policies, like local public goods, that can be targeted at their local clientele. Candidates in a proportional system, in turn, maximize voter support in a few, large districts, and hence, support policies that appeal to broad social groups like providing general public goods or broad redistributive programs.²

The second reason electoral rules affect policy-making is because they influence political participation and the composition of parliaments. Scholars in comparative politics have long pointed out that turnout is higher in a proportional system (see, e.g., Powell, 1980; Lijphart, 1997). Under proportional representation, previous non-voters, but also non-marginal voters, e.g., geographically dispersed groups may increase their representation in parliament. The additional political weight of disadvantaged groups may be a crucial prerequisite for public policies catering to their interests and needs (see, e.g., Meltzer and Richard, 1981; Acemoglu et al., 2015).³

Very little is known, however, whether the broader population benefits from such shifts in electoral incentives and political representation under a proportional system – or, whether there is no gain or even a net loss as some groups benefit at the expense of others. This question is closely related to the broader discussion on the nature of conflict between the elite and the general

¹ Electoral systems may vary in other dimensions across countries (see, e.g., Cox, 1997 for a detailed discussion).

² In a standard model of electoral competition, candidates in both electoral systems would choose the same policy if they engaged in pure redistribution (Lindbeck and Weibull, 1987). This prediction no longer holds if candidates choose both public goods and targetable transfers instead. Then, candidates in a majoritarian system are more likely to tax minorities and to target benefits (in order to secure a majority of voters) than politicians under a proportional system, esp. when the public good is valuable to voters (Lizzeri and Persico, 2001).

³ The models typically rely on plurality voting, which reflects the fact that enfranchisement preceded the debate about alternative forms of political representation in most countries.

population in theories of nineteenth century democratization and enfranchisement (see Acemoglu and Robertson, 2000; Aidt and Franck, 2015; Lizzeri and Persico, 2004).

A major shift in political representation occurred between 1890 and 1950 when parliaments in many countries switched from a majoritarian to a proportional system. The first country to adopt a proportional system at the national level was Belgium in 1900 with many European nations following suit over the next decades - like Germany in 1919 or France in 1945. Analysts of these broad constitutional reforms, however, face the challenge that electoral systems typically vary across countries only, which makes it difficult to separate the causal effect of political representation from other institutional or cultural differences across countries.

This paper uses the exemplary case of Switzerland, which offers the rare opportunity to study the political and broader social consequences of constitutional reform. Its federalist structure enables sub-national governments to choose their electoral system for parliamentary elections. In 1890, all Swiss states, like all democracies around the world, had a plurality system in place. Between 1890 and 1950, eighteen of the twenty-five states (“cantons”) switched to proportional representation – just like many European countries. I can therefore exploit rare within-country variation in electoral systems as some cantons adopted a proportional system, while others did not, and some cantons switched to a proportional system earlier than other cantons. Using the staggered introduction of proportional rule within a country has the virtue that it reduces problems of unquantifiable historical, cultural and institutional differences between countries that often plague cross-country studies.

Based on the sequential adoption of proportional representation, I investigate whether the electorate in adopting cantons benefitted faster from the late nineteenth century breakthroughs of the bacteriological revolution. While the scientific discoveries made by Robert Koch, Louis Pasteur and others revolutionized the knowledge about disease transmission, it took several decades before the general population enjoyed these benefits. Paramount for health improvements was the dissemination of basic knowledge about body hygiene, living conditions, food preparation, milk stations and breastfeeding (Gubéran, 1980; Heller, 1979; Mesmer, 1982). In Switzerland, an important transmission channel was the educational system, where schools, in collaboration with local physicians and the health office, could monitor children’s health and support disadvantaged children through school meals (Hofmann, 2016; Ruckstuhl and Ryter, 2017). Furthermore, school curricula could teach basic principles of body, food and household hygiene, especially in specific household classes for young women in school (Heller, 1979; Mantovani Vögeli, 1998). Most importantly perhaps, child labor, which was especially widespread in agriculture, decreased as some cantonal

governments intensified efforts to increase enrolment and attendance rates (Gruner, 1987). With the switch to proportional representation, cantonal governments speeded up and expanded investments in primary and secondary education thus raising enrolment, teaching basic hygiene and monitoring child health.

A major difficulty lies in establishing a causal link between the staggered adoption of proportional representation and observed improvements in population health. A first concern is reverse causality as health conditions or the underlying social and economic plight might have fueled the quest for electoral reform. A second concern is that both electoral reform and population health could be the consequences of some unobservable factor, like a rising demand for government following urbanization or industrialization, for instance. To address the first concern, I first show below that none of the main outcomes of interest can predict electoral reform. Instead, the historical literature suggests certain political constellations, especially the political fragmentation existing under the old majoritarian system, as relevant determinants of reform. Even if electoral reform per se is unrelated to past political participation, public spending and mortality, the time of adoption might still be endogenous. To mitigate these concerns, I provide additional evidence that the timing of electoral reform was unrelated to other political events and the canton's socio-economic makeup in 1890.

To tackle the concern of omitted variables, I rely on a difference-in-differences approach to estimate the causal effect of proportional representation. Canton fixed effects control for all time-invariant institutional or historical differences across cantons, while year fixed effects allow for arbitrary aggregate trends in the outcome variables over time. I further include canton-specific trends to absorb any broad shifts in public spending and mortality that are specific to a canton over this period. The causal interpretation of any difference-in-differences strategy relies on the assumption that in the absence of electoral reform, the evolution of policy or health outcomes would have been similar independent of electoral reform or its timing. I provide supporting evidence that political and health outcomes change shortly after the first election under proportional rule. To bolster my findings, I use information on failed reform attempts by the government or the electorate to show that it is only the actual electoral reform that shifts policy or health outcomes and not some unobserved canton-level shock that jointly determines reform movements and changes in mortality. Finally, I show that the main results are robust to controlling for voter preferences, migration, school enrolment or the strength of direct democratic institutions in a canton.

My empirical investigation relies on new archival records from Swiss cantons between 1890 and 1950. The Swiss Statistical Office has collected comprehensive deaths by cause statistics that report mortality by age, sex and detailed cause for each canton over time. For the analysis, I have digitized the handwritten records for each canton, year and gender by age groups and by detailed causes. The result is a comprehensive database of canton-level mortality data over a 60-year period. I combine these mortality statistics with public finance statistics obtained from the archives of each canton as well as published sources; with socio-demographic characteristics from the Population Census, among others, and with detailed information on each canton's political system, which I coded from cantonal constitutions.

The empirical analysis yields four main results. The switch to proportional representation in cantonal parliaments raised electoral turnout by about 14 percentage points. Electoral reform further shifted representation in the cantonal parliaments. Over the period analyzed, the workers' movement became an increasingly important social and political force in Switzerland and Europe in general. Under the old plurality system, left-wing parties won a few seats, but never achieved a sizable share or even majority of parliamentary seats (Degen, 2009b; Gruner, 1975). After the adoption of proportional representation, however, left-wing parties increased their political weight in cantonal parliaments gaining 10 additional seats on average.

The shift in political participation and representation under a proportional system had important implications for public spending: investments into primary and secondary education increased substantially as did investments in public health measures, though the latter effect is statistically noisy. In contrast, I find no evidence that poor relief increased between 1890 and 1950, which reflects the fact that the modern welfare state developed in Switzerland only after 1945. Furthermore, the total size of government or its vertical structure were unaffected by electoral reform. Supplementary evidence on voter preferences indicate no change in the overall demand for government indicating that electoral reform encouraged a mere shift in public spending toward public goods and services without expanding the overall size of government.

I then establish that this reorientation of public policy carried substantial health benefits for the general population: the death rate from infectious diseases, the major killer of the time, decreased by 9.7 percentage points; the decline was with 14.5 percentage points even stronger for those infections affecting children disproportionately. Reductions in mortality were especially pronounced for meningitis (19 percent), infant diarrhea (15 percent) and urogenital tuberculosis (10 percent).

These reductions in child mortality and in the burden from infectious diseases contributed between 11 and 17 percent to the overall mortality decline between 1890 and 1950 as Switzerland underwent its epidemiological transition.⁴ In contrast, I find no effect for other causes of deaths (like cancer or suicide) which should be largely unaffected by public health and sanitation measures during this time. Finally, I show that the health benefits were larger in cantons with traditionally low enrolment in compulsory education. A large number of robustness checks and informal validity tests bolster the paper's main empirical findings.

The article proceeds as follows. The next section positions the article within the existing literature. Section 3 discusses the historical background and investigates the determinants of adopting proportional representation in Swiss cantons. Section 4 introduces the archival data sources and discusses the empirical strategy. Section 5 presents and discusses the results on political participation and representation, public spending and mortality by age, sex and cause. Section 6 reports a number of additional validity tests to bolster the main findings. Finally, Section 7 discusses the implications of the findings and concludes.

2. Related Literature

The analysis in this article contributes to two different literatures. A recent literature has analyzed the consequences of electoral systems for politicians' behavior and public finances (Aidt et al., 2006; Funk and Gathmann, 2013; Gagliarducci et al., 2011; Milesi-Ferretti et al., 2002; Persson and Tabellini, 2003; 2004).⁵ Using variation in electoral systems both across countries and at the subnational level, several of these studies provide empirical support for the hypothesis that representatives elected under a proportional system spend more on public goods that benefit broad groups in society. In contrast, parliaments elected in a majoritarian system are more likely to support expenditures that may be targeted geographically.⁶ The broader question whether the observed shifts

⁴ In 1880, one out of five children born in Switzerland died before their first birthday. By 1910, infant mortality was halved and by 1945, it had declined to one out of 40 children dying under the age of one (Floris et al., 2018). Overall life expectancy in turn increased from around 40 years in 1880 to 63 years in 1945 (Chesnais, 1986). Much of this decline is explained by reductions in infectious diseases during the Swiss epidemiological transition (Lorenzetti and Perrenoud, 1999; Lorenzetti and Meffre, 2005).

⁵ Besley and Preston (2007), in turn, demonstrate that electoral incentives also vary within majoritarian systems and affect public spending behavior. They show that districting, which produces more electoral bias in favor of core supporters (relative to swing voters), leads to spending tilted in favor of core supporters.

⁶ Gagliarducci et al. (2011) show that politicians elected under a majoritarian system behave systematically different from representatives elected under proportional rule: they propose more bills and seem to have higher attendance rates when the parliament is in session. For Switzerland, Hug and Martin (2012) also find that MPs represent different policy positions in the population if elected under a majoritarian rather than a proportional system.

in public spending improve the well-being of the electorate at large; benefit some population groups at the expense of others; or just waste public resources has not been investigated. Higher spending on broad goods in a proportional system might benefit the electorate if the marginal value of the broad good is large compared to the marginal value of the targetable benefits preferred by policy-makers in a majoritarian system (Lizzeri and Persico, 2001). Yet, better political representation or participation of disadvantaged groups in a proportional system might just redistribute resources from richer to poorer groups with little net benefit for the population at large (Austen-Smith, 2000; Iversen and Sostice, 2006); or even waste public resources through patronage or corruption (Persson and Tabellini, 2003). This study provides the first quantitative evidence that proportional representation carried sizable health benefits for the broader population.

More generally, I shed light on the link between political representation and fiscal policy or health outcomes.⁷ Here, this study is most closely related to improving the political representation of underrepresented groups like racial minorities (Cascio and Washington, 2014; Husted and Kenny, 1997; and Naidu, 2012) or the poor (Fujiwara, 2015; Hinnerich and Pettersson-Lidbom, 2014). All these analyses exploit contemporaneous, within-country variation in legal mandates or voting technology that improved the political representation of certain groups.⁸ Instead, I investigate the effects of a general constitutional reform of the electoral system that applied to all voters within a historical context. My work is also connected to the analysis of nationwide enfranchisement episodes (Acemoglu and Robinson, 2000; Aidt and Jensen, 2013) and the enfranchisement of women (Lott and Kenny, 1999; Miller, 2008 for the U.S.; Aidt et al., 2006 for Europe). Both changes in political representation seemed to have raised redistribution and encouraged investments in education and public health (Lindert, 2004). The article most closely related is by Miller (2008) who shows that the enfranchisement of women carried sizable health benefits for young children. My analysis also shows a close connection between actual political representation and health, but complements these findings by studying a major reform in the electoral system rather than an extension of the franchise.

3. Background

⁷ A long-standing debate centers on the question whether democratic regimes improve population health (see, e.g., Besley and Kudamatsu, 2006; Kudamatsu, 2012; or Pieters et al., 2016).

⁸ Some recent examples of legal changes to improve political responsiveness for (all or some) voters in a developing context are elections (Martinez-Bravo et al., 2014); participation in budgeting (Besley et al., 2005); or plebiscites (Olken, 2010).

Switzerland provides an ideal setting to study the consequences of adopting proportional representation. Its strong federalism implies that all political rights and responsibilities remain with the canton, unless a specific right or responsibility was ceded to the federal government in a referendum. As a result, cantonal governments have a lot of fiscal autonomy to provide public goods or redistribute wealth: they are mainly responsible for education and security, while sharing responsibility with local governments in the area of poor relief, health and sanitation. Cantons also have their own sources of revenue, most importantly the cantonal income tax, which generates more revenues than the federal income tax. Federal subsidies and other federal transfers, in contrast, account for only a small share of canton revenues.

Even more importantly, Switzerland is a rare case where subnational governments can choose their electoral system for parliament. Before 1890, all cantons, like all democratic countries in Europe and elsewhere, had a majoritarian system in place. Between 1890 and 1950, eighteen out of the twenty-five cantons switched to proportional representation. I first outline the political and economic conditions that brought electoral reform on the political agenda (in Section 3.1). Then, I discuss the determinants of electoral reform and its timing (in Section 3.2); and how these changes in political representation refocused efforts in public education and public health (Section 3.3).

3.1 The Roots of Political Conflict: Fractionalization and Industrialization

Switzerland's population has long been divided along linguistic lines between the German-, French- and Italian-speaking population and, since the Reformation, along religious lines between Catholics and Protestants. The religious split in particular resulted in several violent clashes, most importantly during the war in 1847 (*Sonderbundskrieg*) and the cultural conflict (*Kulturkampf*) of the 1870s.⁹ In the political arena, this rift was mirrored in the long-lasting struggle between conservative forces supported by the Catholic population and the liberal-radical movement backed by the Protestants. Only in very few cantons was one party – either the Conservatives or the Radicals – able to secure political dominance over an extended period. In most cantons, the political majority alternated between the liberal and conservative factions resulting in only temporary coalitions. Industrialization and its sweeping changes of the workplace and family life added a new dimension to existing conflicts. Leading industries (textiles, railways and electro-technics) first developed in a

⁹ While the conflict in 1847 largely took place between politically conservative Catholic and radical-liberal cantons, there were also violent conflicts between the two groups within some cantons, e.g., in *Fribourg*, *Lucerne*, *Valais* and *Zug*. The cultural conflict of the 1870s in turn took place between the Catholic Church and the public authorities over the educational privileges and responsibilities of the Catholic Church.

few, mostly rural areas in Switzerland in the first half of the nineteenth century. During its second half, industrialization diffused nationwide and became increasingly concentrated in the urban centers, while shifting large shares of the population out of agriculture into manufacturing. A by-product of the diffusion of industrialization was the emergence of social deprivation ranging from dangerous workplaces with exhausting working conditions to overcrowded living quarters with horrific hygiene conditions (Degen, 2010).

In response to the pressing needs of the growing working class, occupation-specific associations (called *Hilfsvereine*) were founded to provide financial support for its members and their families in case the male breadwinner became ill or disabled. Broadly based voluntary associations for workers, the so-called *Grütlivereine*, first emerged in *Geneva* in 1838 and quickly developed into a national organization in 1843. The movement's main goal was improved and free access to education (including school lunches), but it also pushed for state support in case of illness or disability of the main breadwinner (Degen, 2009a).

It was not until the second half of the nineteenth century, however, that workers became politically organized: the Social Democratic Party was first founded at the canton level in 1850 and at the national level in 1888; it won its first seat in national parliament only in 1890 (Degen, 2009b). Historians have attributed the delayed political organization of the working class to three factors: first, workers were more dispersed geographically than in other countries. In addition, cheap foreign labor reduced the pressure unions and other organizations could exert on employers (Gruner, 1975). Most importantly, male workers had already obtained many of the political rights their counterparts in other European countries still had to achieve: Universal male suffrage had been introduced in 1848 and freedom of assembly was guaranteed in the federal constitution of 1874. Moreover, men could affect policies through voting in referendums or launching an initiative (Gruner, 1975).¹⁰ Yet, even after the Social Democratic Party and other workers' organizations entered the political arena, their political success remained limited under the majoritarian system: left-wing candidates were rarely able to secure a majority of district votes; and even if they did, they never achieved a majority of seats under the old system (Gruner, 1977; 1988).

In a climate of unstable majorities between two parties and emerging political conflicts with the workers' movement, the new system of proportional representation promised a more stable political environment while accommodating the divergent political interests in a canton. The

¹⁰ Female suffrage, in contrast, was adopted in the cantons between 1959 and 1990 and hence, after our sample period.

majoritarian system came also under scrutiny by contemporaries because ruling parties manipulated voting registers to secure their vulnerable political positions (see Klöti, 1901; and Saripolos, 1899). Out-of-canton migrants, for example, were often not included in population counts, which in turn determine the number of seats per district – and discriminated against rapidly growing urban districts in favor of rural districts.¹¹

3.2 The Spread of Proportional Representation

Understanding the temporal pattern of electoral reforms is important to evaluate the validity of my empirical strategy. Figure 1 shows that adoption of proportional representation exhibits no obvious geographic pattern. The earliest adopting cantons (shown in dark blue) are spread across Switzerland as are the cantons that adopted after 1950 (shown in light blue). The cantons that kept their majoritarian system until today are located in Eastern Switzerland, but so is *Ticino*, the first canton to adopt a proportional system. Table A1 in the appendix shows in which year a canton first elected their parliament under proportional representation, and whether a canton uses a mixed proportional system or not (in column (2)).¹²

Historical accounts emphasize two factors that facilitated electoral reform (Gruner, 1977; 1988; Klöti, 1901; and Saripolos, 1899). In Switzerland, the electorate, if unsatisfied with parliamentary or party conflicts, could launch a constitutional initiative to put electoral reform on the political agenda. Column (3) of Table A1 shows that electorates in nine of the eighteen cantons adopting proportional representation before 1950 used such initiatives to push for electoral reform. Many initiatives failed initially; yet, the easier it was to put an initiative on the ballot, the more pressure the electorate could exert to break the resistance of political stakeholders.

The second set of factors discussed by historians was the distribution of power under the old system. Electoral reform seemed more likely in cantons that faced political deadlocks between two parties with comparable electoral support in the population. In the canton of *Ticino* (1891), for instance, plurality rule and fixed voting districts produced a more and more unequal distribution of seats in favor of one party, which led to violent clashes. The conflict escalated to the point where the federal government intervened and mandated proportional representation. In *Neuchâtel* (1895),

¹¹ Unlike present debates about plurality systems, gerrymandering, i.e. the manipulation of district boundaries by politicians was not an issue in the Swiss cantons at the time. The reason is that voting districts are tied to historical political units, especially communities and district boundaries (*Bezirke* or *Kreise*). Furthermore, the number and boundaries of voting districts are laid down in the cantonal constitutions; any changes therefore require approval by the electorate in a referendum.

¹² Detailed discussions of the Swiss electoral system can be found in Garrone (1991); or Lutz and Strohmann (1998).

plurality rule failed to generate a winning candidate even after multiple voting cycles, which made the formation of a functioning government impossible. In urban cantons with a sizable working class, like *Zurich*, *Basle City* or *Lucerne*, electoral reform was pushed on the political agenda by a coalition of emerging left-wing parties and existing minority parties, which hoped to gain political influence through electoral reform.

To investigate the determinants of adoption more systematically, I estimate fixed effects regressions where the dependent variable is whether a canton had a proportional system in place in a given year. The variable is zero until the first election takes place under proportional rule and equal to one after the first election. In the year of the first election, the dependent variable is equal to the share of the year proportional rule was in place in that year.¹³ All specifications include controls for population and its broad age structure, canton and year fixed effects as well as canton-specific trends. All other independent variables are lagged three years to account for political decision-making and the time lag between passing the electoral reform and the first election under the new system.

Table A2 in the appendix shows some support for the historical accounts: electoral reform is less likely if political power became fragmented in a canton as measured by the number of parties that canton elected into the national parliament (see column (1)). Having a dominant party, measured by the concentration of seats in the state legislature, also reduces the likelihood of electoral reform, as does a higher signature requirement for an initiative; yet both coefficients are only statistically significant (and of similar size) without canton-specific trends but lose significance otherwise.

An important concern is that broader social and economic changes predict electoral reform and public spending or mortality. I find no indication that electoral reform was more likely the more pronounced linguistic or religious fragmentation in the canton was (column (2)). Further, there is little support for the idea that electoral reform was related to the degree of urbanization and industrialization (column (3)) or higher educational investments in the past (column (4)). Likewise, past turnout (column (5)) or the strength of left-wing representation in federal elections before the reform cannot predict the adoption of a proportional system in the cantons (column (6)). Another threat to my empirical strategy could be that electoral reform is caused by public spending, mortality or their respective growth rates. Columns (7) to (12) investigate reverse causality, but fail to find any statistical support for this concern. The last column of Table A2 in the appendix includes all variables simultaneously. The picture remains unchanged: the dominance of a single party in the old

¹³ I obtain very similar results when I include a simple binary variable instead.

system is the only significant predictor of adopting a proportional system conditional on fixed effects and canton-specific trends.

Even if electoral reform per se is unrelated to past socio-economic conditions, previous political participation, spending and mortality patterns, the timing of reform might still be endogenous. That would pose a threat to my empirical strategy, which exploits both the occurrence and the timing of reforms for identification. Table A3 in the appendix tests whether the year of the first election under proportional representation is correlated with canton-level socio-economic characteristics at the beginning of the sample period in 1890. I find no meaningful correlations between the timing of electoral reform and a canton's size, religious and linguistic composition or fractionalization, its degree of urbanization or industrialization, living conditions and level of education. The only significant coefficient is between the number of secondary teachers and early adoption. The bottom part of Table A3 shows that the timing of adoption is unrelated to other major political events or reforms like the founding year of the Social Democratic Party, the adoption of direct elections for the executive or the introduction of mandatory health insurance at the cantonal level.

Only the correlation between the timing of adopting a mandatory budget referendum and electoral reform is statistically significant. I further show in the robustness section below that my results are robust to controlling for educational inputs and the strength of direct democratic institutions. Overall, there is little support for the notion that electoral reform or its timing in a canton can be accounted for by changes in underlying socio-economic conditions like industrialization or urbanization, or other confounding political reforms like public health insurance, for instance. I next discuss how electoral reform influenced public attention and measures to combat high mortality rates, esp. among young children.

3.3 Proportional Representation, Education and Public Health Efforts

Toward the end of the nineteenth century, the emerging social hygiene movement focused its attention on the strong correlation between social deprivation and the high prevalence of mortality. Most importantly, it no longer considered poverty and poor hygienic conditions as a moral problem of the individual but as a social problem that required attention by public authorities (Ruckstuhl and Ryter, 2017).

The most important transmission channel for the social hygiene movement was the educational system (Hofmann, 2016).¹⁴ Education has traditionally been a cantonal responsibility: cantons share with municipalities the responsibility for primary school (ranging between four and six years) and are the main provider for secondary education (adding four to eight years for a total of 12 years). Yet, child labor was still widespread, especially in agriculture, but also in the industrial production at home.¹⁵ As a result, many children did either not attend school or attended sporadically; and even if they went to school, the notorious long working hours combined with hard physical labor took their toll on children's health. The Federal Law on Primary Education (*Volksschulgesetz*) in 1874 mandated free, adequate primary education for all children. It was left to the cantons, however, to decide and execute educational curricula, staffing or organization of primary school and beyond (Ruckstuhl and Ryter, 2017). In the aftermath of the federal law of 1874, some cantons intensified their efforts in expanding enrolment, redefining curricula and imposing minimum educational and health standards in public schools (Crotti and Kellerhals, 2007; Mesmer, 1982). Others did little to increase enrolment or define common standards allowing any kind of educational instruction, including home schooling instead.¹⁶

Cantonal efforts to expand and enhance basic education played an important role for health improvements for three reasons. As more children were enrolled and attended school regularly, fewer children labored for long hours in the factories, at home or on the farms, which posed a serious threat to their long-run health and development. A second reason was that school physicians were installed who examined all schoolchildren in regular intervals (Hofmann, 2016). Supporting measures targeted children from poorer families through providing school meals or school showers, for instance (Heller, 1979). Together with an increase in enrolment, these measures allowed to monitor general population health and fence the spread of infectious diseases. Finally, schools and teachers were effective catalysts in bringing the basic rules of hygiene to the general population. Not only did children enjoy better hygienic conditions within the school; teachers, in collaboration with

¹⁴ Other factors, like access to clean water through sewage provisions, water filtration and chlorination, for instance, probably contributed to the mortality decline (see, e.g., Cutler and Miller, 2005; Ferrie and Troesken, 2008 for U.S. cities or Bhalotra et al., 2017 in developing countries today). In Switzerland, these public investments were concentrated in the large cities and preceded the adoption of the proportional system in most cantons (Floris and Staub, 2019; Hardegger, 1932).

¹⁵ The federal factory law (*Fabrikgesetz*) in 1877 prohibited children under 14 to work in factories, among others. Yet, the law only applied to factory work, while child labor in the home (e.g., in the tobacco industry) or on the farms was still allowed and widespread.

¹⁶ Schooling efforts intensified with the introduction of national tests for army recruits in reading, writing and math, which enabled for the first time a direct comparison of educational outcomes across cantons (Crotti and Kellerhals, 2007).

local authorities, physicians and the public health office, could educate children and young adults about healthy behaviors and hygiene measures in their daily life (Mesmer, 1982; Hofmann, 2016). Paramount for the diffusion of knowledge about hygiene was the education of young women and girls as they were in charge of the household and childcare. Cleanliness and fresh air was promoted as an effective measure to combat bacteria and other microorganisms in the home; hand and food washing were stressed to improve food hygiene. Popular transmitters of the principles of food, body and household hygiene were books on household economics and supporting brochures like the *Principes de hygiene* published by the Red Cross in 1924 as well as special household classes targeting at girls and young women (Heller, 1979; Mantovani Vögeli, 1998).

The social hygiene movement did not limit its attention and efforts to school-aged children and the educational system, however. A special focus was on the high infant mortality rates, with one child out of five births dying within the first year. The vast majority of infants and small children (70-80%) died from intestinal problems caused by contaminated milk or other food. It was known early on that child mortality was linked to poor socio-economic conditions. That link became even stronger as working-class women spent more time in factories and abandoned breastfeeding (Bickel, 1947; Ruckstuhl and Ryter, 2017). The quality of substitute milk from cows was often low because of insufficient cooling or dilution with contaminated water.

Cantonal authorities, especially through their sanitary departments, implemented milk stations to supply high-quality cow's milk to families and provided additional information about food and body hygiene in the form of leaflets and advice by midwives and nurses. These measures were supported by public campaigns to encourage breastfeeding among mothers and improve infant care (Heller, 1979; Ruckstuhl and Ryter, 2017). Many of these activities for promoting basic hygiene in the general population and improving child survival started as private or local initiatives – but became later coordinated and financed by cantonal authorities (see, e.g., Koller, 1995 for the canton of Basle City).¹⁷ Below, I provide systematic evidence that the switch to proportional representation was an important catalyst for improving hygienic conditions in daily life and hence, child survival. I now turn to a description of the data sources and empirical strategy.

¹⁷ Another area of concern were the catastrophic housing conditions of the poor in the city centers. Reports of cantonal committees describe the cramped spaces, poor air quality and filthy living quarters of the urban poor. While the conditions and their role in the transmission of diseases were well known, public authorities shied away from large-scale social housing programs and confined themselves to rules about poor housing and overcrowding (Ruckstuhl and Ryter, 2017). After adopting proportional representation in 1905, for example, *Basle City* passed a housing law (*Wohnungsgesetzgebung*) that laid down specific criteria for better housing conditions and how they should be enforced by the sanitary department (Koller, 1995).

4. Data Sources and Empirical Strategy

4.1 Data Sources

For a systematic analysis of the link between proportional representation, political power, public investments and mortality, I assemble a rich dataset for all Swiss cantons between 1890 and 1950 combining archival and secondary sources.¹⁸

To establish how reforms of the political system relate to health and child survival, state-level mortality data by cause, age and sex is required. I obtain the complete cause of death statistics from the archives of the Swiss Federal Statistical Office. I digitize the original, handwritten paper records to construct a new dataset on deaths by age and detailed causes for each canton and year between 1891 and 1950. As the original data include many cells with zero, I aggregate them into two separate datasets: a balanced panel of age-specific deaths for each canton and year on the one hand; and a balanced panel of cause-specific deaths for each canton and year on the other hand. The construction of consistent death-by-cause statistics face the familiar challenge of accounting for changes in the national and international classifications of diseases over time. I use the walkovers from the Swiss Federal Office of Statistics and the WHO to track easily identifiable diseases like measles and pox over the 60-year period.¹⁹ Descriptive Statistics on mortality rates by age and selected causes for the years 1890, 1920 and 1950 are shown in panel A and B of Table 1. Panel A shows the dramatic decline in infant mortality rates over our sample period: in 1890, 76 children per 1,000 births died before reaching the age of one; this rate had declined to around 16 in 1950. I observe similar drastic declines for slightly older age groups though starting from much lower levels.

To investigate the link between proportional representation and the size and composition of public spending, I collect detailed public finance statistics from cantonal archives and published sources. Specifically, I obtain data on total cantonal spending, federal subsidies and total local spending in a canton as well cantonal expenditures for public education, public health, administration, social welfare and poor relief. Public health spending combines expenditures for hospitals, midwives and the health office whose task is to monitor contagious diseases as well as food and drug safety. Further, public health spending also includes measures to combat epidemics such as pox, for instance. Education spending covers secondary education, which is the prime

¹⁸ The data appendix contains more details about the data and the definition of the main variables.

¹⁹ Switzerland followed its own, rather detailed national classification of causes of deaths between 1876 and 1930 (with revisions in 1900 and 1920) and adopted the International Classification of Diseases (ICD) in 1930.

responsibility of the cantons, as well as primary education, where both municipalities and cantons contribute to its provision. Administration covers all expenditures for the cantonal bureaucracy. Welfare spending combines social security payments and social assistance to the poor reflecting both old age provisions and insurance against poverty.

Since 1930, the Federal Tax Administration has collected and harmonized canton-level spending by major categories. For the years prior to 1930, no such data are available. Instead, spending by categories has to be extracted from the annual state accounts, which are kept in the cantonal archives. Expenditures on education are available since 1890 and on public health for thirteen cantons since 1890, for all cantons in 1910 and since 1930. Data on welfare spending are available since 1890 (for a few cantons) and 1910 (for all cantons), while information on poor relief is available for all cantons since 1890 (see Table A4 in the appendix). Public spending categories are measured in 2000 Swiss Francs and converted to logs per capita. Panel C of Table 1 provides descriptive statistics of political representation and the public finance statistics over the study period.

To analyze the relationship between electoral reform and political representation, I use data on turnout in parliamentary elections at the canton level and the number of seats won by the six major parties. Here, I again rely on an unbalanced panel, as the distribution of party seats is not available for all cantons over the whole period (see Table A4 and the data appendix for details). I define the parliamentary strength of left-wing parties as the seat share of the Social Democratic Party including its canton-specific branches. To check for other shifts in voter preferences or political participation, I collect information on turnout and seats won by social democratic parties in federal elections, information on voting behavior of each canton in federal ballots as well as vote and seat shares of other major parties in cantonal parliaments.

Finally, I examine in detail each canton's constitution and relevant electoral laws to characterize the electoral system and other cantonal political institutions. I complement and crosscheck this information with cantonal archives (personal communication) as well as with secondary sources (see, e.g., Lutz and Strohmman, 1998). The main variable is an indicator equal to one if the canton uses a proportional or mixed proportional system to elect MPs. The variable is zero if the parliament is elected under plurality rule. When a canton switches from plurality rule to proportional representation, the indicator is zero until the first election took place under the new rule. It is equal to the share of the year a proportional system was in place in the year of adoption, and

equal to one in all years thereafter.²⁰ I assign the electoral rule of the last parliamentary election in non-election years, which allows me to evaluate the consequences of electoral system in election and non-election years.

4.2 Empirical Strategy

Exploiting the rich spatial and temporal variation in electoral reforms, the basic empirical model uses a difference-in-differences approach to relate changes in mortality by age or cause, public spending and political representation to the adoption of a proportional system in Swiss cantons between 1890 and 1950. Specifically, I estimate the following model for canton c and year t :

$$\ln(Y_{ct}) = \alpha + \beta * PR_{ct} + \gamma' X_{ct} + \delta_t + \theta_c + \lambda_c * year_t + \varepsilon_{ct}, \quad (1)$$

where Y_{ct} is an outcome of interest like log public spending or log deaths by age or by cause in canton c and year t .²¹ The variable PR_{ct} measures whether or not a proportional system had been adopted.²² Equation (1) includes canton (θ_c) and year (δ_t) fixed effects, canton-specific linear trends ($\lambda_c * year_t$) and basic demographic characteristics (X_{ct}) like the age structure (three broad groups) and population size in each canton (in logs).

The parameter of interest in this specification is β , which identifies how the adoption of proportional representation affects public spending or mortality, for example. In this framework, only the timing of adopting proportional representation is assumed exogenous. Permanent differences across cantons (between German- and French-speaking cantons, for example) and common factors varying non-linearly over time (such as the two World Wars) are fully absorbed by canton and year fixed effects respectively. In addition, the parameter estimate β is purged from any canton-specific shifts in public spending or mortality that increase or decrease linearly over time. Only differential trend breaks in public spending and mortality that coincide precisely with the timing of adoption of proportional representation are captured by this parameter. I explore the validity of the empirical strategy in much more detail in Section 6.

²⁰ As noted in the introduction, electoral systems may vary along multiple dimensions, most notably the electoral rule (to translate votes into seats) and the district magnitude (the number of seats per electoral district). Our empirical analysis uses the electoral rule to discriminate between electoral systems. Yet, cantons with proportional system also have more seats per district (the average district magnitude is 20 seats) than cantons with a majoritarian system (where the average district has 4 seats).

²¹ Note that I use deaths rather than death rates as dependent variables in the analysis. The main reason is that population data by detailed age categories are available for the decennial censuses only. Rather than using population projection methods to interpolate inter-census years, I follow Miller (2008) and include state and year fixed effects as well as canton-specific trends instead.

²² All results are robust to the inclusion of an indicator whether a canton uses a mixed proportional system.

Finally, equation (1) also raises the question how to calculate consistent standard errors. In the baseline specifications, I report standard errors clustered at the canton level to account for serial correlation in the dependent variables. Recent work has questioned the need for clustering if the specification includes fixed effects at the same level of aggregation (Abadie et al., 2017). In Section 6.2, I demonstrate that alternative estimation methods using no clustering, alternative clustering levels and wild bootstrap approaches to account for the small number of clusters do not alter the inference of my results (Cameron and Miller, 2015).

5. Empirical Results

5.1 Changes in Political Participation and Representation

I start out with direct evidence on how electoral reform shifted electoral turnout and party representation in cantonal parliaments. Figure 2 traces the evolution of voter turnout in parliamentary elections at the canton level before and after the first election under proportional rule. The figure suggests that turnout in the first election after adoption jumps from around 62 percent to 81 percent – an increase by 18.5 percentage points.²³ To examine changes in turnout more systematically, I estimate equation (1) for election years where the dependent variable is electoral turnout measured in percent of the voting population. Supporting the sizable jump visible in Figure 2, column (1) of Table 2 shows that the adoption of proportional representation raises voter turnout in elections for cantonal parliaments by on average 14 percentage points. These effects are highly persistent: extending the period of analysis to 2000, I still find that average turnout is 13.6 percentage points higher than under a majoritarian system, suggesting that citizens are consistently more likely to participate in elections under a proportional system.

A potential concern is that higher turnout and electoral reform may be jointly determined by a broader quest for political participation among citizens. The social and political mobilization of the working class, for instance, might have raised awareness of common interests and hence, furthered political participation and electoral reform. If that were the case, however, voter turnout should increase in other elections as well. To assess this alternative channel, I re-estimate equation (1) where the dependent variables are cantonal turnout in federal elections or federal ballots (combining referendums and voter initiatives). Columns (2) and (3) of Table 2 show no economically or

²³ Turnout is not available for all cantons in all years, thus raising concerns about potential composition bias (see Table A4 in the appendix). Earlier work, however, shows that the increase in turnout is very similar if the sample is restricted to cantons with turnout data before and after electoral reform (see Figure A.2 in Funk and Gathmann, 2013).

statistically significant increase in turnout in federal elections or federal ballots in cantons that adopted proportional representation. Hence, the persistent increase in political participation is indeed the result of electoral reform in a canton and not caused by voters' demand for broader political involvement.

Higher turnout will change the composition of parliament whenever these additional voters have different needs and preferences than the majority in the marginal district under the old electoral system. The discussion in Section 3 and historical accounts suggest that previously underrepresented parties like the Social Democrats were likely to gain from electoral reform. Figure 3 shows that both the number of seats and the seat share of the Social Democratic Party (and its cantonal branches) jumps up in the first election under proportional representation.²⁴ The number of seats almost doubles from eleven to twenty-two seats increasing their seat share by six percentage points – from eight to fourteen percent. To quantify who benefits or loses from electoral reform, I re-estimate equation (1) where the dependent variables are now the vote and seat shares of different parties in parliamentary elections. Mirroring Figure 3, the Social Democrats gain about 5 percentage points in vote shares as well as 10 additional seats – almost doubling their number of parliamentary seats (see columns (4) and (6) of Table 2). Parliamentary representation might carry few consequences for actual policy-making unless Social Democrats also entered cantonal governments. Unfortunately, systematic evidence on the composition of cantonal governments is not available. Yet, historians point out that, by the late 1920, Social Democrats entered coalition governments in eight cantons that had switched to proportional representation (Degen, 2009b); a similar development is observed at the local level (see Junker, 1996, for example).

Left-wing parties like the Social Democrats were not the only party benefitting from the new electoral system. Table A5 in the appendix shows that the other beneficiary of proportional representation was the farmers' party, which was popular in rural areas with a predominantly German-speaking and Protestant population.²⁵ The farmers' party, like the Social Democrats, increases its vote share by around 5 percentage points and gain around 7.5 seats though the latter effect does not reach statistical significance (see columns (1) and (2) of Table A5). The Radicals, one of the two dominating parties under plurality rule, lose both votes and seats (columns (3) and (4) of Table A5), while voter support for the Conservatives, the second dominant party under the old system, did not change after electoral reform (columns (5) and (6) of Table A5).

²⁴ In general, party names and even program details differed across cantons.

²⁵ The farmers' party supported national conservatism, stressed individual responsibility and was skeptical of government interventions.

The rising political weight of Social Democrats could also be explained by unobserved shifts in voter preferences for government activity or left-wing policies, which might be correlated with electoral reform. Yet, the analysis of the forces underlying electoral reform discussed in Section 3.2 suggested no link between popularity of left-wing parties and the incidence and timing of electoral reform. Furthermore, voter support for the Social Democratic party in federal elections did *not* increase in cantons adopting proportional rule shown in column (5) of Table 2. Finally, I check whether electoral reform coincided with a broader quest for government. Table A6 in the appendix reruns equation (1) where the dependent variables are now canton-level vote shares in favor of more government activity (columns (1)-(4)) or more government spending (columns (5)-(8)) in federal ballots.²⁶ I find no evidence that voters in cantons adopting a proportional system have or develop a quest for more government, irrespective of whether I use an indicator for electoral reform (see columns (1)-(2) and (5)-(6) of Table A6) or years since adoption of proportional representation (shown in columns (3)-(4) and (7)-(8) of Table A6). If anything, there is a slight negative correlation between proportional rule and preferences for more government spending.

Overall then, the results support the hypothesis that it was the adoption of proportional representation, rather than a change in the demand for government, that shifted political power toward previously underrepresented groups – e.g. those represented by the farmers’ party or Social Democrats.²⁷

5.2 Public Spending

Models of distributive politics and electoral systems suggest that shifts in political representation as documented in Table 2 should be reflected in public expenditures. More participation and better representation of the working class might favor redistribution or investments to alleviate the poor living (and hygienic) conditions in the industrial centers. Even beyond the

²⁶ Information about additional government activity and fiscal costs of each ballot, if approved, are coded from the parliamentary debates and the information material each citizen receives before each vote, which contain, among others, detailed calculations about the financial consequences of each ballot (see Funk and Gathmann, 2011 for details).

²⁷ Two-thirds of these seat gains were redistributions of seats away from formerly dominant parties; the remainder came from an expansion of parliamentary seats by on average seven seats. In addition, the number of parties with at least one seat increased by 0.5 after electoral reform (Funk and Gathmann, 2013). New parties often emerged after electoral reform because existing parties split into several factions. One example is *Geneva* where the Conservatives split into the Democrats and the Independents after 1891. As the number of parties standing for elections increased, so did the number of parties with seats in cantonal parliaments.

special interests of the working class, proportional representation pushes the electoral incentives of *all* MPs to cater more to social groups and support investments in broad public goods.²⁸

I first illustrate the relationship graphically for those spending categories with complete information for all cantons over the 1890-1950 period: public education, poor relief and total spending. Public education, which combines spending on primary and secondary education and is supplied jointly by municipalities and cantons, represents a broad public good. Poor relief captures monetary or in-kind transfers to the poor, which should disproportionately improve the economic plight of the urban masses; I thus consider it a targetable transfer. Changes in total spending show any adjustments to the overall size of cantonal governments.

Using residual public spending obtained by estimating equation (1) without the proportional representation variable, Figure 4 shows the evolution of mean residual spending for the five years preceding and following the first election under proportional representation. Year 0 denotes the year the first election took place under the new electoral system. The graph suggests no relative decline or rise in education spending before the first election; after the first election education spending sharply increases. In turn, I see no relative changes in poor relief or total spending in the immediate years around electoral reform.

To examine the shift in the size and composition of public spending more systematically, I report estimates of equation (1) with all baseline controls in Table 3. As the dependent variables are annual real expenditures per capita in logs, one can interpret the coefficients as percentage changes. Confirming the evidence in Figure 4, column (1) of Table 3 suggests that spending on public education goes up by around 18 percentage points under a proportional system. Additional data from educational statistics (see the data appendix for details) indicate that electoral reform mostly encouraged additional investments in basic public education.²⁹ Table 4 shows that spending on primary education (Panel A) and the number of teachers in lower secondary education (Panel B) increased after the adoption of a proportional system. These estimates in Table 4 are again obtained from equation (1) where the first specification includes canton and year fixed effects as well as canton-specific trends; the second specification also adds controls for a canton's population and age

²⁸ Ideally, one would like to trace such shifts in the incentives of MPs through roll call votes, for instance. Yet, roll call votes either at the cantonal or even federal level in Switzerland are not available for this early period. See Hug and Martin (2012) for a contemporaneous analysis of the differences in incentives of Swiss MPs elected under majoritarian and proportional rule.

²⁹ Primary education covers the first four to six years, while lower secondary education adds between two and four years, upper secondary education another four years. In all cantons, a high school degree typically requires twelve years of schooling.

composition. Panel C of Table 4 further suggests that more children went to school after electoral reform: enrolment increases by 15 percentage points in primary education, for instance. Ensuring that all children, boy or girl, obtained basic primary and secondary education enabled cantons to reduce child labor and monitor children's health and well-being. In addition, cantonal authorities could establish curricula, esp. for girls, to diffuse information about food and body hygiene or other preventive measures to reduce the burden of contagious diseases (see Heller, 1979; Mesmer, 1982).³⁰

Education could have an impact on mortality by improving the living standard of those enrolled in school. To investigate this alternative channel, I use supplementary information on cantonal income derived from tax statistics and on the height of army recruits as a long-run indicator for nutritional status.³¹ The top panel of Table A7 in the appendix does not support the idea that living standards improved significantly after the adoption of proportional representation (see, e.g., Lorenzetti and Meffre, 2005). This null effect on income and nutritional status suggests that the effect on mortality works primarily through better information on basic hygiene and monitoring of child health.

To assess the impact of electoral reform on investments in public health, column (2) of Table 3 uses the log of public health spending as dependent variable. Public health spending includes expenditures for hospitals, physicians and midwives as well as health-related measures to improve hygienic conditions (through food inspection, for example) and combat epidemic diseases. The estimates in column (2) suggest an increase of 16 percentage points - similar to the boost in educational spending. Yet, the large standard error for public health spending indicates substantial noise in the data. There are two sources of noise: one related to data quality, the other one is substantive. Before 1930, cantons used different classification schemes to report public health efforts in their annual state accounts. Not only did cantons report components of public health spending under different headings; it was also difficult to obtain the annual accounts detailed enough to track public health spending consistently in and across cantons. Hence, there are both fewer observations and likely measurement error in the coded data on public health spending. The second explanation is substantive: public health spending combines investments in broad public goods (like health

³⁰ A similar development occurred in the U.S.. According to Richard Easterlin (1999), "As knowledge grew, education expanded to encompass food handling and infant and child care, and health programs were introduced into the schools. Because women were principally responsible for household care and childrearing, these educational efforts were especially directed towards women."

³¹ Measures of income inequality and mean income are taken from tax statistics, which have been collected since 1917 (Schaltegger and Gorgas, 2011; see the data appendix for details). As before, estimates are based on equation (1), where the first specification includes year fixed effects and population and age controls, while the second specification adds canton fixed effects. Data on the height of army recruits are from Staub (2010) and Floris et al. (2018).

campaigns) as well as local public goods (like local efforts to improve the housing stock). As discussed above, it is unclear whether public health spending is higher or lower after electoral reform.

In line with Figure 4, I find no evidence that the switch to proportional representation increased redistribution to poorer segments of society. The coefficients on social welfare, which combine old age pensions and poor relief, or poor relief alone (columns (3)-(4) of Table 3) are with 1-2 percentage points small in magnitude and not statistically significant.³² Governments might use other means of redistribution to reduce income inequality – through progressive taxation, for instance.³³ Yet, supplementary evidence from tax statistics indicate no relationship between proportional representation and the Gini coefficient, the top 1% income share or the welfare caseload (see the lower panel of Table A7 in the appendix). These null results for welfare and poor relief are in line with historical accounts, which stress that large-scale redistribution in the cantons, in particular public assistance for the poor and elderly, expanded only *after* the end of World War II (Sommer, 1978; Studer et al., 2002).

Column (5) of Table 3 further indicates no systematic relationship between proportional representation and total expenditures at the canton level (see Aidt et al., 2006; and Funk and Gathmann, 2013 for similar results). That there is no effect on total spending is fully consistent with the evidence in Table A6 that voter preferences for government are similar for early and late adopters, and that voters' demand for government did not increase following adoption. Rather than the total size of government, I also investigate administrative spending, which might indicate a waste of public resources through rent seeking or patronage, but do not find any effect (see column (6) of Table 3). Finally, proportional representation does not shift the vertical structure of government: federal subsidies to the canton and total municipal spending in a canton are unaffected by the switch to proportional representation at the canton level (see columns (7) and (8) of Table 3).³⁴

Overall then, the switch to a proportional system not only increased political participation and shifted representation in parliaments; it also boosted investments in public goods and services. In turn, there is no evidence that electoral reform induced more redistribution to the poor over this

³² Funk and Gathmann (2013) report that adopting proportional rule increased welfare spending over the 1890-2000 period. In line with the historical accounts, this effect is explained solely by the post-1945 period. Using the full period from 1890 to 2000, I find that the switch to proportional representation is indeed associated with a sizable increase in overall welfare spending as well as poor relief of around 30-40 percent.

³³ See Austen-Smith (2000) for a theoretical model on the link between progressive taxation, redistribution and the electoral system.

³⁴ Unfortunately, municipal spending stratified by type is not available until the second half of the 20th century.

period or had much effect on the overall size of government. I next turn to the question whether the observed changes in government priorities carried benefits for population health.

5.3 Mortality by Age and Cause

Ultimately, I am interested in assessing whether electoral reform – with its changes in electoral incentives of MPs, political participation and representation – has real consequences for population health. I first investigate the link between proportional representation and deaths by age. Using residuals from estimating equation (1) without the measure of electoral system, Figure 5 plots mean residual deaths for children and teens in the decade around the first election under proportional representation. Figure 5 suggests substantial mortality declines for children under the age of 14 shortly after cantons switched to proportional rule.

Figure 6 examines the link between electoral reform and age-specific mortality more broadly. The figure shows parameter estimates β from equation (1) with log deaths in each age interval (0, 1-4, 5-14, 15-24 etc.) as dependent variables and the same control variables as before.³⁵ The figure and the corresponding estimates in Table A8 in the appendix indicate that proportional representation is associated with mortality declines for children and young teens (between the age of 0 and 14) with few statistically significant effects for adults or old age mortality. The age-specific mortality reductions range from 12 to 14 percentage points depending on the age group considered.

Do these results suggest a sizable contribution to the overall mortality decline observed during this period? According to the summary statistics in Table 1, mortality rates between 1890 and 1950 declined by 79 percent for children under the age of one, by 76 percent for children between the age of one and four, and by 86 percent for children between the age of five and fourteen.³⁶ Proportional representation in the Swiss cantons then accounts for 17 percent of the improved survival of infants under the age of one; the contribution to mortality reductions for children between the age of one to four and five to fourteen is 15 percent.³⁷ These effects are substantial but consistent

³⁵ In estimating equation (1) for mortality, I use log deaths (rather than the death rate) as dependent variables. The reason is that canton-level population counts by age have only been available on a year-to-year basis since 1980. Prior to 1980, population by detailed age is available from decennial censuses starting in 1880. As such the denominator, the resident population in a specific age group, is only available roughly every 10 years, which makes the calculation of death rates difficult.

³⁶ Declines in infant and child mortality might affect fertility behavior as well. Using supplementary data on the number of births and our baseline empirical model in equation (1) shows a negative effect of proportional representation that is not statistically significant, however (not reported).

³⁷ Between 1890 and 1950, observed mortality between the age of 5 and 14 declined by 86% (calculated from Table 1). The estimated mortality decline due to proportional representation is 12.5 percentage points. Hence, I obtain $-0.125/0.86=0.145$.

with the substantial shifts in political participation and representation documented in Table 2. Moreover, the political shifts boosted basic educational investments as shown in Table 3. The health benefits of these shifts in political representation and public finances could be sizable if they were indeed effective in promoting regular school attendance and basic hygiene in the household.

I next turn to an analysis of mortality by detailed causes. Table 5 shows results from estimating equation (1) where the dependent variables are now the log number of people dying from a specific cause. The top panel demonstrates that the switch to proportional representation is associated with sizable reductions in the risk of dying from common infectious diseases. Specifically, adopting proportional representation reduces deaths from meningitis (by 19 percent), urogenital tuberculosis, the most common form of extra-pulmonary tuberculosis, (by 10 percent) and diarrhea among infants (by 15 percent). All three diseases were major killers for children at the time, and most importantly, could be combated effectively through good hygiene. While proportional representation had sizable effects on the odds of dying from infectious diseases, the middle panel of Table 5 shows that deaths from chronic diseases do not respond to electoral reform in any way. The absence of any effect on chronic diseases is reassuring as these illnesses became quantitatively important only later in the twentieth century and few effective medical treatments were available prior to 1950. Likewise, proportional representation did little to reduce deaths from external causes like suicides or accidental deaths.

As the data on cause-specific deaths are somewhat noisy, I also aggregate individual causes into infectious diseases affecting all ages, childhood infectious diseases that were most prevalent among young children (following Miller, 2008) and all other diseases.³⁸ I then regress the log number of deaths in each aggregate category on canton and year fixed effects, population and the broad age structure as before. In addition, I control for cause-specific fixed effects and linear trends, which account for any differential speed in the decline of individual infectious diseases.

The bottom panel of Table 5 indicates that the switch to proportional representation is associated with a reduction in infectious diseases by 9.7 percentage points. The decline in mortality is even stronger for those infectious diseases that mostly affect children – where I find a decline in 14.5 percentage points. On the contrary, electoral reform has no impact on other causes of death that are associated with chronic diseases or external causes. To put these estimates in perspective, I take

³⁸ Childhood infectious diseases are diphtheria, meningitis, measles, whooping cough, chickenpox, smallpox, scarlet fever and diarrhea deaths among infants. Infectious diseases include diphtheria, diarrhea under age two, childbed fever, measles, scarlet fever, typhus and whooping cough. All other causes combine stroke, diabetes, cancer, nephritis, epilepsy, deaths after childbirth, suicides, accidents, alcohol abuse and chronic poisoning.

the mortality rate from infectious diseases reported in Table 1, which declined from 0.33 in 1890 to 0.04 in 1950, a reduction of 87%. The shift to a proportional system can then account for 11 percent (0.097/0.87) of the total decline in infectious diseases over this period. These are sizable health improvements, though somewhat smaller than the health benefits associated with the U.S. enfranchisement of women during the Progressive Era (Miller, 2008).

To shed some light on the channels underlying the observed health benefits, I explore whether the mortality reductions are concentrated in cantons with traditionally low enrolment, suggesting an important role for the educational system. I thus augment equation (1) with an additional interaction effect between the treatment and indicators whether the canton was below the median in terms of primary or lower secondary school enrolment at the beginning of our sample period in 1890. Table 6 shows that the decline in infectious and childhood infectious diseases is concentrated in cantons with below median enrolment in primary (columns (1)-(2)) and lower secondary education (columns (3)-(4)).

Instead, there is only weak indication that mortality reductions are larger in urban cantons, where the canton is classified as urbanized if its urban population share is above the median in 1890 (columns (5)-(6)). As such, it was not solely or primarily the urban masses suffering from poor housing and hygienic conditions that benefitted from mortality reductions after electoral reform. Instead, mortality reductions were also sizable in the rural areas where child labor on the farms was widespread at that time imposing a substantial risk to children's long-run health (Gruner, 1987). Finally, I check whether cantons with high initial infant mortality rates (above the median in 1890) benefit more than cantons with lower prevalence of infant deaths. The estimates (in columns (7)-(8) of Table 6) show that infectious diseases decline more in cantons with below median initial infant mortality ruling out that the observed reductions merely represent a catch-up process of high-mortality areas. Overall, Tables 5 and 6 suggest that proportional representation results in sizable health benefits for the general population and especially for children in cantons with low initial levels of basic education.

6. Robustness and Estimation of Standard Errors

6.1 Testing for Pre-Trend Breaks and Failed Reform Efforts

The difference-in-differences approach relies on the assumption that outcomes in early adopting cantons would have evolved similarly to the outcomes in later or non-adopting cantons prior to the reform. While I cannot test for the unobservable counterfactual trend directly, I follow

existing studies and conduct a pre-trend analysis. To test for trend breaks at various points in the pre-reform period, I estimate variants of equation (1) adding dummy variables denoting intervals two, four, and six years before the first election to the baseline specification. Table 7 shows that for all dependent variables related to electoral reform, the resulting estimates are statistically indistinguishable from zero. This evidence is consistent with the view that late reformers evolved on similar trends than early reformers supporting the credibility of the identifying assumption.

Another potential concern with the econometric strategy is that other political changes or institutional reforms, which coincide with electoral reform, actually caused the mortality decline; or that broader social changes affect both the decision to adopt a proportional system and mortality. Yet, Figures 2-5 suggest that changes in political representation, public spending and mortality occurred quickly after the first election under proportional system, which implies that any unobservable shock to the outcomes must follow a very specific timing.

I now report several robustness tests that probe but fail to substantiate these concerns. If broader changes in political or economic conditions determined electoral reform and changes in public finances and health, I should observe similar effects for reform movements that ultimately failed. In Switzerland, attempts to reform the electoral system were launched either by the electorate through initiatives, or by politicians through parliamentary petitions. Historical accounts highlight that many cantons saw several initiatives or petitions before an electoral reform was successful. I use information on the timing of initiatives or parliamentary petitions (see Table A1 in the appendix for details) to define two placebo indicators: the variables are equal to one if a canton has voted on an initiative or petition in a given year and zero otherwise. I then re-estimate equation (1) and add to the baseline specification the indicator for failed reform attempts. Table 8 indicates that most outcomes are unrelated to reform attempts. Of the 28 reported estimates, one is statistically significant at the 5% level (deaths between the age of 1 and 4, though the effect is of the wrong sign); and two estimates are statistically significant at the 10% level (meningitis deaths and deaths under the age of 1, though the latter is again of the wrong sign). The statistically significant coefficients likely reflect false positives (type I errors) at the 5% and 10% significance levels respectively.

6.2 Additional Validity Checks

I perform several additional robustness checks to rule out other confounding factors, which might explain the move to proportional representation, increase public investments or bring down

mortality. Table A9 in the appendix shows coefficients for the proportional rule measure from estimating equation (1) where the outcome variables are listed on the left side of the table.

Consistent with the evidence that voter preferences for government are unrelated to and unaffected by electoral reform (see Table A6 and the results in Table 2) column (1) shows that adding voter preferences measured by federal ballots leaves the main results unchanged. Column (2) indicates that controlling for population fragmentation along linguistic and religious lines, which might reduce incentives for public investments, has few effects on my estimates.

A potentially important issue is that cantons with an educated electorate are more in favor of electoral reform, invest more in education and therefore benefit from faster mortality declines. Yet, Section 3.2 suggested few effects of a canton's educational infrastructure on electoral reform (see Tables A2 and A3 in the appendix). To further check for the confounding influence of education, column (3) of Table A9 reports estimates of equation (1) when I also control for the educational enrolment in each canton. The coefficient on electoral reform remains qualitatively unchanged, which supports the earlier argument that education cannot account for the changes in representation, public finances and population mortality.

Cantons that adopted proportional representation earlier might offer better living conditions or other opportunities and hence, received more internal or international immigrants. Changes in spending and mortality might thus reflect more a shift in the composition of the population rather than adjustments following electoral reform. I do not have detailed information on migration flows between cantons or from abroad for the period. However, the population censuses record every ten years the share of the population living in their canton of birth. For the pooled years of population censuses, I then regress this share on a variable indicating the number of years since proportional representation has been adopted as well as decade and canton fixed effects, controls for population size and for the broad age structure. A second specification further controls for canton-specific trends. Table A10 in the appendix suggests no correlation between adopting a proportional system and the share of migrants between 1890 and 1950 (columns (1) and (2)) or in the longer period from 1890 to 2000 (columns (3) and (4)). Given there is no migratory response to electoral reform, it is not surprising that the coefficient on proportional rule is unchanged if the (interpolated) share of the population living in the canton of birth is added to the baseline (see column (4) of Table A9 in the appendix).

Historical accounts of the reform process in the cantons highlight the importance of direct democracy and the extent of political hegemony or conflict as key drivers of electoral reform. Yet,

Table A3 showed only weak correlation with the timing of adoption conditional on canton-specific trends. Columns (5) and (6) of Table A9 further confirm that controlling for the strength of direct democratic institutions and political conflict in the cantons does not affect my estimates.

Finally, some other unobservable shocks might bias my main results. To rule out that disruptions associated with the reform interfere with my estimates, I leave out the two years before and after the first election under proportional representation (column (7) of Table A9). The results are not much affected. Given that the period of investigation spans six decades, a linear canton-specific trend or the canton-level observable characteristics might not be flexible enough to capture canton-specific changes. Columns (8) and (9) of Table A9 therefore use two additional specifications to test for any bias from unobserved, canton-specific shocks. I first restrict my sample to the decade before and after the first election under proportional rule, which leaves the results largely unchanged (column (8)). Alternatively, I use a very demanding specification by allowing canton-specific decade dummies in addition to all other control variables (column (9)). The mortality results by age now become noisier and lose significance, which is not too surprising given that this specification imposes high demands on the data. The results on turnout, educational spending and cause-specific mortality remain unchanged, however. Overall then, the extensive set of robustness checks confirms that electoral reform not only shifted political representation and public investments but also improved population health, esp. among children under the age of 14.

6.3 Estimation of Standard Errors

My main analyses cluster standard errors at the canton level. As this strategy might be sensitive to the type of clustering and the small number of clusters ($N=25$), I report in Appendix Table A11 a range of alternative strategies for obtaining standard errors based on the model in equation (1). For ease of comparison, the baseline estimates and standard errors clustered at the canton level are shown in column (1) of Table A11. Following Abadie et al. (2017), I first present estimates without clustering (column (2)). The rationale is that fixed effects at the level of clustering (here, the cantons) take care of correlated errors as long as there is no heterogeneity in treatment effects. Alternatively, I include separate state clusters for the pre- and post-reform period allowing for breaks in the temporal dependence of the error term over time (column (3)). Both alternative estimators yield sometimes larger and sometimes smaller standard errors than in the baseline.

To account for the overall small number of clusters, I also implement two alternative wild bootstrap procedures: the first one uses binary weights for bootstrapping standard error (column (4));

the second one uses Webb (6 point) weights (column (5)), which seem to perform better with a small number of clusters (Cameron and Miller, 2015). All alternative estimators of standard errors generate confidence intervals and p values support the view that proportional representation, through its effect on turnout, electoral incentives and public spending in education, carried substantial health benefits for the broader population, especially children.

7. Conclusion

Political representation, i.e. whose preferences and interests politicians listen and cater to in the political process, plays a crucial role for public policies. Using the unique case of Swiss cantons, this article documents a sizable shift in political participation and representation when cantons switched from a majoritarian to a proportional system. The constitutional reforms not only swung electoral incentives of MPs in favor of broad social groups, but also gave the previously underrepresented working class a greater weight in the political process.

Adjustments in public spending followed swiftly after the electoral reform: cantons adopting a proportional system invested much more in basic public education allowing cantons to encourage school enrolment and attendance, monitor children's health and teach basic rules of hygiene, especially to girls and young women. Most importantly, the electoral reform generated substantial benefits for population health: it reduced mortality among young children and the burden from infectious diseases, the major killer of the time, thus contributing between 11 and 17 percent to the observed decline in mortality during this period. Such sizable mortality reductions demonstrate that electoral rules and hence, the form of democratic representation have powerful consequences for population well-being.

Are these results specific to the Swiss context or do they hold more generally? The electoral reforms happened at a time similar to that of many other European countries. Furthermore, the structure of legislative and executive branches at the canton level, the main level of government at that time, is comparable to other parliamentary democracies. A unique feature in Switzerland is that the electorate has access to several direct democratic instruments to influence policies directly. Yet, the robustness analysis showed that reforming the electoral system has similar effects if I control for the strength of initiatives and referendums at the canton level. As such, the benefits of proportional representation are likely to be valid even beyond the particular Swiss context.

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Table 1: Summary Statistics

	<u>1890</u>		<u>1920</u>		<u>1950</u>	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
<u>Panel A: Age-specific Death Rate (per 1,000 in Age Range)</u>						
Deathrate Under Age 1	76.60	13.72	44.33	11.44	16.02	4.14
Deathrate Ages 1-4	11.45	2.85	17.12	6.76	2.77	0.94
Deathrate Ages 5-14	4.01	1.86	2.89	1.30	0.56	0.40
Deathrate Ages 15-19	5.40	1.68	3.85	1.01	0.90	0.38
Deathrate Ages 20-29	7.10	1.29	5.40	0.93	1.45	0.60
Deathrate Ages 30-39	9.55	1.31	7.19	1.99	2.14	0.66
Deathrate Ages 40-49	13.26	2.33	9.78	1.87	4.06	1.04
Deathrate Ages 50-59	22.82	5.23	18.49	2.53	9.84	1.83
Deathrate Ages 60-69	51.05	10.79	41.72	5.04	25.50	3.42
Deathrate Ages 70-79	110.94	11.91	98.70	10.67	65.36	7.32
Deathrate Ages 80 plus	235.23	43.10	210.01	28.97	165.76	22.51
<u>Panel B: Cause-specific Death Rate (per 1,000 Population)</u>						
Typhoid fever and Typhus	0.17	0.08	0.01	0.02	0.00	0.00
Small pox and chickenpox	0.01	0.01	0.00	0.00	0.00	0.00
Measles	0.06	0.08	0.12	0.10	0.00	0.00
Scarlet Fever	0.09	0.10	0.02	0.02	0.00	0.00
Whooping Cough	0.15	0.13	0.13	0.24	0.02	0.02
Diphtheria	0.27	0.10	0.23	0.18	0.01	0.02
Influenza	0.03	0.04	0.94	0.30	0.06	0.03
Meningitis	0.00	0.00	0.01	0.01	0.00	0.00
Pulmonary Tuberculosis	2.05	0.47	1.28	0.27	0.29	0.13
Gastrointestinal Tuberculosis	0.12	0.05	0.16	0.04	0.06	0.03
Urogenital Tuberculosis	0.01	0.01	0.03	0.03	0.02	0.01
Diarrhea Deaths Infants	0.99	0.40	0.41	0.19	0.04	0.04
Stroke	0.81	0.24	0.40	0.12	0.28	0.12
Epilepsy	0.05	0.03	0.04	0.02	0.02	0.01
Diabetes	0.03	0.04	0.07	0.04	0.11	0.06
Cancer	1.20	0.39	1.29	0.25	1.78	0.45
Nephritis	0.32	0.14	0.33	0.12	0.21	0.08
Suicide	0.18	0.10	0.19	0.09	0.22	0.10
Accidents and external Causes	0.61	0.23	0.60	0.24	0.54	0.16
Substance Abuse	0.06	0.04	0.07	0.06	0.02	0.02
Death after Childbirth	1.24	0.36	0.79	0.28	0.45	0.16
<u>Panel C: Political Representation and Real Public Spending Per Capita</u>						
Turnout Cantonal Elections	68.77	5.93	78.48	6.73	77.80	8.52
# Seats Left-Wing Parties	7.00	6.08	27.07	23.13	25.31	19.38
Health Spending	16.97	20.72	51.18	38.09	145.51	115.40
Welfare Spending	13.56	6.34	42.84	36.98	148.59	86.74
Poor Relief	65.30	25.34	57.82	22.92	83.79	26.09
Education Spending	49.71	59.05	48.17	40.28	226.12	138.83

Notes: The table reports summary statistics. Data for political representation and public spending refer to the periods 1890-1895, 1920-1925 and 1950-1955 respectively. Turnout is measured in percentages, while public spending is measured in real Swiss Francs per capita (at 2000 prices). Death rates by age refer to the number of deaths per 1,000 in the specific age range based on population numbers in the Census years 1888, 1920 and 1950 respectively. Deaths by individual causes are calculated as the number of deaths per 1,000 inhabitants.

Table 2: Proportional Representation, Voter Turnout and Political Representation

	<u>Voter Turnout (%)</u>			<u>Social Democrats</u>		
	Cantonal Elections	Federal Elections	Federal Ballots	Vote Share Canton level	Vote Share Federal level	# Seats in Parliament
	(1)	(2)	(3)	(4)	(5)	(6)
Proportional Representation	14.055*** [3.364]	-1.484 [3.108]	-3.158 [2.623]	0.046 [0.033]	0.019 [0.016]	10.409** [4.920]
Demographic Controls	Yes	Yes	Yes	Yes	Yes	Yes
Canton Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Canton-Specific Trends	Yes	Yes	Yes	Yes	Yes	Yes
Observations	388	443	1,271	832	443	247
R Squared	0.771	0.765	0.853	0.889	0.803	0.951
Mean Dependent Variable	75.01	62.20	58.26	0.17	0.13	22.55

Notes : The dependent variables on the left-hand side are voter turnout (in percent) in parliamentary elections at the cantonal level (column (1)), at the federal level (column (2)) or turnout for federal ballots (column (3)). The dependent variables at the right-hand side are the vote share for left-wing parties in parliamentary elections at the canton level (column (4)) or federal elections (column (5)); and the number of seats in canton parliaments for left-wing parties (column (6)). The main independent variable is equal to one if the cantonal parliament is elected by proportional rule and zero if it is elected under majoritarian rule. The variable is equal to the share of the year under proportional rule in the year the first election is held under the proportional system. All specifications contain year and canton fixed effects as well as canton-specific linear trends. In addition, we control for canton population (in logs) and the broad age structure of the population. Standard errors are clustered at the state level. * p<0.1, ** p<0.05 and *** p<0.01.

Table 3: Proportional Representation and Public Spending

	<u>Education Spending</u>	<u>Health Spending</u>	<u>Welfare Spending</u>	<u>Poor Relief</u>	<u>Total Expenditures</u>	<u>Administration</u>	<u>Federal Subsidies</u>	<u>Local Expenditures</u>
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Proportional Representation	0.177** [0.078]	0.161 [0.217]	0.020 [0.218]	-0.010 [0.055]	0.023 [0.056]	-0.021 [0.046]	0.049 [0.127]	-0.035 [0.063]
Canton Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Canton-Specific Trends	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,525	1,044	1,065	1,525	1,525	573	1,450	1,381
R Squared	0.962	0.926	0.939	0.913	0.959	0.98	0.873	0.969
Mean Dependent Variable	4.13	3.47	4.43	4.29	6.22	4.29	4.62	6.07

Notes: The dependent variables are canton-level educational (column (1)), which covers money for primary and (lower and upper) secondary education. Expenditures for public health (column (2)) combines spending on hospitals, costs to monitor food and drug safety by the health police and other public health measures to combat contagious diseases. Welfare spending at the canton level (column (3)) combines spending on poor relief and social security payments, while column (4) uses spending on poor relief only. Total spending combines all sources of expenditures and income (column (5)), while expenditures for administration (column (6)) covers costs of the bureaucracy. To test for effects on the structure of government, columns (7) use federal subsidies to the canton and column (8) local spending; the latter combines all expenditures by municipalities in a canton. All spending variables are annual in per capita terms and deflated to 2000 prices. The main independent variable is equal to one if the cantonal parliament is elected by proportional rule and zero if it is elected under majoritarian rule. The variable is equal to the share of the year under proportional rule in the year the first election is held under the proportional system. Non-election years are assigned the value of the previous election. All specifications contain year and canton fixed effects as well as canton-specific linear trends. In addition, we control for canton population (in logs) and the broad age structure of the population. Standard errors are clustered at the state level. * p<0.1, ** p<0.05 and *** p<0.01.

Table 4: Educational Inputs and Enrolment

	Primary Education	Primary Education	Lower Secondary Education	Lower Secondary Education	Upper Secondary Education	Upper Secondary Education
Panel A: Expenditures (in logs)						
Proportional Representation	0.373*	0.317*	0.165	0.085	-0.071	0.006
	[0.204]	[0.185]	[0.100]	[0.074]	[0.166]	[0.155]
Observations	882	882	858	858	615	615
R Squared	0.949	0.951	0.801	0.829	0.935	0.938
Time Period Available	1890-1928		1890-1928		1890-1922	
Panel B: Teachers (in logs)						
Proportional Representation	0.065	0.043	0.545**	0.496**	-0.007	-0.028
	[0.043]	[0.031]	[0.208]	[0.220]	[0.131]	[0.128]
Observations	1,400	1,400	1,386	1,386	969	969
R Squared	0.988	0.989	0.735	0.737	0.928	0.929
Time Period Available	1890-1948		1890-1948		1890-1948	
Panel C: Enrolment (in logs)						
Proportional Representation	0.153*	0.131*	0.337	0.337	-0.175	-0.163
	[0.078]	[0.070]	[0.204]	[0.207]	[0.108]	[0.110]
Observations	1,525	1,525	1,525	1,525	1,279	1,279
R Squared	0.815	0.815	0.734	0.736	0.943	0.944
Time Period Available	1890-1950		1890-1950		1890-1948	

Notes : The table reports whether proportional representation is associated with more school inputs and educational enrolment. The dependent variables are log expenditures for primary education, for lower secondary education and for upper secondary education in panel A; the log number of teachers in primary education, in lower secondary education and in upper secondary education in Panel B; the log number of students enrolled in primary education, in lower secondary education and in upper secondary education in Panel C. The variable for proportional representation is defined as in previous tables. All specifications in Panel A-C include canton and year fixed effects as well as canton-specific trends. The second specification adds controls for population and age structure in each canton. The last row in each panel shows the time period for which the dependent variables are available. Standard errors are clustered at the state level. * p<0.1, ** p<0.05 and *** p<0.01.

Table 5: Proportional Representation and Cause-Specific Mortality

	Estimate (1)	Std. Error (2)
Typhoid Fever	-0.056	[0.082]
Smallpox + chickenpox	-0.012	[0.014]
Scarlet Fever	0.039	[0.116]
Diphtheria	-0.001	[0.094]
Whooping Cough	0.003	[0.118]
Measles	-0.009	[0.138]
Meningitis	-0.191**	[0.086]
Pulmonary Tuberculosis	0.083	[0.088]
Gastrointestinal TB	-0.054	[0.038]
Urogenital TB	-0.098*	[0.054]
Diarrhea Deaths Infants	-0.149**	[0.056]
Influenza	0.168	[0.120]
Stroke	0.060	[0.072]
Epilepsy	-0.027	[0.056]
Diabetes	-0.051	[0.070]
Cancer	0.001	[0.022]
Nephritis	-0.017	[0.069]
Death after Birth (mother, child)	-0.046	[0.057]
Accidents and External Causes	-0.077	[0.053]
Suicides	-0.024	[0.057]
Substance Abuse	-0.006	[0.076]
Infectious Diseases (all ages)	-0.097**	[0.044]
Childhood Infectious Diseases	-0.145**	[0.064]
All Other Diseases	-0.001	[0.023]

Notes: The table reports estimates (column (1)) and standard errors (column (2)) of regressing causes of deaths (shown on the left) on our measure of proportional representation and other controls. All causes of deaths are measured as the log of 1 plus the number of deaths in a given category in a canton and year. The main independent variable is equal to one if the cantonal parliament is elected by proportional rule and zero if it is elected under majoritarian rule. The variable is equal to the share of the year under proportional rule in the year the first election is held under the proportional system. Non-election years are assigned the value of the previous election. In the top part of the table, the causes of deaths (from typhoid fever to influenza) are infectious diseases; the second set of diseases (from stroke to substance abuse) cover other chronic or accidental diseases. All specifications here contain year and canton fixed effects as well as canton-specific linear trends. In addition, we control for canton population (in logs) and the broad age structure of the population. The bottom panel collapses infectious diseases and other diseases into a single category. The control variables here are cause-specific linear trends, canton and year fixed effects, log population and controls for the canton's broad age structure. All standard errors are clustered at the state level. * p<0.1, ** p<0.05 and *** p<0.01.

Table 6: Heterogeneous Effects of Proportional Representation on Cause-specific Mortality

	<u>High Enrolment Primary Edu</u>		<u>High Enrolment Secondary Edu</u>		<u>Urban Cantons</u>		<u>High Infant Mortality</u>	
	PR (1)	PR*D(Primary) (2)	PR (3)	PR*D(Secondary) (4)	PR (5)	PR*D(Urban) (6)	PR (7)	PR*D(InfMort) (8)
Infectious Diseases (all Ages)	-0.170*** [0.044]	0.182** [0.067]	-0.159*** [0.042]	0.124 [0.079]	-0.068 [0.063]	-0.070 [0.074]	-0.160*** [0.050]	0.140* [0.079]
Childhood Infectious Diseases	-0.232*** [0.059]	0.214** [0.094]	-0.224*** [0.051]	0.157 [0.099]	-0.087 [0.085]	-0.144* [0.083]	-0.241*** [0.055]	0.212* [0.107]
All Other Diseases	-0.020 [0.019]	0.048 [0.050]	-0.026 [0.023]	0.049 [0.045]	0.015 [0.029]	-0.041 [0.038]	0.001 [0.032]	-0.005 [0.042]

Notes : The table reports how the effects of proportional representation vary with observable canton characteristics. The dependent variables are the aggregate categories of diseases shown on the left-hand side (see notes to Table 6 for a definition of these categories). Odd columns show the main effect of proportional representation; even columns the differential effect for the cantons whose initial observable characteristic (shown in the top row) is above the median canton. The observable characteristics are: enrolment in primary school in 1900 (in columns (1) and (2)); enrolment in lower secondary school in 1900 (in columns (3) and (4)); population share in urban areas in 1890 (in columns (5) and (6)); and infant mortality in 1890 (in columns (7) and (8)). The main independent variable is equal to one if the cantonal parliament is elected by proportional rule and zero if it is elected under majoritarian rule. The variable is equal to the share of the year under proportional rule in the year the first election is held under the proportional system. Non-election years are assigned the value of the previous election. The interaction effect in even columns is an indicator equal to one if the respective observable characteristic is above the median canton. All specifications include cause-specific linear trends, canton and year fixed effects, log population and controls for the canton's broad age structure. All standard errors are clustered at the state level. * p<0.1, ** p<0.05 and *** p<0.01.

Table 7: Trend Breaks Prior to Electoral Reform

	<u>1-2 Years before Election</u>		<u>1-4 Years before Election</u>		<u>1-6 Years before Election</u>	
	Estimate (1)	Std. Error (2)	Estimate (3)	Std. Error (4)	Estimate (5)	Std. Error (6)
<u>Turnout and Representation:</u>						
Voter Turnout	-4.328	[5.584]	-4.356	[5.337]	-5.179	[4.270]
# Seats Left-Wing Parties			-1.047	[5.325]	1.618	[3.371]
<u>Canton-level Spending:</u>						
Health Spending	-0.245	[0.176]	-0.315	[0.208]	-0.265	[0.193]
Poor Relief	0.080	[0.055]	0.106	[0.067]	0.141	[0.083]
Education Spending	0.122	[0.083]	0.129	[0.086]	0.088	[0.065]
<u>Deaths by Age:</u>						
Deaths under 1	-0.051	[0.052]	-0.020	[0.054]	0.109	[0.080]
Deaths 1-4	0.033	[0.053]	0.020	[0.047]	-0.051	[0.052]
Deaths 5-14	0.055	[0.078]	-0.111	[0.088]	-0.075	[0.082]
<u>Deaths by Cause:</u>						
Meningitis	-0.009	[0.056]	-0.053	[0.065]	-0.092	[0.082]
Urogenital TB	-0.036	[0.080]	-0.065	[0.069]	-0.037	[0.049]
Diarrhea Deaths Infants	-0.002	[0.069]	0.034	[0.076]	0.065	[0.069]
Infectious Diseases	-0.081	[0.063]	-0.069	[0.055]	-0.037	[0.038]

Notes : The dependent variables are shown in the left column. Each estimate (shown in odd columns) and standard error (shown in even columns) comes from a separate regression, which includes separate indicators for 1-2 years (columns (1)-(2)), 1-4 years (columns (3)-(4)) or 1-6 years (columns (5)-(6)) prior to the first election under proportional representation: All specifications controls for the adoption of proportional representation as well as canton and year fixed effects, canton-specific linear trends, log population and broad age structure. Standard errors are clustered at the state level. * p<0.1, ** p<0.05 and *** p<0.01. See notes to main tables for details on the dependent variables.

Table 8: Failed Attempts to Adopt Proportional Representation

	<u>Voter Initiatives</u> (1)	<u>Parliamentary Petitions</u> (2)
<u>Turnout and Representation:</u>		
Voter Turnout	2.342 [2.551]	3.667 [6.497]
# Seats Left-Wing Parties	1.009 [5.017]	-9.818 [5.856]
<u>Canton-level Spending:</u>		
Health Spending	0.027 [0.269]	0.023 [0.270]
Poor Relief	-0.007 [0.027]	-0.022 [0.039]
Education Spending	-0.003 [0.023]	0.044 [0.044]
<u>Deaths by Age:</u>		
Deaths under 1	0.105* [0.055]	-0.103 [0.066]
Deaths 1-4	0.088** [0.040]	-0.095 [0.059]
Deaths 5-14	0.064 [0.056]	-0.015 [0.062]
<u>Deaths by Cause:</u>		
Meningitis	-0.131 [0.111]	-0.302* [0.157]
Urogenital TB	0.043 [0.135]	-0.041 [0.111]
Diarrhea Deaths Infants	0.035 [0.075]	-0.033 [0.071]
Infectious Diseases	0.051 [0.051]	-0.005 [0.066]

Notes: The dependent variables are shown in the left column. Each entry comes from a separate regression, which includes canton and year fixed effects, canton-specific linear trends, whether a canton has adopted proportional representation, controls for population and the broad age structure in a canton. The main independent variable in column (1) is equal to one if a voter initiative to introduce proportional representation had been launched in a canton in a given year. In column (2), the main independent variable is equal to one if a parliamentary petition to introduce proportional representation had been voted on in a canton in a certain year. Standard errors are clustered at the state level. * p<0.1, ** p<0.05 and *** p<0.01. See notes to main tables for details on the dependent variables.

Figure 1: Timing of Adopting Proportional Representation in Swiss Cantons

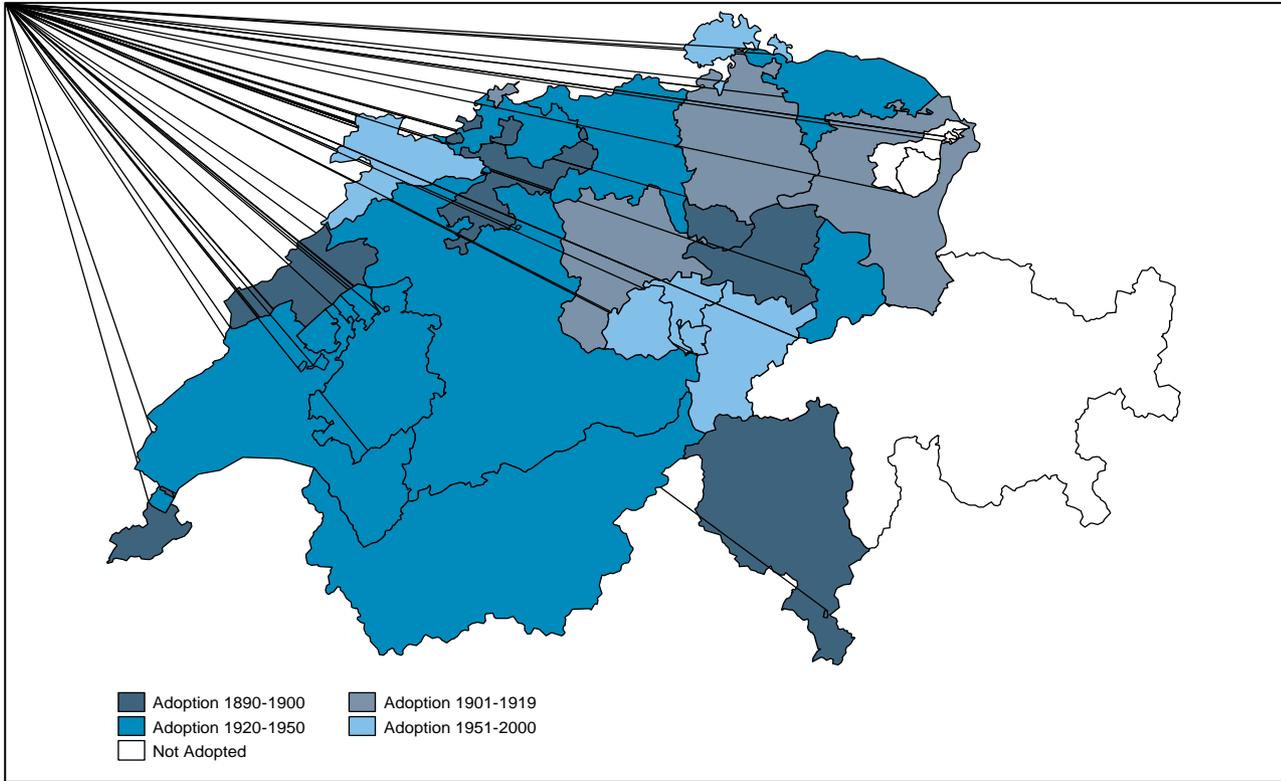
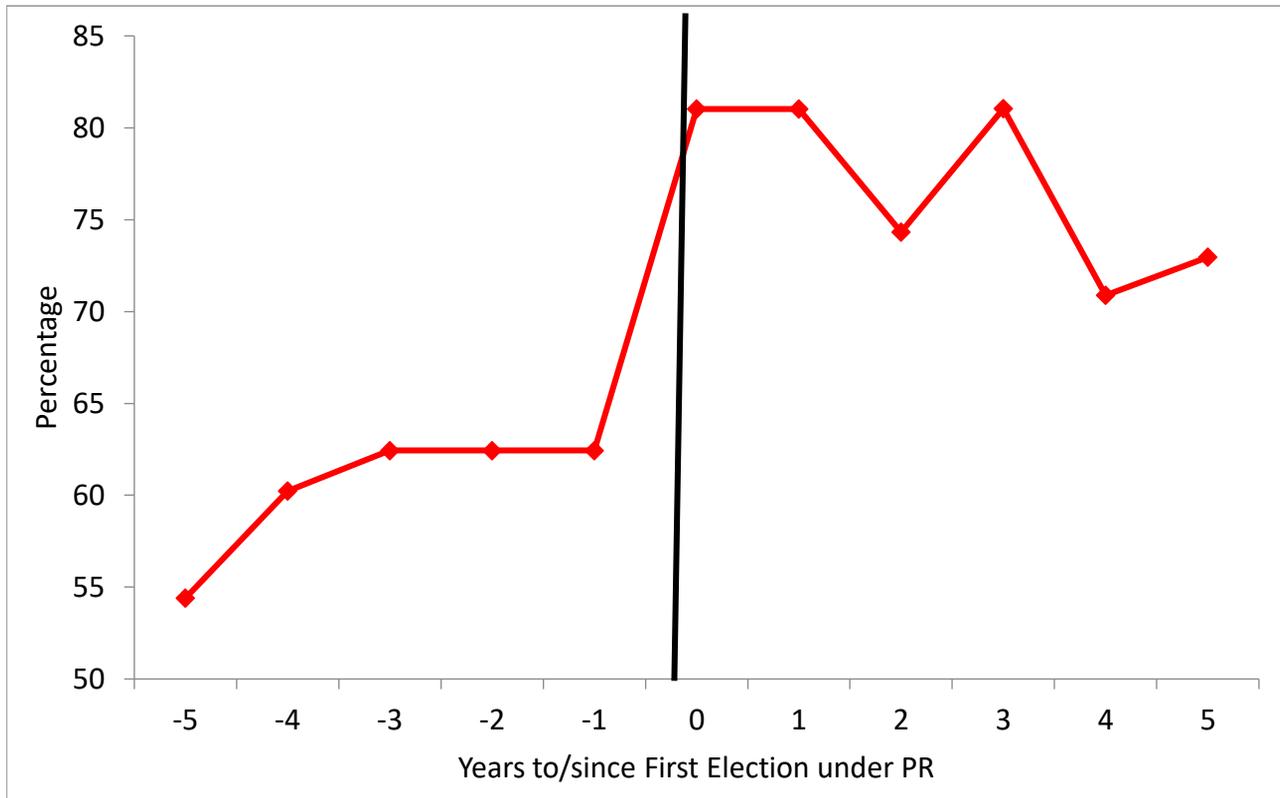
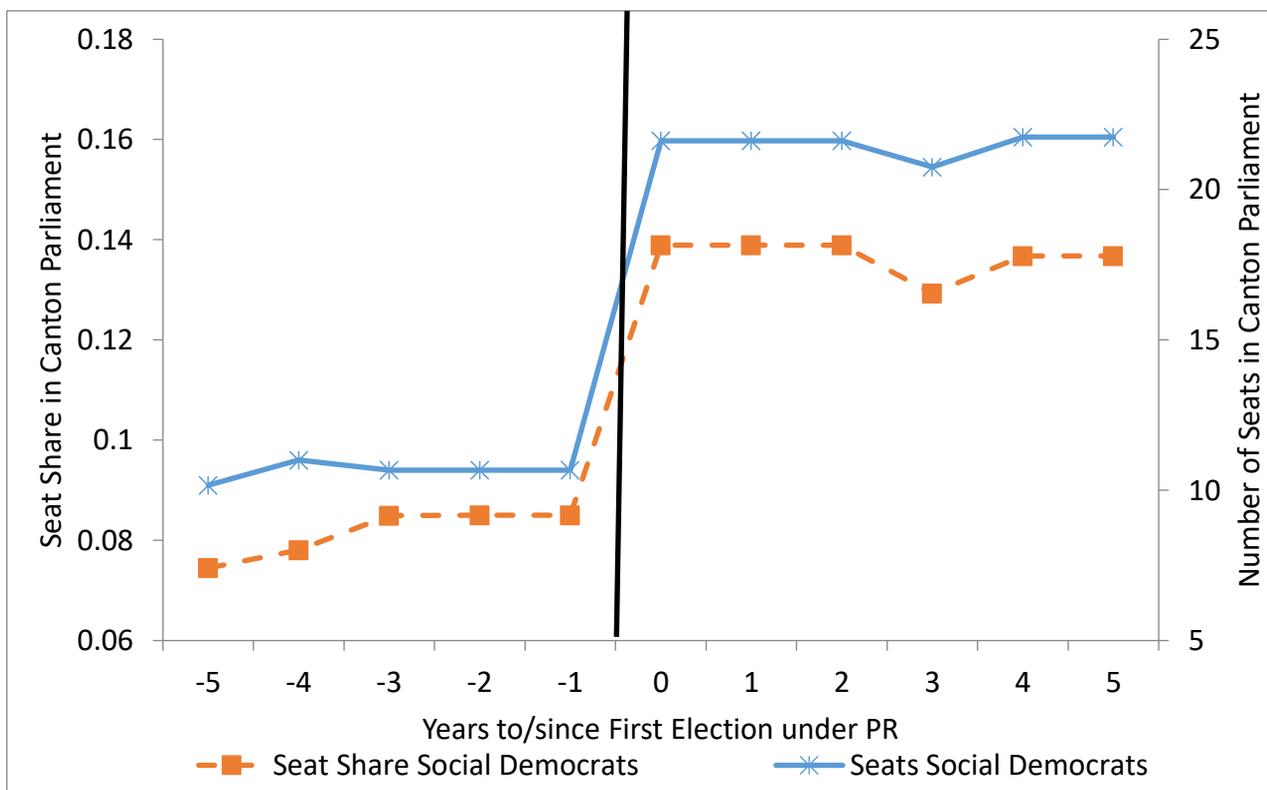


Figure 2: Proportional Representation and Turnout in Cantonal Elections



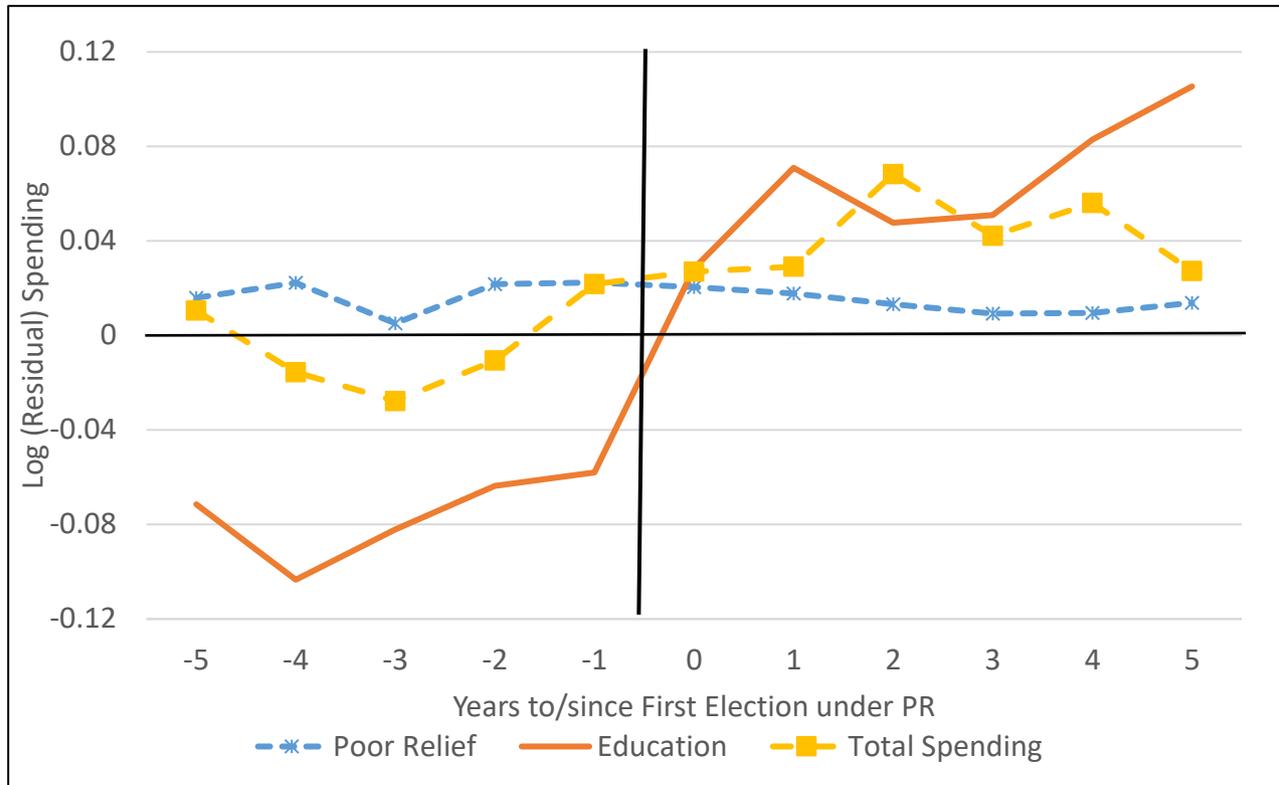
Notes: The table shows the evolution of voter turnout in elections for canton parliaments before and after the adoption of proportional representation. The x-axis shows the number of years before (negative) and after the first election under proportional representation (for which $x=0$). As electoral cycles differ across cantons, non-election years in a canton are assigned the value of the previous election.

Figure 3: Proportional Representation and the Share of Left-Wing Parties



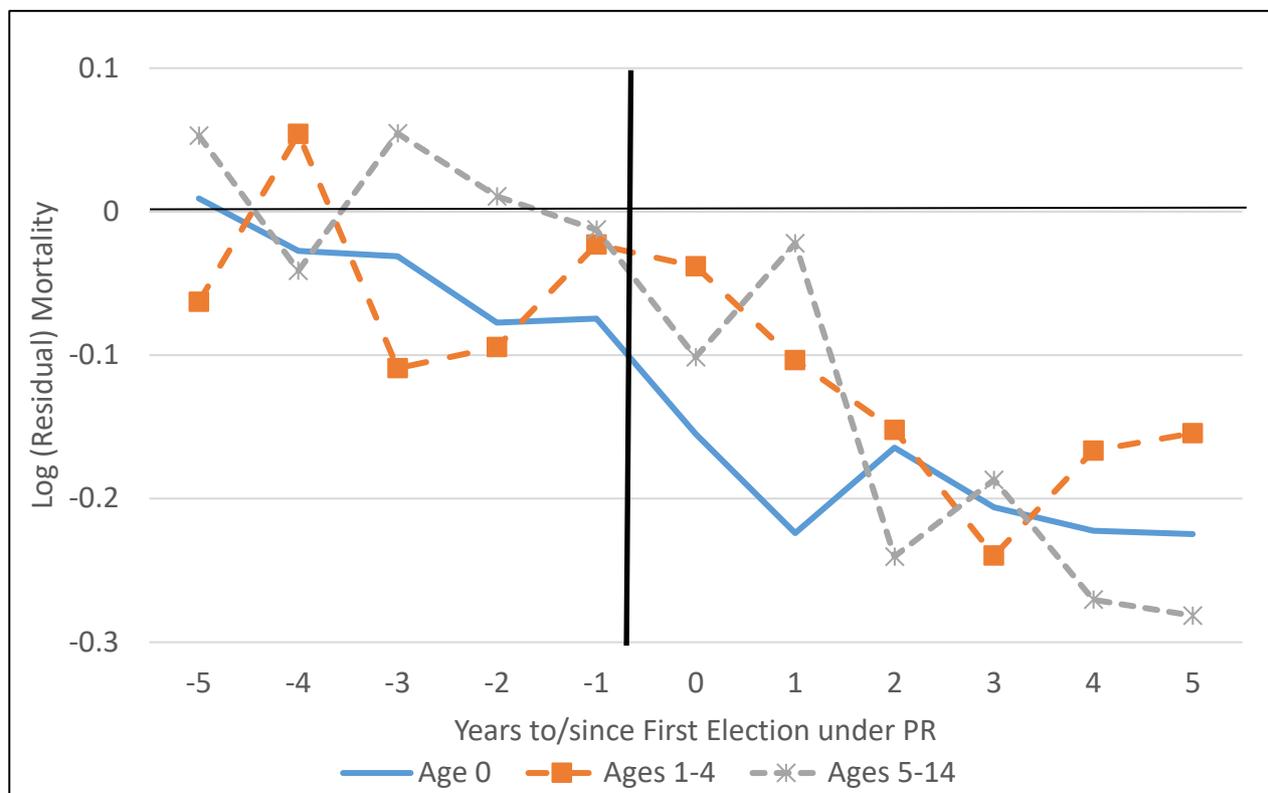
Notes: The figure shows the seat shares (left axis) and number of seats (right axis) in canton parliaments won by left-wing parties. The axis shows the years before (negative) and after (positive) the first election (for which $x=0$) under proportional rule. As electoral cycles differ across cantons, non-election years are assigned the values of the previous election.

Figure 4: Proportional Representation and Public Spending



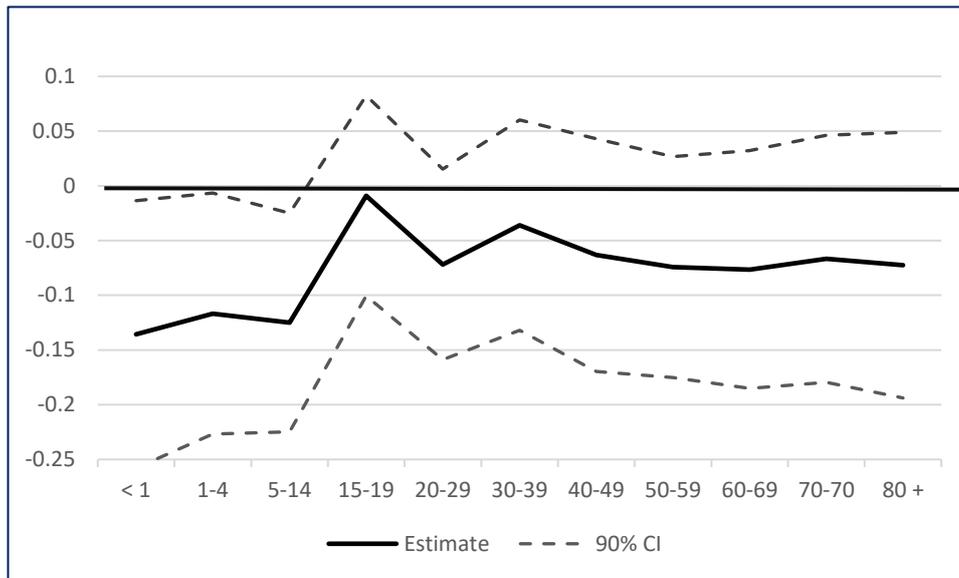
Notes : The figure shows the residual log public spending for the 5 years before (negative numbers on the x-axis) and the 5 years after (positive numbers on the x-axis) the first election took place under proportional representation in a canton. The residuals are obtained by regressing the log of expenditures per capita in the specific category on canton and year fixed effects, canton-specific linear trends and controls for cantonal population and the broad age structure.

Figure 5: The Timing of Proportional Representation and Deaths by Age



Notes : The figure shows the residual log deaths in a specific age range for the 5 years before (negative numbers on the x-axis) and the 5 years after (positive numbers on the x-axis) the first election (for which $x=0$) took place under proportional representation in a canton. The residuals are obtained by regressing the log of (1 plus) the number of deaths in the age range on canton and year fixed effects, canton-specific linear trends and controls for cantonal population and the broad age structure.

Figure 6: Proportional Representation and Age-Specific Mortality



Notes : The figure shows the estimates and 90% confidence intervals of the residual log deaths in the age range specified on the x-axis. The residual is obtained by regressing the log of (1 plus) the number of deaths in the age range on canton and year fixed effects, canton-specific linear trends and controls for cantonal population and the broad age structure.

Table A1: Reforms of Electoral System in Swiss Parliaments

	Adoption of Proportional System	Mixed System	Failed Efforts to Introduce PR	
	(1)	(2)	by Voter Initiative	by Petition (Parliament or Government)
	(1)	(2)	(3)	(4)
<u>Adopted prior to 1919:</u>				
Ticino (TI)	1891			1890
Geneva (GE)	1892			
Zug (ZG)	1894	X		
Neuchatel (NE)	1895			
Solothurn (SO)	1896		1892	
Schwyz (SZ)	1900	X		
Basle City (BS)	1905	X	1889, 1895	1890
Lucerne (LU)	1911		1893, 1895	1882, 1890, 1895
St. Gallen (SG)	1912		1893, 1901, 1906	1893
Zurich (ZH)	1917		1911	1881, 1889, 1891, 1899
<u>Adopted 1920-1945:</u>				
Basle County (BL)	1920			
Glarus (GL)	1920			
Thurgau (TG)	1920		1904	
Aargau (AG)	1921		1909	
Fribourg (FR)	1921			1894
Valais (VS)	1921			1918
Berne (BE)	1922		1895, 1897	1892, 1900
Vaud (VD)	1949/1962		1920, 1931, 1937	1885, 1893, 1896
<u>Adopted 1951-2000:</u>				
Schaffhouse (SH)	1952	X	1918, 1924	
Nidwalden (NW)	1982			
Obwalden (OW)	1986			1946, 1957, 1974
Uri (UR)	1992	X	1985	
<u>Not Adopted:</u>				
Appenzell Outerrhode (AR)	1996	X		
Appenzell Innerrhode (AI)	N/A			
Grisons (GR)	N/A		1982, 1996	

Notes: The table summarizes the adoption process of electoral reforms in the cantons. Column (1) shows the first year the canton parliament was elected under proportional rule, while column (2) indicates the cantons that allow for a mixed proportional system: *Vaud* had a mixed electoral system between 1949 and 1962 before adopting a pure proportional system in 1962. *Appenzell-Outerrhode* allows its districts to adopt proportional representation since 1997 but only one (Herisau) out of six has chosen to do so. *Appenzell-Innerrhode* and *Grisons* still have a majoritarian system in place. Column (3) indicates the year of a voter initiative to introduce proportional representation failed, while column (4) lists the year a parliamentary petition to introduce proportional rule was discussed but rejected in a canton.

Source: Canton constitutions; Lutz and Strohmann (1998).

Table A2: Panel Regressions of Adoption Decision

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Hegemony of Dominant Party	-0.226 [0.137]												-0.185 [0.139]
# Parties in National Elections	-0.036** [0.014]												-0.028* [0.014]
Signature Requirement Initiative	-0.002 [0.002]												-0.003 [0.002]
Religious Heterogeneity		0.771 [2.389]											-1.051 [1.973]
Language Heterogeneity		-1.288 [2.186]											-0.718 [1.683]
Urban Population			0.001 [0.005]										-0.001 [0.005]
Manufacturing Employment (%)			0.004 [0.009]										-0.001 [0.008]
Teachers Primary School (in logs)				0.083 [0.080]									0.096 [0.082]
Teachers Lower Secondary School (in logs)				0.014 [0.017]									0.009 [0.020]
Turnout in National Elections					0.000 [0.001]								0.001 [0.001]
% Left-Wing Parties (National Elections)						-0.000 [0.002]							-0.001 [0.002]
Total Expenditures (in logs)							0.027 [0.092]						0.040 [0.094]
Growth in (log) Expenditures								0.030 [0.021]					-0.010 [0.064]
Total Deaths (in logs)									-0.041 [0.055]				-0.059 [0.074]
Growth in (log) Deaths										-0.014 [0.014]			0.012 [0.033]
Infant Deaths (in logs)											-0.012 [0.027]		-0.009 [0.039]
Growth in (log) Infant Deaths												-0.003 [0.004]	0.003 [0.020]

Notes: The dependent variable is equal to one if a canton has held the first election under proportional representation in a given year and zero otherwise. The variable is equal to the share of the year when the first election is held under proportional representation. The independent variables are all lagged three years to allow for the lag in political decision-making. Column (1) includes the signature requirement (in %) to get a new law on the ballot, the seat share of the largest non-left party in the canton parliament and the number of parties in the federal parliament. Column (2) includes Herfindahl indices for religious and language fractionalization of the population; column (3) the share of the urban population and manufacturing employment. Column (4) uses the number of teachers in primary and lower secondary education. Columns (5) and (6) include the turnout in national elections and the vote share of left-wing parties in federal elections respectively. Columns (7) and (8) include total spending (in logs) and the % growth in total spending respectively. Columns (9) and (10) include the total number of deaths in a canton in logs and the % growth in total deaths. Columns (11) and (12) use the number of infant deaths (under the age of 1) and the %growth in infant deaths. Column (13) includes all explanatory factors simultaneously. All specifications include canton and year fixed effects as well as canton-specific trends. In addition, we control for population size (in logs) and the broad age structure of the population. Standard errors are clustered at the canton level. * p<0.1, ** p<0.05 and *** p<0.01.

Table A3: Correlates with Timing of Electoral Reform

Independent Variable	Estimate	Standard Error
Population (1890)	-0.026	[0.038]
Labor Force Participation (1890)	-0.739	[0.649]
Share Protestants (1890)	-135.28	[365.22]
Share Catholics (1890)	130.83	[363.88]
Religious Fractionalization	-28.756	[25.812]
Share German-Speaking (1890)	-246.66	[373.52]
Share French-Speaking (1890)	380.90	[414.27]
Linguistic Fractionalization	-5.930	[30.610]
Employment Share Manufacturing (1890)	-0.328	[0.301]
% Urban Population (1890)	-0.236	[0.179]
Persons in Household (1890)	-11.000	[13.742]
Height of Recruits (1888)	-4.178	[2.797]
Log Teachers Primary School (1890)	-6.491	[3.875]
Log Teachers Secondary School (1890)	-7.432**	[2.660]
Student-Teacher Ratio Primary School (1900)	0.173	[0.375]
Student-Teacher Ratio Secondary School (1900)	-0.596	[0.487]
Year Mandatory Budget Referendum Adopted	0.015**	[0.006]
Year Mandatory Law Referendum Adopted	0.003	[0.005]
Year Constitutional Initiative Adopted	-0.015	[0.012]
Year Executive is Directly Elected	-0.141	[0.176]
Year Social Democratic Party Founded	-0.014	[0.012]
Year Mandatory Health Insurance Adopted	0.004	[0.006]

Notes : The dependent variable is the year of adopting proportional representation in each canton. Cantons that have adopted proportional representation after 1950 or never adopted it are assigned the last year of our sample period (1950). The coefficient and standard error reported are from bivariate regressions with N=25.

Table A4: Number of Cantons with Nonmissing Information for Selected Canton-level Variables

Year	Turnout	Left-Wing Parties	Health Spending	Welfare Spending
1890	1	3	13	2
1895	4	6	13	2
1900	4	7	13	2
1905	4	7	13	2
1910	4	8	25	25
1915	5	9	13	2
1920	6	15	13	2
1925	8	18	13	2
1930	8	17	25	25
1935	9	20	25	25
1940	9	21	25	25
1945	9	22	25	25
1950	11	22	25	25

Notes : Turnout data are not available for Appenzell-Innerrhode, Appenzell-Outerrhode, Basle Country, Friourg, Geneva, Grisons, Neuchatel, Nidwalden, Obwalden, Schaffhouse, Schwyz, Uri, Vaud and Valais; the seats for left-wing (or other) parties is unavailable for the two cantons that have held town meetings over this period (Appenzell-Innerrodhe, Appenzell-Outerrhode and Obwalden).

Table A5: Proportional Representation and Other Parties

	<u>Farmers' Party</u>		<u>Radicals</u>		<u>Conservatives</u>	
	Vote Share	# Seats	Vote Share	# Seats	Vote Share	# Seats
	Canton level	in Parliament	Canton level	in Parliament	Canton level	in Parliament
	(1)	(2)	(3)	(4)	(5)	(6)
Proportional Representation	0.050*	7.614	-0.085	-11.173	0.021	2.495
	[0.026]	[5.824]	[0.050]	[10.411]	[0.022]	[2.307]
Demographic Controls	Yes	Yes	Yes	Yes	Yes	Yes
Canton Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Canton-Specific Trends	Yes	Yes	Yes	Yes	Yes	Yes
Observations	832	247	832	247	832	247
R Squared	0.937	0.958	0.903	0.928	0.992	0.993
Mean Dependent Variable	0.05	8.64	0.35	41.92	0.30	32.105

Notes : The dependent variables in odd columns are the vote shares in parliamentary elections at the canton level (columns (1), (3) and (5)) for the farmers' party, Radicals and Conservatives. The dependent variables in even columns are the number of seats in canton parliament (columns (2), (4) and (6)) for these same parties respectively. The main independent variable is equal to one if the cantonal parliament is elected by proportional rule and zero if it is elected under majoritarian rule. The variable is equal to the share of the year under proportional rule in the year the first election is held under the proportional system. All specifications contain year and canton fixed effects as well as canton-specific linear trends. In addition, we control for canton population (in logs) and the broad age structure of the population. Standard errors are clustered at the state level. * p<0.1, ** p<0.05 and *** p<0.01.

Table A6: Proportional Representation and Voter Preferences in Federal Ballots

	<u>Support for More Government</u>				<u>Support for More Public Spending</u>			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Proportional Representation	-2.195 [1.962]	0.255 [1.749]			-5.197* [2.537]	-1.306 [2.359]		
Years since Adoption			-0.103* [0.057]	0.021 [0.071]			-0.176** [0.076]	0.067 [0.098]
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Demographic Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Economic Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Canton Fixed Effects	No	Yes	No	Yes	No	Yes	No	Yes
Observations	500	500	460	460	425	425	391	391
R Squared	0.746	0.779	0.745	0.776	0.604	0.714	0.600	0.713
Mean Dependent Variable	33.86	33.86	33.86	33.86	27.32	27.32	27.32	27.32

Notes : The table investigates the link between proportional representation and the support for government spending using data on federal ballots (referendums or voter initiatives). The sample includes all ballots with explicit consequences for government intervention or public spending held between 1890 and 1950. In columns (1)-(4), the dependent variable is the percentage of voters in a canton who voted in favor of more activity by the federal government; in columns (5)-(8), the dependent variable is the percentage of voters in a canton in favor of more public spending at the federal level. The information is extracted from the parliamentary debates and information material sent to each citizen prior to the vote, which contains, among others, detailed information about the financial consequences of a ballot. The main independent variable in columns (1)-(2) and (5)-(6) is equal to one if the cantonal parliament is elected by proportional rule and zero if it is elected under majoritarian rule. The variable is equal to the share of the year under proportional rule in the year the first election is held under the proportional system. Non-election years are assigned the value of the previous election. The key independent variable in columns (3)-(4) and (7)-(8) is equal to the number of years since adoption of proportional representation (with zero for non-adopters). All specifications include controls for population (in logs), the broad age structure in a canton, share urban, share protestants, share employed in agriculture and manufacturing, the share of car owners and year fixed effects. Even columns further add canton fixed effects. Standard errors are clustered at the canton level. * p<0.1, ** p<0.05 and *** p<0.01.

Table A7: Other Potential Channels

<u>Living Standards</u>	<i>Mean Cantonal Income</i>		<i>Mean Income (in logs)</i>		<i>Height of Army Recruits</i>	
Proportional Representation	371.295 [291.580]	-86.630 [267.991]	0.120 [0.110]	-0.111 [0.121]	0.320 [0.394]	0.222 [0.198]
Observations	287	287	287	287	325	325
R Squared	0.820	0.944	0.806	0.948	0.718	0.976
Time Period Available	1917-1950		1917-1950		1890-1950	

<u>Income Inequality</u>	<i>Gini coefficient</i>		<i>Top 1% Income Share</i>		<i>Welfare caseload (in logs)</i>	
Proportional Representation	0.008 [0.012]	-0.024 [0.023]	0.049 [0.531]	-0.154 [0.819]	0.113 [0.248]	0.471 [0.307]
Observations	287	287	287	287	100	100
R Squared	0.847	0.909	0.535	0.697	0.784	0.875
Time Period Available	1917-1950		1917-1950		1890-1950	

Notes: The table reports whether proportional representation is associated with higher living standards or lower inequality. The dependent variables in the medium panel are average cantonal income per year, the log of average annual income (constructed from tax statistics) and the height of army recruits in centimeters (taken from data on army recruits). In the bottom panel, the dependent variables are the Gini coefficient, the share of cantonal income owned by the top 1% (taken from tax statistics) and the caseload on poor relief (in logs). All specifications include log population, the broad age structure of the canton and year fixed effects. The second specification also includes canton fixed effects. Standard errors are clustered at the state level. * p<0.1, ** p<0.05 and *** p<0.01. The last row shows the time period for which the dependent variables are available.

Table A8: Proportional Representation and Age-Specific Mortality

	Estimate (1)	Std. Error (2)
Deaths under 1	-0.136*	[0.071]
Deaths 1-4	-0.117*	[0.064]
Deaths 5-14	-0.125**	[0.058]
Deaths 15-19	-0.009	[0.053]
Deaths 20-29	-0.072	[0.051]
Deaths 30-39	-0.036	[0.056]
Deaths 40-49	-0.063	[0.062]
Deaths 50-59	-0.074	[0.059]
Deaths 60-69	-0.076	[0.063]
Deaths 70-79	-0.067	[0.066]
Deaths 80 and older	-0.072	[0.071]

Notes: The dependent variables shown in the left column are the log of one plus the number of age-specific deaths in each canton and year. The main independent variable is equal to one if the cantonal parliament is elected by proportional rule and zero if it is elected under majoritarian rule. The variable is equal to the share of the year under proportional rule in the year the first election is held under the proportional system. Non-election years are assigned the value of the previous election. Each estimate and standard error come from a separate regression of equation (1) with N=1,399. All specifications contain year and canton fixed effects as well as canton-specific linear trends. In addition, we control for canton population (in logs) and the broad age structure of the population. Standard errors are clustered at the state level. * $p < 0.1$, ** $p < 0.05$ and *** $p < 0.01$.

Table A9: Proportional Representation and Controlling for Confounding Influences

	<u>Voter</u> <u>Preferences</u> (1)	<u>Population</u> <u>Heterogeneity</u> (2)	<u>Canton</u> <u>Education</u> (3)	<u>Migration</u> (4)	<u>Direct</u> <u>Democracy</u> (5)	<u>Political</u> <u>Conflict</u> (6)	<u>Leave out Years</u> <u>around Reform</u> (7)	<u>20 Years around</u> <u>Reform Only</u> (8)	<u>Canton*Decade</u> <u>Dummies</u> (9)
<u>Turnout and Representation:</u>									
Voter Turnout	15.661*** [2.154]	14.746*** [2.926]	11.501** [3.603]	14.553*** [4.180]	14.951*** [3.942]	12.330** [4.187]	13.058*** [2.635]	18.398*** [3.727]	14.563*** [2.220]
# Seats Left-Wing Parties	11.285** [4.767]	8.936* [4.850]	11.745* [6.514]	9.110* [4.732]	10.354** [4.721]	10.330* [5.108]	10.409** [4.920]	7.625 [6.418]	7.575 [6.964]
<u>Canton-level Spending:</u>									
Health Spending	0.144 [0.184]	0.169 [0.165]	0.123 [0.214]	0.196 [0.219]	-0.006 [0.163]	0.160 [0.217]	0.079 [0.225]	0.105 [0.154]	-0.097 [0.063]
Poor Relief	-0.007 [0.054]	-0.023 [0.053]	-0.022 [0.049]	-0.003 [0.051]	0.007 [0.020]	-0.008 [0.055]	-0.001 [0.061]	0.012 [0.017]	0.008 [0.021]
Education Spending	0.187** [0.074]	0.179** [0.080]	0.220** [0.089]	0.274*** [0.075]	0.177** [0.074]	0.267*** [0.077]	0.204** [0.089]	0.139** [0.065]	0.150** [0.071]
<u>Deaths by Age:</u>									
Deaths under 1	-0.108* [0.055]	-0.104 [0.074]	-0.127** [0.056]	-0.122* [0.062]	-0.108 [0.080]	-0.140* [0.071]	-0.147* [0.082]	-0.074* [0.042]	-0.109 [0.083]
Deaths 1-4	-0.094 [0.055]	-0.094 [0.068]	-0.137*** [0.048]	-0.106* [0.059]	-0.058 [0.075]	-0.122* [0.064]	-0.109 [0.069]	-0.078** [0.034]	-0.061 [0.078]
Deaths 5-14	-0.107* [0.062]	-0.110* [0.060]	-0.090* [0.046]	-0.127** [0.059]	-0.045 [0.070]	-0.128** [0.058]	-0.150* [0.073]	-0.065 [0.043]	-0.067 [0.073]
<u>Deaths by Cause:</u>									
Meningitis	-0.200** [0.082]	-0.195* [0.094]	-0.156* [0.085]	-0.190** [0.087]	-0.223** [0.106]	-0.192** [0.086]	-0.209** [0.095]	-0.144** [0.067]	-0.215** [0.102]
Urogenital TB	-0.095* [0.055]	-0.097* [0.055]	-0.103 [0.071]	-0.098* [0.054]	-0.289** [0.110]	-0.098* [0.055]	-0.119* [0.060]	-0.086 [0.067]	-0.258** [0.109]
Diarrhea Deaths Infants	-0.151*** [0.052]	-0.134** [0.060]	-0.370*** [0.115]	-0.128** [0.046]	-0.151** [0.058]	-0.150** [0.056]	-0.158** [0.062]	-0.130* [0.062]	-0.002 [0.058]
Infectious Diseases	-0.096** [0.044]	-0.092** [0.043]	-0.137*** [0.034]	-0.098** [0.044]	-0.098** [0.045]	-0.102** [0.043]	-0.107** [0.045]	-0.098 [0.065]	-0.020 [0.039]

Notes: The dependent variables are shown in the left row. Each entry comes from a separate regression of the dependent variable on the proportional representation measure (see notes to main tables for details). All specification includes canton and year fixed effects, canton-specific linear trends and controls for population and the broad age structure in a canton. Column (1) includes controls for voter preferences derived from canton-level voting in federal ballots. Column (2) controls for religious and linguistic fractionalization (measured as one minus the Herfindahl index for 3 language and religious groups). Column (3) adds educational enrolment in primary, lower and upper secondary education. Column (4) controls for the share of the population who still live in their canton of birth. Column (5) adds whether a canton has a mandatory law referendum, a mandatory budget referendum and the signature requirement for the voter initiative. Finally, column (6) includes the seat share of the largest non-left party and the number of parties in the national parliament. Column (7) shows the baseline with the two years before and after the reform dummied out. Column (8) uses only the twenty years before and after each reform for estimation. Finally, column (9) includes flexible canton-specific decade dummies. Standard errors are clustered at the canton level. * p<0.1, ** p<0.05 and *** p<0.01. See also notes to previous tables.

Table A10: Proportional Representation and Internal Migration

	% Living in same Canton since Birth			
	(1)	(2)	(3)	(4)
Years since Adoption	-0.114 [0.184]	0.098 [0.081]	-0.058 [0.080]	0.103 [0.073]
Demographic Controls	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes
Canton Fixed Effects	No	Yes	No	Yes
Time Period	1890-1950	1890-1950	1890-2000	1890-2000
Observations	150	150	275	275
R Squared	0.502	0.955	0.438	0.883

Notes : The table investigates the link between proportional representation and the prevalence of internal migration using the decennial Census. The dependent variable is the share of individuals who live in their canton of birth. Columns (1) and (2) restrict the data to our sample period (1890-1950), while columns (3) and (4) use all Census years from 1890 to 2000. The main independent variable is the number of years since the cantonal parliament is elected under proportional rule; the variable is zero if the parliament is elected under majoritarian rule. All specifications include decade fixed effects as well as controls for population (in logs) and the broad age structure in a canton. Even columns further add canton fixed effects. Standard errors are clustered at the canton level. * $p < 0.1$, ** $p < 0.05$ and *** $p < 0.01$.

Source : Population Census (1890-2000)

Table A11: Alternative Ways to Estimate Standard Errors

	<u>Baseline (State)</u>	<u>No Clustering</u>	<u>Kanton * Pre-/</u> <u>Post-Reform</u>	<u>Wild Bootstrap</u>	
	(1)	(2)	(3)	<u>Binary weights</u>	<u>Webb weights</u>
	(1)	(2)	(3)	(4)	(5)
<u>Turnout and Representation:</u>					
Voter Turnout	14.055*** [3.364]	14.055*** [2.971]	14.055*** [2.648]	14.055 [9.110; 19.00]	14.055 [6.560; 21.549]
# Seats for Left-Wing Parties	10.409** [4.920]	10.409** [4.029]	10.409** [3.928]	10.409 [3.855; 16.986]	10.409 [0.357; 20.575]
<u>Canton-level Spending:</u>					
Health Spending	0.161 [0.217]	0.161* [0.089]	0.161 [0.218]	0.161 [-0.243; 0.542]	0.161 [-0.287; 0.609]
Poor Relief	-0.010 [0.055]	-0.010 [0.019]	-0.010 [0.057]	0.130 [-0.018; 0.271]	0.130 [-0.034; 0.294]
Education Spending	0.177** [0.078]	0.177*** [0.034]	0.177** [0.069]	0.177 [0.028; 0.318]	0.177 [0.017; 0.338]
<u>Deaths by Age:</u>					
Deaths under 1	-0.136* [0.071]	-0.136*** [0.037]	-0.136* [0.072]	-0.136 [-0.253; 0.010]	-0.136 [-0.283; 0.012]
Deaths 1-4	-0.117* [0.064]	-0.117*** [0.042]	-0.117* [0.059]	-0.117 [-0.228; 0.001]	-0.117 [-0.250; 0.02]
Deaths 5-14	-0.125** [0.058]	-0.125*** [0.042]	-0.125 [0.075]	-0.125 [-0.235; -0.002]	-0.125 [-0.245; -0.004]
<u>Deaths by Cause:</u>					
Meningitis	-0.191** [0.086]	-0.191*** [0.062]	-0.191* [0.100]	-0.191 [-0.343; -0.045]	-0.191 [-0.369; -0.013]
Urogenital TB	-0.098* [0.054]	-0.098 [0.060]	-0.098 [0.061]	-0.098 [-0.191; -0.001]	-0.098 [-0.211; 0.014]
Diarrhea Deaths Infants	-0.149** [0.056]	-0.149*** [0.040]	-0.149** [0.056]	-0.149 [-0.254; -0.038]	-0.149 [-0.265; -0.034]
Infectious Diseases	-0.097** [0.044]	-0.097*** [0.021]	-0.097*** [0.036]	-0.097 [-0.177; -0.011]	-0.097 [-0.188; -0.006]

Notes : The dependent variables are shown in the left row. Each entry comes from a separate regression of the dependent variable on the proportional representation measure (see notes to main tables for details). All specifications include canton and year fixed effects, canton-specific linear trends and controls for population and the broad age structure in canton. Column (1) shows the baseline with clustering at the state level; column (2) shows standard errors without clustering, while column (3) reports standard errors with separate canton-specific clusters before and after electoral reform. * p<0.1, ** p<0.05 and *** p<0.01. Columns (4) and (5) implement two wild bootstrap procedures using binary weights and Webb (6 point) weights (see Cameron and Miller, 2015 for details). Here, the numbers in square brackets are the upper and lower bounds of the 95% confidence intervals.