Was the Industrial Revolution censored in Austria before 1848?
Industrial Revolution Uncensored: Institutional Change and Useful Human Capital in the Wake of the 1848 Revolutions

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Abstract: Exploiting the 1848 revolution in the Austrian Empire, I study how a sudden institutional change impacts economic development. In contrast to much existing research, which focuses on the rule of law and the security of property rights, I argue that the main impact occurred through the expansion of the upper-tail useful human capital (Mokyr, 2005) following the revolution. While the revolution was defeated, important liberalizing reforms persisted in the areas of (i) the press, (ii) technical education and (iii) knowledge-promoting voluntary associations – the information space, for short. Pushing back against the existing consensus that the revolution had no discernible impact on the empire's economic development, I combine newly collected data on the pre-1848 and post-1848 information space with data on the use and location of steam engines in 1841–1863 to establish the causal link between the post-1848 reforms and the diffusion of this important industrial technology.

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1. Introduction

The notion that institutions matter for economic development has a long pedigree but a more precise understanding of the actual mechanics of this causal link is still subject to much debate. One way to investigate the relationship is to study the impact of a sudden, sweeping institutional change, such as the Glorious Revolution or the French Revolution (North and Weingast, 1989; Acemoglu et al., 2011). Such approach has its advantages: the suddenness of the revolution allows for a clearcut comparison of before and after while its sweeping breadth presumably furnishes a big enough shock to produce a measurable effect. It also has its downsides, however. Victorious revolutions alter many institutions at once, often at the most general, constitutional, level, making clear identification of the specific institutional cause and its economic effect difficult. Moreover, even a profound institutional change can take time to make a difference, leading to more ambiguity in the identification. A further, practical complication is that the farther back in history one goes, the scarcer are precise, consistent, continuous indicators of social and economic activity, in which the institutional change could leave its mark.

Clearly, the nature of institutional change entails many biases against finding an effect. Even those revolutions which supposedly ushered in the "right" kind of institutions – among which the Glorious Revolution of 1689 is the poster case – produce rather few unambiguous breaks in relevant measures of economic activity (Murrell, 2017; Clark 1996). In the case of France, the dismantling of feudal land ownership after 1789 led, in the long run, to improved agricultural productivity (Finley et al, 2021) and more investment in infrastructure (Rosenthal, 1992), but it is doubtful whether such effects were replicated in France's neighbors, when the reforms were exported there via conquest (Kopsidis and Bromley, 2016). Extending the skepticism further east, the 1848 revolution in the Habsburg Empire, which is the focus of this paper, has long ago been declared an economic non-event,

with no discernible impact, positive or negative, on the underlying development of the empire (Komlos, 1983; Good, 1984; Good, 1991; Rudolph, 1983).

Cliometric research into institutional change usually focuses on the rule of law and security of property rights in areas such as land tenure, serfdom, extractive taxation and state capacity – not on human capital. In contrast to the ruptures of revolutions, the role of upper-tail useful human capital, championed by Mokyr (2005, 2017) as the key ingredient in the onset of industrialization, is usually viewed as a long-term phenomenon, unfolding over generations and centuries. Squicciarini and Voigtlander (2015) furnish a telling example when they link the subscriptions to the *Encyclopédie* in pre-1789 France to various mid-19th century measures of French economic development, effectively sidestepping the political events of 1789–1815 altogether.

Here is where Austria's revolution of 1848 presents a welcome change of pace, offering a constellation of events which brings the two key concepts – sudden institutional change and upper-tail useful human capital – into a single focus. The Spring of Nations was a sudden outburst of political activity after more than three decades of an infamously rigid and reform-averse regime of Prince Metternich. Yet, the initial radicalism notwithstanding, it was a fairly contained episode: the revolution was defeated by the summer of 1849 and a neo-absolutist regime was re-established by the end of 1851. The three revolutionary years nonetheless succeeded in shifting the domestic political equilibrium (i) towards more technical and practical education, (ii) towards better availability and higher circulation of the press (including technical press), and (iii) towards a greater freedom of (non-political) association (e.g. self-improvement and development-promoting societies). In all three areas, the shift away from censorship, repression and curriculum control is observable in the law. I argue that this led to an almost immediate increase in upper-tail human capital that can be then causally linked to the similarly rapid diffusion of the steam engine after 1848.

The statistical analysis, supporting the argument, proceeds in three steps. In the first step, I show that the 1848–51 period was a moment of a sharp, clean break – if one knows where to look. I apply the Bai-Perron (1998, 2003, 2006) algorithm, employed in similar contexts by Murrell (2016), to 259 time series of economic, social and cultural indicators spanning 1815–75 to search for breaks during the revolutionary years 1848–51. I show that those series capturing economic activity do not break in trend between 1848 and 1851, confirming the earlier conclusions of cliometricians (Komlos, 1983). However, the time series capturing changes in upper tail human capital are unambiguous "hockey sticks", all breaking in 1848–1851. All these breaks can be linked to specific laws, enacted in 1848–1851. In the second step, I describe the size of the changes in human capital, showing that the breaks were not only statistically significant but also large enough to matter economically. In the third step, I link the changes in the useful human capital to the adoption of the steam engine. I use four cross-sectional surveys of steam power use in the crownland of Bohemia in years 1841, 1847, 1851 and 1863 and link this dataset with newly collected data on pre-1848 and post-1848 extent of secondary technical schooling. Controlling for districts fixed effects, I show that districts that most benefited from the liberalization of the empire's information space also recorded the fastest and greatest expansion in the use of steam engine.

The argument has implications for our understanding of the role of institutions in explaining why nations fail. The early 19th century Austrian institutions were not particularly extractive: the country had a modern Civil Code since 1812, personal bondage was gone and the public administration was not too corrupt or unpredictably predatory. Quite to the contrary, the Metternichian regime made a point of being bound tradition and sticking to the tried and tested ways – in contrast to the wild experiments of the French revolution. Censorship of the press and classical curriculum in school were important parts of the policy package designed to ensure stability and public order. And yet, these were the very

institutions through which, by the lights of this paper, the government contributed to, and reinforced, the empire's economic backwardness.

2. Discussion of existing literature

Since the institutional explanation of economic growth rose to prominence, research has made amply clear that identifying the precise impact of institutions is complicated: many institutional features (e.g. security of property rights) are difficult to measure; the timing of institutional change is not always easy to pin down (Murrell, 2017: Table 1), and the precise mechanism of causation need not be straightforward. Usually, the causal link is hypothesized to work through predictability of investment. Simply put, economic agents are wary of making large investments, when they are not sure whether they would reap the returns. Consequently, "adverse political regime reduces material output principally by driving up the return on capital, and hence reducing its supply" (Clark, 1996: 565). Some cross-sectional comparisons of substantial institutional differences across space have yielded results consistent with this argument (van Bavel et al., 2018; Bosker et al., 2013). Pinning down the impact of institutional change across time has proven trickier. In the case of the Glorious Revolution, neither Clark (1996), nor Sussman and Yafeh (2006), nor Murell (2017: Table 4) find evidence of more secure property rights leading to lower returns and more abundant capital supply, although Bogart (2011), comparing pre- and post-1688 parliamentary acts, reports a positive structural break in the volume of Parliament-approved infrastructure investment.

Outside Britain, the obvious candidate for an abrupt institutional change is the French Revolution, except that, through the Napoleonic Wars, the institutional upheaval lasted considerably longer and was arguably more all-encompassing than the Glorious Revolution, making any causal impact even more difficult to isolate. Acemoglu et al. (2011) attempt to

measure the effect of French institutional exports, such as the Civil Code and the abolition of feudal relations, in post-Napoleonic Germany. Given the varied scope and nature of the institutional change, they resort to proxy measures both for the treatment (using duration of Napoleonic occupation between 1792 and 1815) and for the outcome (degree of urbanization in the latter half of the 19th century). Inevitably, their approach was criticized for misdating, mischaracterizing and mismeasuring the institutional change (Kopsidis and Bromley, 2016). Nevertheless, Rosenthal (1992) documents how the revolutionary abolition of feudal privileges in France simplified land ownership, thereby making infrastructural improvements more likely, and Finley et al. (2021) find that revolutionary land reallocations positively impacted agricultural productivity in mid-19th century.

In the case of the Habsburg monarchy, too, past research focused primarily on the impact of those post-1848 institutional changes that affected property rights. The prime candidate was the abolition of *robota*, the last vestige of coercive feudal labour relations, which enjoyed great political resonance at its time (Urban, 1982; Judson, 2016: 175–176). Within later Austrian historiography, the impact of 1848 was discussed in the context of the search for the Gerschenkronian "growth spurt" moment, for which the revolutionary year was one of the candidates (Gerschenkron, 1962; Good, 1991: 221). The first post-war generation of economic historians saw "1848" as a watershed, considering the numerous economic reforms of the 1850s (Brusatti, 1960; März, 1968: 15–19; Matis, 1972: 31, Sandgruber, 1978: 119). This was before consistent, standardized measures of the empire's economic development appeared. Then, having meticulously reconstructed the time series of industrial and mining production, Komlos (1983: 11) found no noticeable break in trend around mid-century and so concluded that the "mid-century reforms cannot be viewed as a watershed in the development" of the Habsburg economy. Good (1984: 86–95), citing Komlos (1983) writes off the abolition of *robota* as yielding no more than a one-off static gain. Similarly

modest – about 1–2% GNP – was the impact of the other big item, the abolition of internal tariff between Hungary and the rest of the Empire in 1850, which led in Hungary to some conversion of forests into croplands, increasing the latter by 8% (Alix-Garcia et al., 2018). These gains were perhaps worth having but they hardly add up to a wholesale change in a country's growth path. The inevitable conclusion was the "1848" did not matter for economic growth, since beyond these two big items, the revolution altered little that touched upon property rights, contractual freedom and market access.[1] Rudolph (1983) makes the point of recounting all the plausible causal mechanisms linking "1848" with industrialization, put forward by earlier historians, only to shoot them down one by one. It is telling, however, that liberalization of the empire's information space is not among them.

I therefore focus on institutions that affected the information space as a new, different route through which the revolution affected economic dynamism – a route that is not tied to security of property rights or rule of law but to periodical press, knowledge-promoting associations and technical schooling. The quality and breadth of this information space directly affected the upper tail of the distribution of human capital, especially the useful technical human capital (Mokyr, 2005: 1156–7). Such a technically savvy minority among workers can be a source of appreciable productivity gains and economic growth once it reaches a sufficient critical mass (Squicciarini and Voigtlander, 2015). In the Austrian case, I find that abolition of censorship led to proliferation of periodicals and that the reform of secondary schooling led to the expansion of the network of technical schools (known as *Realschulen*). The breaks in the relevant time series are unambiguous and can be clearly dated to 1848–51. All these institutional changes affected Habsburg citizens' access to information, representing a shift in the same direction: whereas before 1848 the overarching

[1] A similar point would apply to broader political or constitutional matters: Any notion of parliamentary oversight of the executive was quashed when the revolution was defeated. Far from independent, the judiciary continued as a branch of the imperial administration answering, in the last instance, to the Emperor.

principle both in censorship and in education was elitist and paternalistic, after 1848, various types of know-how became accessible to broader strata of the population. In other words, with the reforms of 1848, the Austrian Empire made definite steps towards developing and expanding what Mokyr and Voth (2010: 29–30) call the technically capable minority. These, then, were the men who as technicians and managers enabled Austrian businesses to grow through technological change, as will become apparent.

3. Institutional changes in the context of the 1848 revolution[2]

The revolution of 1848 marked a clear break between two eras. From the end of the Napoleonic Wars until 1848, Austrian politics operated in a regime shaped by Emperor Francis I who appointed Prince Metternich (Austria's foreign minister from 1809 and state chancellor from 1821) to head a conservative government of minimal political and social reform. The Metternichian system, as it came to be known, showed remarkable personnel continuity.[3] The institutional continuity was, if anything, even more pronounced. Table 1, which summarizes the institutional changes relevant for this paper, shows that most of the laws in force on the eve of the revolution had been in place, without an update or an amendment, for decades.

The revolution broke out abruptly in March 1848. There followed three years of frantic political activity which came to an end with the Silvester Patents of 1851, through which the recently crowned emperor Franz Joseph I instituted a neo-absolutist regime that lasted for a decade. While the young Emperor succeeded in putting the genie of Austria's first

[2] For a more detailed description of the institutional changes and the historical context, please see Appendix 1.
[3] For example, between 1815 and 1848, mere 18 individuals staffed the State Ministers' Conference, Austria's highest-level collective government organ of about 4–10 members. Their median tenure was 11 years, with Prince Metternich, the longest serving of all, lasting for 39. The Police Presidency, which also controlled the censorship apparatus, was held by Count Sedlnitzky from 1817 to 1848, while Count Mitrowsky led the Education Commission for 14 years during the same period. See the personnel data in Hof- und Staats-Schematismus des österreichischen Kaiserthums, 1808–1843, and Hof- und Staatshandbuch des österreichischen Kaiserthumes, 1844–1847.

constitutional experiment back in the bottle to some extent, the three revolutionary years brought about irreversible institutional changes in many areas of public life, including the abolition of *corveé/robota* and all other vestiges of feudal dues (1848), a reform of the administrative division of the country and introduction of civil (as opposed to feudal) governance (1849–56), the abolition of internal tariff (1850), a reform of the notary profession (1850), the creation of Chambers of Commerce (1850), new legislation regulating bills of exchange (1850) and a reform of criminal code (1852). Further reforms followed throughout the 1850s.[4] I focus on those introduced in 1848–51, which were directly shaped by the political demands of the revolutionary actors and which the Emperor did not have the power to stop or to overturn later on.

Furthermore, within the set of revolutionary reforms, I focus on those affecting the empire's information space: this includes the spheres of censorship, of education and of voluntary association. As Table 1 shows, the extent of these changes varied from area to area.[5] They were most pronounced in the sphere of schooling where the neo-absolutist regime adopted much of the revolution's agenda. Thus, the reformed and expanded 1849 secondary school curriculum remained in place, municipalities gained the right to establish new schools and even the central administration became active in launching new *Realschulen*, in contrast to its rather discouraging disposition of the pre-1848 years (Cvrcek, 2020: 45). The upper echelon of elementary schooling, the urban *Hauptschule*, too, received a new expanded curriculum so that it would serve as a steppingstone for potential *Realschule* applicants.

In the area of the press, the emperor tried to turn the clock back with less than complete success. Certainly, the press law of 1852 constrained the information space

[4] By then, the neo-absolutist regime was firmly in power. Thus, even if these later reforms can be viewed as deliberate moves to mollify particular political constituencies, they were not a direct product of revolutionary politics.

[5] This overview also omits the intermittent regulations that were put in place "on the hoof" during the revolutionary years 1848-51. They are described in Appendix 1.

compared to the free-for-all of 1848–49, when censorship was abolished overnight with next to no regulation replacing it. Nevertheless, the 1852 legislation was less stringent than what had been in place before 1848. Specifically, the switch from preventive to reactive censorship meant that the opaque pre-1848 system of censors was scrapped, the constraints on press freedom were now transparently specified in the press law and the decisions of relevant authorities were at least in principle challengeable in court. The law clearly singled out political periodicals as the focus of the government's censorial activity, leaving non-political publications, such as scientific or professional journals, relatively free to operate, as long as they steered clear of policy discussion. In short, the monarchy was far from embracing free press in the 1850s but the stringent regulations of the Metternich era did not return.

The least pronounced (though still observable) institutional shift occurred in the sphere of freedom of association. Since the 18th century, the monarchy's chief regulation was the imperial ban on secret societies, which applied to all organizations except the few explicitly permitted by the Emperor.[6] The need to regulate the fledgling sector of collective investment called forth a new decree in 1843, which standardized a system of concessions for both for-profit and non-profit associations, listing a set of areas in which they could operate (e.g. railroad and canal construction and mining, but also scientific and charitable pursuits). The 1848 revolution swept away the concession system at first, replacing it with a mere announcement requirement, but with the defeat of the revolution, a new 1852 law on associations effectively reproduced the 1843 decree, except for a few updates of administrative and procedural nature. Yet, while the formal regulations remained substantially the same, the enforcement became more lenient than it had been before 1848 –

[6] These fortunate few included provincial history-oriented "museum societies", some agricultural associations, musical societies and a few others, usually located in the capital and often operating with an imperial family member as their patron to ensure as much "political cover" as possible.

that is to say, more concessions were now granted than had been the case before the revolution, as will become apparent from the data below.

Unlike its West-European counterparts of 1688 and 1789, the Austrian revolution was defeated and therefore did not lead to a wholesale overhaul of the country's constitutional framework. The dynasty was not deposed, the suffrage was not introduced (except for a fleeting parliamentary experiment in 1848-49), the empire's constitutional structure was not (yet) substantially altered, large expropriations did not take place. Nonetheless, the revolution did produce substantial institutional change. Underneath the façade of institutional immutability of the Metternich regime, the Austrian society had been changing, its political center of gravity gradually shifting towards the urban bourgeois elements, engendering a new equilibrium which even the conservatives had to respect upon their return to power in 1851. This was why many of the revolutionary reforms survived the revolution's defeat.

4. Assessing the impact

Did the described institutional changes of 1848–51 have any effect on the spheres they were regulating? To answer this question, I apply a set of tests of structural breaks based on Bai and Perron (1998, 2003, 2006) and Ditzen, Karavias and Westerlund (2021) on a number of time series covering the relevant historical period. The test is open-ended enough to allow for testing for breaks in specific years as well as for breaks at unknown dates. The basic model is specified as follows:

Eq. 1

$$Y_t = \alpha_1 + \beta_1 t + \varepsilon_t \quad t = 1, 2, 3 \ \dots k-1$$
$$Y_t = \alpha_2 + \beta_2 t + \varepsilon_t \quad t = k, k+1, k+2 \dots T$$

where *k* can be either specified to be equal to a particular year or it can emerge as a result of estimation. Equation 1 assumes only a single break in year *k*, and thus two distinct regimes.

However, it can be generalized to a number of breaks, b, which implies $b+1$ distinct underlying regimes or periods and therefore $b+1$ sets of regression parameters. The logic of the test is to identify such number and locations of breaks and accompanying sets of regression parameters that minimize the global sum of squared residuals across the $b+1$ regimes.

There are three ways I test for the structural break. In the first, most constrained formulation (call it Test 1), I ask: was there a break specifically in 1848? Thus, the null hypothesis posits no structural break in 1848; the alternative hypothesis exactly one break that occurred in 1848. The test statistic is $W_\tau \approx F(b, q)$ where b is the number of breaks (here, $b = 1$) and q is the number of parameters open to change at the break date (in our case, two: α and β). In the second formulation (Test 2), the underlying question is: if we were to search for the single most prominent structural break, in which year would the data indicate that it occurred? This formulation of the test therefore allows for precisely one structural break in the series but the date of the break is estimated through the optimization described above. The third and most open-ended test (Test 3) is a sequential test for up to five distinct structural breaks with break dates left unspecified *a priori*.[7] Test 3 therefore asks whether 1848 (or the revolutionary period, 1848–51) would be the location of at least one of those breaks.

These tests of structural breaks are applied to 259 time series of various annual indicators spanning the period 1815–1875, covering a range of areas.[8] From among purely economic indicators, they include 10 output series (and their natural logarithms), 21 series of welfare ratios, or, effectively, real wages (one for each province), 21 cost-of living series and 21 food price series. As for periodicals, they include times series on the number of titles

[7] The only constraint on the dating of the breaks is implied by the specification of the "trimming" parameter, i .e. the shortest span between breaks, which is set at 15% of the length of the series. So, for a time series of 60 years (1815 – 1875), this would imply 9 years.

[8] The full list of the time series together with the test results is presented in the Appendix Table A1. Not all of the series span the whole time period but all start no later than 1828 and extend at least as far as 1865.

published by type of content (11 series), by language of publication (10 series), by location (23 series), and for selected language–content type combinations (12 series). Next to the number of titles, corresponding time series are also available for the number of issues published annually (56 series). Further, I apply the test to 12 series pertaining to the provision of education and 14 series of elementary school enrolment rates by province. I also test 18 times series capturing voluntary associations by location and 30 time series measuring voluntary associations by focus of activity.

The complete set of test results is reported in Appendix Table A1; here, let us focus on a selection of test results that are perhaps most relevant and informative with regards to the underlying argument.

4.1 Economic time series

To date, most of the research into the impact of 1848 focused primarily on measures of production and output, often in the context of the search for the "take-off moment" of Industrial revolution in Austria (Good, 1991). Table 2 shows the test results for a selection of output, living standard and price indices that are relevant to this debate. In its most constrained formulation (Test 1), the Bai-Perron test cannot reject the null hypothesis of no break in 1848 for four of the ten output series (cotton, woolens, railroads and flour) at $\alpha = 0.05$. The years 1848–51 also do not emerge as the time of the single most prominent break in Test 2 – perhaps with the exception of industrial production in Transleithania (a territory comprising the Kingdom of Hungary and Croatia). The revolutionary years, however, do crop up in the results for Test 3 in eight of the ten output series. This would suggest that perhaps there is at least some mixed evidence for a marked change of pace in the industry in consequence of the 1848 revolution. To further check the nature of the breaks and to ensure that they are in the "right" direction and are of noteworthy size, I present three of the time

series in Figure 1, with the breaks estimated via Test 3 marked in the graphs. I also run the same three break tests on the natural logarithm of the series (reported in Appendix Table 1) to see whether the supposed breaks are breaks in the series' growth rate. Here, the evidence in favour of a structural break in the wake of 1848 becomes even more ambiguous: the 1847 break in Transleithanian industrial production in fact marks the beginning of a severe cyclical downturn and the 1849 break in anthracite production disappears in the logged series: there does not seem to have been any change in the growth rate of coal mining around 1848. Even the 1847 break in the Cisleithanian industrial production seems to mark more of a cyclical downturn than the dawning of a new industrial era – contrast the relative insignificance of 1848–51 in the industrial production series with the pronounced impact wrought by the American Civil War in 1861–65.

With the welfare-related measures, the picture is similar. Generally, welfare ratios do not exhibit any consistent significant structural break in the 1848–51 period. Only in Test 1, the null of no break in 1848 is rejected for some provinces. The three locations that are highlighted in Table 2 and in Figure 2 (Vienna, Carniola and Bohemia) serve to illustrate both the variations (in living standards) and the commonalities (in price trends) across the empire at that time. As for living standards, only Vienna could perhaps claim to have experienced a change in trend in the 1850s but the test places the date of the break in 1845–46, not 1848. Neither Carniola, nor Bohemia record any visible change in their welfare ratios around the time of the revolution. The cost-of-living series are included mainly because they reflect movements in the prices of foodstuffs, i.e. agricultural products. One of the supposed revolutionary contributions of "1848" was the final abolition of *corveé*, or *robota*, and with it all remaining vestiges of feudal relations in agriculture. In their place came a standard commercialized private ownership in land and a free agricultural labour market. Such shattering of feudal fetters could have plausibly brought about greater efficiency into

agriculture and led to higher production and greater abundance of foodstuffs, with corresponding effect on prices. The structural breaks tests performed on the cost-of-living series do not seem to furnish much convincing evidence towards such a hypothesis, however. In a number of provinces, the test results as well as the graphs indicate a break in the series sometime in the early to mid-1840s – a break that led to an upward trend in prices lasting at least two decades. This is clearly visible in Figure 2. This trend break predates 1848, and so cannot be a consequence of the abolition of robota.[9]

Thus, overall, the evidence that the 1848 revolution marked a take-off point for industrial production in Austria is weak, in line with what Komlos (1983) and Good (1984) had argued.

4.2 Educational time series

Compared to the economic time series, the revolutionary period made a much more visible dent in matters of education – but not across the board. Test 1 rejects the null of no structural break in 1848 for 23 of the 26 educational time series at $\alpha = 0.05$ (see Appendix Table A1) and the years 1848–50 also appear more than once as the moment of the most prominent structural break (Test 2). However, as with the economic time series, not all such breaks necessarily ushered in a visibly new trajectory. Figure 3 shows that at the level of elementary schooling level, for example, the impact of 1848 was practically non-existent, whether in terms of overall number of elementary schools (*Volksschulen*) or the enrollment ratio. Table 3 lists the results for enrollment ratios in two of the most industrialized crownlands (Lower Austria and Bohemia), neither of which experienced an upswing in enrollment around 1848. The exception in primary education were the major schools –

[9] If anything, the evidence supports to the notion that rising food prices intensified the social turmoil, of which the outbreak of the 1848 revolution was a consequence, not a cause.

Hauptschulen – where one can observe first a very prominent one-off jump in 1850–51 and then a clear steepening of the curve for the rest of the 1850s, as the pace of the establishment of new *Hauptschulen* (or conversion of existing elementary schools into *Hauptschulen*) picked up. These major schools were the main pipeline of pupils for the technically oriented *Realschulen*, a burgeoning part of the secondary tier, where the post-1848 changes left a clear mark. Both in terms of number of schools and number of students, the *Realschulen* recorded a break in 1849–50, the time of the so-called Exner-Bonitz reform of secondary education. The graphs in Figure 3 show the size of the break. This visible boost in secondary technical schooling is surely the main story of 1848 in the realm of education. Note that the reform played out very differently in the other branch of secondary education, the classically oriented *Gymnasia*. Their number fell sharply in 1848–49 and did not resume growth until 1855. By 1860, the number of *Gymnasia* increased by 5 whereas the number of *Realschulen* grew from 9 in 1850 to 31 a decade later. Similarly, *tertiary* technical education, i.e. number of polytechnics students, did not experience any change in 1848–50 either and the student numbers actually declined somewhat after 1853.

Taken together, the evidence of breaks in some time series but not in others is consistent with the claim that the 1848–51 reforms in education led to a reorientation towards, and a new emphasis on, a wider diffusion of technical competency in the population. The type of education that recorded the most dynamic growth after 1848 was not the kind that trains accomplished engineers (i.e. polytechnics) who are at the frontier of technology and research but the kind that produces competent repair, maintenance and accounting staff – precisely the layer of workers who comprise the bulk of the upper tail of useful human capital (Mokyr, 2005).

4.3 Periodicals time series

I capture the volume of periodical press in Austria using two measures: by the number of titles in circulation each year and by the number of issues published each year. Expansion and contraction of the press thus occurs either as new magazines and newspapers are introduced to, or withdrawn from, the market or as existing periodicals change their periodicity. In capturing the impact of 1848 on periodicals, I must make a distinction between the immediate effect and the long-term effect. One can clearly see from the graphs in Figure 4 that the wholesale abolition of censorship in March 1848 led to an explosion of the press, much of it of ephemeral duration. The spike of 1848 reflects this immediate effect. To capture that part of the institutional change which lasted beyond the immediate revolutionary upheaval and became part of the new post-1851 political equilibrium, I run the structural breaks tests on time series consisting of those publications that survived at least until 1852, when a new neo-absolutist press law came into effect. In Figure 4, those publications are tracked by the light-blue interrupted lines.

Table 4 shows that the years 1848–51 made an impact on the press market in almost all its segments. Test 1 rejects the null hypothesis of no change in 1848 for all 113 time series (see Appendix Table 1). In Test 2, the revolutionary period is identified occasionally as the moment of the most prominent single break although later reforms, such as the resumption of constitutional politics in 1860–61 and the passing of a new liberal constitution in 1867, are also strong candidates for the most prominent break. However, in Test 3, where all these potential breaks can be tested side by side, the impact of "1848" is clearly visible. The graphs in Figure 4 help to clarify whether the estimated breaks represent a change of trend in the expected direction. The press world clearly generated a number of unambiguous "hockey sticks" though some were more pronounced than others. Scientific, technical and expert

periodicals, for example, recorded a more pronounced jump in terms of issues than in terms of titles.

4.4 Time series on voluntary associations

Of all the time series discussed so far, the data on voluntary associations are perhaps the least suitable for the test. They come from a single nation-wide survey, recorded in 1890 (K.k. Statistische Central-Commission, 1892); I reconstructed the annual tallies of active voluntary associations for each year retrospectively using the associations' cited dates of establishment. Thus, if a particular period before 1890 saw a high "churn" of voluntary associations – for example, if there were a sudden explosion in associational activity of only fleeting duration in the wake of the 1848 revolution (as there was with periodicals) – the 1890 survey would capture none of it. My retrospectively reconstructed tallies are therefore a less precise measure of associational activity at any point in time than, say, the contemporaneously collected annual data on periodicals are for the press activity. But turning the vice into a potential virtue, the survivorship bias means that the time series are biased towards associations that stood the test of time. In contrast to periodicals, there is no need to filter out "flash-in-the-pan" organizations that lasted only a few revolutionary weeks. My reconstructed association totals are biased towards those associations that survived and lasted and therefore represent the long-term changes in associational life in the monarchy across the decades.

The first thing to notice in Table 5, which shows the Bai-Perron test results for a selection of associational time series, is that while Test 1 rejects the null hypothesis, thereby suggesting a trend break in 1848, the revolutionary year does not come up as the most prominent break point for any of the series according to Test 2. Indeed, the real heyday of voluntary association did not arrive until the resumption of constitutional life in the early

1860s. This dovetails with the description of the institutional change in associational life given above: the regime was somewhat less repressive after 1851 than it had been before 1848 but this was mostly on account of less intensive enforcement rather than a genuine liberalization. The graphs in Figure 5 show a visible uptick in 1848 for some types of voluntary associations (e.g. agricultural associations) but not others (scientific & research associations), even as the results for Test 3 include the 1848–51 period among plausible break points in this most open formulation of the Bai-Perron test.

Both the scientific associations and the agricultural associations (which were associations of farmers for the promotion of more effective farming techniques, not agricultural cooperatives) form a part, together with associations for the promotion of business and trade and with reading clubs, of a broader category which I call the useful human capital-related associations. I constructed this category to capture voluntary associations that could serve as vehicles for the diffusion of useful practical knowledge across all sectors of the economy. Table 5 shows that the number of these associations increased more than three-fold between the late 1840s and the late 1850s and that a more than proportionate part of that increase came from the countryside. The rise of agricultural societies was the main factor behind this expansion.

Across sections 4.1-4.4, the Bai-Perron tests and the graphs in Figures 1–5 show that the revolution of 1848 brought about a clear break in all three segments of Austria's information space: education, periodicals and knowledge-diffusing associations. In most cases, the abrupt change is visible to the naked eye and the statistical tests reject the null hypothesis of no break at any reasonable level of significance. The return of absolutism in 1851 notwithstanding, the evidence suggests that knowledge and specifically useful, technical knowledge could and did receive wider circulation in society, reaching broader and more

remote audiences than ever before. At least some of these newly circulating ideas could presumably be put to use and yield tangible economic benefits. Yet, in contrast to all that, the strictly economic times series, pertaining to output, prices and living standards, do not indicate any such break around the same time. How can these two observations be reconciled?

5. The economic impact of the 1848 reforms

One possible answer is that the effects of these liberalizations, while quick, were simply too small in the great scheme of things to make dent. It may thus be helpful to pause to get a better sense of how sizeable the documented changes were relative to the size of the Austrian population and economy. Tables 2–5 offered a measure of the speed of the response to the post-1848 reforms, showing by how large a factor the levels in the late 1850s exceeded those of the last pre-revolutionary years (1845–47). Some of the tested variables recorded substantial boosts, indeed, but if their pre-1848 levels were very low, then even an order-of-magnitude increase may not have been enough to make a difference.

Let us start from that segment of the information space where the liberalization was least pronounced: the voluntary associations. For selected years around 1848, membership totals for the most prominent associations involved in dissemination of (useful) knowledge ("Bildungsvereine") were published, if somewhat inconsistently, and they are presented in Figure 6. The figure shows that the membership in agricultural societies was severalfold higher than in other types of associations, which is not surprising given the largely agricultural character of the Austrian economy. From late 1840s to late 1850s, the total membership in these major agricultural associations almost doubled, exceeding 21000 in 1859. The 1857 Austrian census counted 1.5 million landowners and another 0.5 million tenants in Cisleithania, the Western part of the monarchy. Assuming that the association

membership consisted of landowners, this would mean that about 1.3% of all landowners were organized in these societies by 1859. With tenants included in the denominator, it would be about 1%.[10] Membership in other types of societies presents a varied record: it increased in scientific societies from 1740 members in 1847 to 3385 members in 1859 and in professional organizations from 685 to 3170 members over the same period, but it declined in associations for the promotion of industry and business from 3864 to 2977. The likely reason behind this decline was the establishment of Chambers of Commerce in 1850, which took over some of the tasks that the pre-1848 pro-business associations set out for themselves.

However, these associations continued to provide a platform for the interaction between entrepreneurs and technical experts. By way of example, Table 6 shows the composition of the most prominent among the business-oriented associations, *Nieder-Oesterreichische Gewerbeverein*. The table shows that the overall membership was a mix of business and trade people, public servants and experts. At the outset, it also enjoyed strong aristocratic patronage. After 1849, the membership shifted away from the aristocrats and public servants and towards members with expertise. At the same time, many non-Viennese members left the organization, as they now could establish local associations in their own places of residence.

To sum up, the associational life certainly received a boost from the 1848-related changes but even a decade later the associations were still relatively thin on the ground. While these organizations probably served as effective venues for the diffusion of economically useful knowledge throughout the empire, their impact would have been strongest in their main centers of operations which were predominantly provincial capitals and Vienna. Their membership was relatively limited, although it consisted of prominent

[10] The percentage was likely higher because the 1859 source (Tafeln zur Statistik der Oesterreichischen Monarchie) is not entirely clear how to treats membership in association branches. The 1890 survey lists a number of local and district branches of the major agricultural associations but of those, only some appear in the 1859 source.

industry leaders, innovators and influential policy makers. Agricultural societies counted the largest (usually aristocratic) landowners among their members, which gave these associations considerable leverage in affecting prevailing farming practice in large parts of the agricultural sector.

The periodicals certainly had greater reach than association membership and their circulation increased substantially, as was already apparent from Table 4. Notwithstanding the tightening of censorship after 1852, the 1848–51 period led to a faster long-term growth in periodicals overall (by almost a factor of 3 between the late 1840s and late 1850s), in business periodicals (by a factor of about 2.5), in scientific and technical periodicals (by a factor of 3) and in publications issued by voluntary associations (here the number of issues increased by a factor of 8.33 between 1845–47 and 1857–59!). Taken together, the available data show that the realm of periodicals – while still a far cry from the liberal ideal of free press – experienced a real opening up of the information space after 1848.

By 1860, some 43 separate scientific, technical and expert periodicals were in circulation, totaling 2020 issues per year, or about 40 per week on average. Business press was even livelier, with around 3000 issues of about 50 separate titles. From another angle, for the first time, the new, post-revolutionary regulations gave a stronger voice to the countryside (i.e. places outside Vienna or provincial capitals), even though the bulk of the periodical press was still based in Vienna. Only 9 "non-capital" locations could boast their own periodical before 1848. From 1848 to 1860, that number increased to 52. Number of issues circulating outside the imperial and provincial capitals grew by a factor of almost six. Appendix Table 1 shows that the expansion of the press occurred in all provinces of the empire and in almost all of the empire's many languages. It is unfortunate that no consistent

data are available on the number of copies of periodicals sold[11] or on developments in the book market. For this reason, it is not possible to compare the extent of the press against the general population.

Changes were even more pronounced with technical schooling. Before considering the student numbers in these schools, it is worth gauging first the expansion of the curriculum, brought about by the post-1848 reforms. Before 1848, *Realschulen* were two- or three-year affairs and the technical, practical subjects of the curriculum consisted of geometry and (technical) drawing, natural science (i.e. biology combined with chemistry), elementary and applied (i.e. business/accounting-oriented) arithmetic and basics of construction (Michl, 1839). With the Exner-Bonitz reform of 1849, the *Realschule* was extended to six years and the curriculum now made room for separate instruction of physics, chemistry, technology and, in the sixth year, machine science (Bidermann, 1854: 135–140). The last of these subjects was designed to draw on the physics instruction of lower grades and to acquaint students with "the most prominent machines generally found in practical life", including specifically the steam engines and other kinds of motors, as well as waterwheels, pumps, mechanical hammers and sawmills. It is clear from the schools' annual reports that this subject was taken quite seriously, with teaching focusing on construction of these machines from component parts, statics, calculation and measurement of energy efficiency, propagation of movement and the like. The *Realschule* in Rakovník apparently even organized visits to local smelting works to see the machines in the wild (Ober-Realschule Rakonitz,1856: 37). It is reasonable to expect that Realschule graduates emerged from their education with the knowledge and skill to, for example, calibrate the energy generation of a steam engine to fit a

[11] Winckler (1875: 88, ft. 1) offers the only data on copies sold that I could find and even those are partial: the number of periodical copies sent out from Vienna via the postal service rose from 1.2 million in 1848 to 15.8 million in 1855. These numbers therefore do not include newsstand sales or periodicals published in locations other than Vienna. Still, accompanied by Winckler's observation that subscription prices fell by as much as 75% over the same period seven-year period, even these few scattered data points suggest that the periodical press expanded substantially after 1848.

desired use as well as to economically evaluate the costs of the engine's operation in comparison with other sources of energy.

Turning to the student numbers and using Bohemia, one of the empire's most developed crownlands around 1848, as an example, one can see in Figure 7, which shows the birthplaces of *Realschule* students, that the education reform truly brought the countryside into the classroom over the 1850s. This happened both along the intensive margin, as the existing *Realschulen* expanded their student intake, and along the extensive margin, with brand new schools founded in Prague (1849), Loket (1852) and Kutná Hora (1857) in addition to those predating 1848 (Liberec, Rakovník and another one in Prague). By the end of the 1850s, of the 209 civil districts that Bohemia was divided into, there were only 18 with zero *Realschule* enrollees, whereas there were 81 such districts in 1841. The average number of *Realschule* students per district went from 1.7 in 1841 to 9.8 by 1859.[12] Table 7 puts the student numbers into broader perspective for all the Western provinces of the empire. There was clearly considerable variation across these provinces, with the fastest industrializing ones, such as Lower Austria and Silesia, reporting more than 1 student per 1000 inhabitants. Overall, the incidence of these students in the general population increased almost sixfold between 1847 and 1860.

How did that affect the overall stock of *Realschule* graduates? Not all enrollees stuck around for all six years of the new and extended curriculum and the graduation rates were not particularly high (around 40% of the entering class). But even accounting for this attrition, I estimate from the data on the inflow and outflow of students that about 3270 new graduates were minted between 1849 and 1860. Compare this to the estimated total of 2930 graduates to have emerged from the smaller, three-year *Realschulen* between 1815 and 1848. Even if all of these pre-1848 graduates remained active throughout the 1850s (which they surely did not

[12] For context, according to the 1857 census, the average district had about 22500 inhabitants.

on account of mortality, retirement or emigration), the post-1848 upswing in technical education must have more than doubled the stock of available technically educated staff. By this count, there were about 340 *Realschule* graduates per million inhabitants in 1860. Clearly, the upper tail of the human capital distribution was getting thicker.

While we do not have comprehensive data on their subsequent employment, we can use as an indication the alumni data from one of the *Realschulen*, in Rakovník, which tracked down about 85% of its graduates on the ocassion of its centennary (Soukup, 1933). Their records indicate that about 17% of the 1852–60 graduates ended up in industry and another 26% in trade and communications (this includes railroads). These were higher shares than those observed for the 1834–47 graduates (8.7% and 17.4%). About a quarter of the graduates ended up in agriculture, where they often served as estate administrators and manorial managers. In the 1850s and 1860s, when the steam thresher, for example, made first inroads into Austrian agriculture, their technical knowledge would find ready employment there, too.

All things considered, the available evidence suggests that the post-1848 changes in Austria's information space were not only abrupt but also substantial and big enough to make a difference.

6. Useful human capital and the diffusion of steam power

The question, then, is whether this boost to economically useful human capital yielded its fruit in the form of measurable technological improvements. I endeavour to answer this question by investigating the role of the *Realschule* graduates in the adoption of the steam engine. Data on steam engine adoption are not available on an annual basis but the Austrian government undertook three comprehensive surveys of operating steam engines in the empire – in 1841, 1852 and 1863 – the aggregate results of which are presented in Table 8. Both in

terms of individual engines installed and in terms of overall horsepower, the pace of adoption was already fairly quick in1840s (about 50 new steam engines per year on average) but the diffusion really picked up in the 1850s (more than 270 steam new engines every year). The expansion eventually affected all sectors of the economy; in agriculture, for example, the steam engine came into use only in the 1850s.[13]

I explore the link between the revolution-induced boom in useful human capital and the spread of steam power in Bohemia. This crownland offers both the most detailed data on the secondary technical education in the *Realschule* and an additional steam engine survey conducted only in this province just before the revolution (Schnabel: Tables 46–48, 1848). This allows me to create a balanced panel containing four cross-sections of steam engine use and *Realschule* students across the 209 civil districts of this province. The descriptive data summarizing these variables are presented in Table 9, in Figure 7 and in Figure 8. Both the table and the maps show that steam power as well as technical schooling made their way into the Bohemian countryside, especially in the 1850s. The locations of the most prominent clusters of steam engine use are not a big surprise: they include the northern and northeastern textile industry, the mining areas around the northwest and the west, the fledgling machinery industry around Pilsen southwest of Prague, some food-processing outfits in the east and then the provincial capital of Prague itself.

My underlying argument is that the liberalization of the information space, brought about by "1848", contributed to the spread of steam power via expanding access to technical expertise and other kinds of useful human capital. While revolutions may be seem random and unpredictable ex ante, this does not imply that the boost in technical expertise was

[13] The pace of steam power expansion notwithstanding, the Habsburg monarchy was clearly behind other industrializing European countries in this regard. England had built and installed 2207 steam engines by 1800, or about 0.27 per 1000 inhabitants (Nuvolari et al., 2020: 834) and, by 1830, some steam power yielded energy to the tune of 165000 horsepower (Crafts, 2004: Table 3). The monarchy, on the other hand, operated about 0.10 steam engines per 1000 inhabitants as of 1863 and generated not quite 60000 horsepower from steam as of 1863 (see Table 8).

entirely exogenous to the steam power diffusion. Young men were clearly enrolling in the available technical schools already before 1848 and would have continued to do so even if the revolution had not happened simply because the ongoing technological developments in the economy offered returns to technical skills and similar kinds of human capital. The endogenous relationship between technological change and human capital supply has, in fact, been the subject of numerous studies (Nuvolari et al, 2020; Ben Zeev et al., 2017; Feldman and van der Beek, 2016) and the notion of technological progress raising returns to human capital, thereby encouraging its higher supply, constitutes an important component in the causal mechanism of the Unified Growth Theory (Galor, 2011). Therefore, an estimation of the impact of the 1848-induced reforms requires us to isolate that component of the human capital expansion that resulted from the revolutionary reform "shock".

A further complication is, however, that the treatment – the revolutionary liberalization – applied to all of Bohemia. The whole crownland lived under the same laws, both before and after 1848. We do not have an obvious control group from some parallel universe in which the 1848 revolution did not happen. However, it is plausible to argue that the treatment was not equally strong across all Bohemian districts: one can think of hypothetical scenarios in which some districts felt the chokehold of pre-1848 censorship and the shortage of relevant expertise more keenly than others. For some districts, in other words, the constraints of the Metternichian system were binding, thereby hindering their further development, whereas in others the clamour after forbidden ideas was next to non-existent and the interference of the censor correspondingly minimal. To isolate the causal link between the post-1848 reforms and the adoption of new technology, I search for ways to measure this variation in treatment. Moreover, such measure also needs to be exogenous with respect to steam adoption. In doing this, I make use of several proxies for exogenous shifters in the demand and the supply of useful human capital.

On the demand side, steam engines would have been more in demand in those districts that already had industry long before the revolution. The pre-1848 Austrian government kept track of industrial development by means of the so-called *Fabriksprivilegium*, a system of concessions granted to large-scale entrepreneurs, which exempted them from any lingering guild regulations and constraints. The list of *Fabriksprivilegium*-holding entrepreneurs was updated and published annually in the *Schematismus des Königreiches Böhmen*, an administrative handbook. This was also one of the sources informing an empire-wide survey of Austrian industry, published in 1841 by the monarchy's statistical commission, which listed all factories by sector and precise location (K.k. Handelsministerium, 1841). This survey also included all mines. I use this survey to locate all the pre-1841 Bohemian factories operating under *Fabriksprivilegium*, thereby differentiating districts in terms of the degree of their industrialization as of 1841. Those districts with more industrial establishments in the pre-1848 era were naturally more eager to employ technically skilled staff who could boost production through the use of modern technology. After all, the point of applying for a *Fabriksprivilegium* was precisely to operate at a larger scale than traditional guild regulations would tolerate. However, these entrepreneurs were constrained in doing so because of the system of censorship and information control.

This changed as the post-1848 reform shifted the supply of the useful human capital. Within Bohemia, the number of *Realschulen* went up from three in 1847 to six by 1860. They were established partly thanks to active support from the Viennese government (Prague, 1849), partly out of local initiative (Loket, 1852; Kutná Hora, 1857). The vast majority of districts were not in a position to choose to establish a full-blown *Realschule* on account of the accompanying expense. Therefore, for all but five Bohemian districts (those five that hosted a *Realschule*), I treat the locations of the available *Realschulen* and a district's

distance to them as exogenously given. It is clear from Figure 7 that distance to school factored into applicants' decision to study, so if a new *Realschule* dropped in a district nearby (as was, for example the case with the Loket one in 1852), this represented an exogenous shift in the availability of technical education in the districts around. Moreover, school leadership at each *Realschule* had power over the size of the incoming cohorts, another shifter that was exogenous with respect to faraway districts' adoption of the steam engine.

Putting all these factors together, I argue that the number of students enrolling at a *Realschule* in a particular year from a particular district depended on the strength of demand for the useful human capital on the one hand (captured by the *Fabriksprivilegium* data), on the availability of student places (measured by the size of each *Realschule* student body) and ease of access of these schools on the other hand (measured by each district's distance to each *Realschule*). I construct the variable *Realschule* availability, RSA_{it}, for a district i in year t, using the following formula:

Eq. 2

$$RSA_{i,t} = F_{i,1841} \sum_{j=1}^{RS_t} \frac{E_{j,t}}{\Delta_{j,i}}$$

In this formula, $F_{i,1841}$ denotes the number of factories and mines in a district according to the *Fabriksprivilegium* data as of 1841, $E_{j,t}$ is the total enrollment at a *Realschule* j in year t and $\Delta_{j,i}$ is distance between a district i and a *Realschule* j. The instrument therefore combines a proxy for a cross-sectional shifter in demand for useful human capital (the factories of 1841) and a proxy for both cross-sectional and time-varying shifter in the supply of useful human capital (exogenously changing distance and size of available Bohemian *Realschulen*). Table 9 reports the mean values for $RSA_{i,t}$ in the four years of the Bohemian panel. By construction, $RSA_{i,t} = 0$ for districts that hosted no factory in 1841 (there were 26 such districts). Also, for

the five districts that hosted the six *Realschulen*, one of the distances is equal to zero, rendering the instrument undefined, so I leave them out of the estimation.[14]

In modelling the adoption and extent of use of steam power, an important consideration is that a large fraction of observations has the dependent variable equal to zero. As Table 9 shows, only 34 of the 209 districts had a steam engine in 1841 and this number increased to 133 by 1863. A straightforward 2SLS model may be informative but the left-censoring of the dependent variable will lead to biased results. I therefore model the estimation using IV-Tobit:

Eq 3.

$$Y^*_{i,t} = \alpha + \beta S_{i,t} + \gamma_i + \theta_t + \varepsilon_{i,t}$$
$$Y_{i,t} = Y^*_{i,t} \; if \; Y^*_{i,t} \geq 0; Y_{i,t} = 0 \; if \; Y^*_{i,t} < 0;$$

where $Y^*_{i,t}$ is the latent dependent variable, $S_{i,t}$ is the number of *Realschule* students coming from district i in year t, γ_i is the district fixed effect and θ_t is the year fixed effect.

6.1 Results

Table 10 shows the results. For comparison's sake, I present an OLS, a standard panel 2SLS estimation, a Tobit model and IV-Tobit model. The first observation to make is that the first-stage estimation is comfortably statistically significant and the first-stage F-statistic indicates that the instrument is not weak. The second observation is that the explanatory variable of interest, the number of *Realschule* students from district, is quite consistently significant at 1% or stronger – with the exception of column (viii). Note that all the reported models included 203 district fixed effects and three period fixed effects. Instrumenting for the

[14] These also happen to be the districts where the availability of technical schooling cannot be reasonably claimed to have been exogenous.

number of *Realschule* student in the Tobit estimation produces a lower estimated coefficient in column (iv) relative to column (iii) but they are very similar. The difference between coefficients in columns (vii) and (viii) is somewhat bigger but still relatively small.[15]

The interpretation of the IV-Tobit coefficient, however, needs to distinguish between two margins along which the explanatory variable exerts its impact: one is the effect on the probability of adoption of steam power in districts which had none, the other is the effect on the extent of the use of steam power in those districts that already use steam engines. In Table 11, I present the average marginal effects for each of the two margins for each year of the panel, using the coefficients from column (iv) of Table 10. Along the probability margin, the results indicate that an extra *Realschule* student from a district would increase the likelihood of steam engine adoption in that district by 1.16–1.64%, depending on the year. The average marginal effect was, predictably, the largest in 1863. An increase in the number of *Realschule* students in a district in that year by one standard deviation (which equaled 8.2 in the districts that had not yet adopted a steam engine) would increase the predicted probability of adoption by 13.4%, which is sizeable difference. In the year 1841, the same exercise would yield an increase by 2.5%, which – in a year when only 16% of all districts could boast a steam engine – is also a non-negligible difference. When it comes to the extensive margin, i.e. the number of steam engines in those districts that had already adopted them, the *Realschule* students also have the strongest impact in the last year of the panel, 1863. Here, an extra such student would increase the total number of steam engines in a district by 0.229 and increasing the

[15] The gap between the OLS and the 2SLS coefficients for the number of *Realschule* students (columns (i) and (ii) and columns (v) and (vi)) is much bigger which is likely due to the nature of the data that neither OLS nor 2SLS can quite deal with. In the OLS estimation, both the number of steam engines (and total horsepower) and the number of students are left-censored. In the 2SLS estimation, the predicted number of *Realschule* students, emerging from the first stage are not left-censored but the steam engine counts still are. This can lead to differential estimation bias in these two specifications. In contrast to OLS and 2SLS, left truncation is something that the Tobit specification is better equipped to handle.

number of students by one standard deviation would lead to extra 1.88 steam engines in the district.

With two steam engine surveys pre-dating and two post-dating 1848, I can also analyze the change in the pace of expansion of steam power adoption between the two eras. To do this, I convert the levels data from my panel into annual changes over the 1841–47 period and over the 1851–1863 period. This yields a balanced two-period panel which I use to regress the annual rate of expansion of steam power use on the annual rate of expansion of *Realschule* student numbers. In contrast to the previous estimation, I omit here the IV-Tobit specification, since the dependent variable is now no longer truncated at zero – the number of steam engines can also decline from one survey to the next and indeed there are ten districts in the dataset that experience such decline in at least one of the two periods. Consequently, Table 12 includes a simple OLS for comparison's sake and an instrumental variable estimation, with the instrument also converted into average annual change in the same way as all the other relevant variables. As can be seen from Table 12, here, too the first-stage regression indicates that the instrument is sufficiently strong.

The results show that, in terms of steam engine numbers, the expansion in the number of *Realschule* students led to an expansion of steam power almost one-to-one. The coefficient on *Δ RS students* in the IV estimation is statistically significant and economically meaningful. The fixed effect for the post-1848 period yields a negative coefficient of –0.069, albeit one that is not statistically different from zero, so one could argue that the economy's post-1848 responsiveness to technical schooling was somewhat weaker than it had been before 1848. But ultimately, the purpose of the estimation is not to show that more technically skilled staff leads to more steam engines (a rather intuitive result). Indeed, the insignificant coefficient on the period fixed effect (–0.069) indicates that the underlying structural relationship between the availability of useful human capital and steam power adoption did ***not*** change with the

revolution. What did change, however, was the key input into that structural relationship: the availability of the human capital. In other words, the upshot of the estimation is that the estimated coefficients allow us to link the revolutionary reforms in education to economic development by gauging the size of the impact of *Realschule* expansion in the wake of 1848. Before 1848, the typical district saw the number of *Realschule* students increase by +0.067 per year. After 1848, the pace picked up to +0.441 per year. Combining these values with the estimated IV coefficients implies that the revolution-induced expansion of technical schooling increased the speed of steam engine adoption from extra 0.069 (= 1.037×0.0.067) new steam engine every year (i.e. next to nothing) to extra 0.388 (= –0.069 + 1.037×0.441) new steam engines every year (or a whole new steam engine every two and a half years) in an average district. This is an appreciable change of pace.

All these estimation results add up to strong evidence that the post-1848 technological modernization was brought about by the augmented upper tail human capital, which itself was a consequence, as Section 4 showed, of the revolutionary reforms.

7. Conclusions

The analysis in this paper offers evidence in support of two main claims. One is a specific point that pertains to 19th century Austrian Empire, the other is a general point that relates to the ongoing debate about the economic impact of institutional change. The specifically Austrian claim, in opposition to some of the existing literature on the topic, is that "1848" mattered for the economic development of the empire, that it mattered a lot and that it mattered with practically immediate effect. The description, in section 3, of the institutional changes of 1848–51 leaves no doubt that the empire underwent an appreciable institutional overhaul, of which the liberalization of the monarchy's information space was an important part. In three segments of that space – the press, voluntary association and

technical secondary education – the liberalizations produced a clear, abrupt change, visible not only in the formal law but also in the available statistical record. Through their impact on useful human capital – primarily in the form of more readily available technical schooling and knowhow – these liberalizations had real tangible economic effect in the form of technological modernization: faster adoption of steam power. The steam engine, while perhaps the most notorious of early industrial contraptions, is but one example. There surely were other technologies ripe for the plucking. In this sense, the analysis presented here undersells the impact of "1848" because the same technical knowhow and skill that underpinned the spread of the steam engine surely brought about other technological and economic improvements, too. After all, the Austrian 1850s (and 1860s) were a time of booming railroad construction, fledgling cooperative banking and expanding sugar refining and beer brewing.

One loose end that needs tying in, however, is why the previous literature found no impact. One reason is that it usually focused on other institutional changes, such as the abolition of the last remaining feudal dues and the abolition of the internal tariff, rather than the press law or the curriculum reform. The abrupt breaks were therefore sought in time series of agricultural production, agricultural prices, land use, internal trade and industrial output – but no clearcut "hockey sticks" and no obvious changes in growth rates surfaced there (see section 4.1). Had I limited my analysis to strictly economic data, my conclusion, too, would have to be that 1848 had no impact on economic development at all. The Bai-Perron analysis, however, illuminates why: an institutional change impacts most visibly those areas that are a law's immediate domain, e.g. in student numbers following a curriculum reform, or in number of periodicals following the abolition of censorship. The knock-on effect on the stock of trained engineers is more spread out because the students first need to graduate which takes time. The further downstream effect on the adoption of steam engines

was inevitably drawn out even more. If we had a continuous annual time series on steam engine use in Austria for this period, it is perfectly possible that the Bai-Perron tests would find no break in 1848–51 for this very reason. Schmitt (1869: 82), for example, argued that the spread of steam threshers did not arrive until an 1857 exhibition organized by the Lower Austrian Agricultural Association highlighted their usefulness to the empire's farmers. It is only through the broadening of the freedom of association, which enabled this agricultura association to operate more freely, that this post-1857 diffusion can be tied to "1848".

The general point emerging from this Austrian case is that it is not always the "usual suspects" of institutional change – more secure property rights, rule of law, constraints on the executive etc. – that do the heavy lifting. Other reforms of 1848, not covered in this paper, may well have brought about a modernization of public administration and with that, say, an improvement in the operation of courts and more transparent governance. But these reforms did not represent the kind of watershed for Austria that the Glorious Revolution did for England. One could speculate that it is an economy's relative international standing which determines which institutions matter at which point in time. Economies on the frontier of development where new technological advances involve a lot of trial and error may well need first and foremost a stable, predictable institutional environment so that the risks inherent in the cutting-edge entrepreneurship is not further aggravated by legal uncertainty. This was likely the case of England in the 18th century. In contrast, economies that follow behind the leaders are not tinkering with the new technologies, trying to debug it and make it function – there is no need to "reinvent the wheel" – but they desperately need to learn how the wheel actually works. In that context, institutions affecting information flow and the formation of the upper-tail human capital of skilled technicians and repairmen are key. This would be the case of the Austrian Empire in 1848 and, needless to say, the majority of countries at any point in time, since leaders usually are few, and followers many.

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Table 1 – Overview of institutional changes in the Austrian information space		
	Pre-1848 regulation	Post-1851 regulation
Education	• Relevant law: *Politische Verfassung* (1805) ○ Adopted in 1805, last curriculum reform in 1819 ○ *Gymnasium*: 5 (later 6) years of classical curriculum (Latin, Greek, grammar) ○ *Realschule*: 3 years of basic accounting, geometry, natural sciences ○ Approval for new schools reserved for Emperor and rarely granted ○ Secondary school instruction in German	• Exner-Bonitz reform of secondary schools ○ Adopted in 1849 ○ *Gymnasium*: 8-year course of classical education, capped with *Maturität* exam ○ *Realschule* curriculum expanded and extended to 6 years ○ Freer market entry ○ Extended choice of textbooks ○ Limited choice of language of instruction • *Hauptschule* curriculum extended (1851)
Press	• Law: *Erneuerte Censur-Ordnung* (1795); *Vorschrift für die Leitung des Censurwesens* (1810) • Preventive censorship ○ Official approval required before publication of all books and periodicals ○ Few appointed censors operate a revise-and-resubmit system ○ Censor instructions not public ○ Light censorship of "learned works" ○ Strict control of general reading of the common public ○ Publishing and bookselling require government licence	• Law: *Pressgesetz* (1849, 1852) • Reactive censorship ○ Areas of censorship (e.g. speech against religion, dynasty) specified in law ○ Strict fines for "subversive" political writing ○ Political press must deposit surety to cover potential fines ○ Duty to publish ex-post corrections ○ Licensing of publishing reinstated ○ Government decisions in principle appealable in court
Voluntary associations	• Law: Ban on secret societies (1780s), *Vorschrift über das Verhältniss der Privat-Vereine zur Staatsverwaltung* (1843) • Concession system: permission required to form an association • Covered both non-profit and for-profit associations	• Law: *Vereinsgesetz* (1852) • ≈ 50% of the law's text is copied from the 1843 decree • Concession system reinstated but operated less stringently • Explicit ban on political associations • Oversight delegated to newly created Interior Ministry and to provincial authorities
Source: ALEX, Winckler (1875), Schmitt (1869)		

Table 2: Tests for structural breaks – Selected economic time series					
Variable	$\emptyset_{1857-59}$	$\frac{\emptyset_{1857-59}}{\emptyset_{1845-47}}$	**Test 1: p-val**	**Test 2:**	**Test 3:**
Industrial production, mil. K. in 1913 prices, Cisleithania,1830-1873	358	1.42	0.0070	1862	**1847**, 1854, 1861, 1867
Industrial production, mil. K. in 1913 prices, Transleithania,1830-1873	112	1.30	0.0000	**1847**	1841, **1847**, 1854, 1860, 1866
Iron production, mil. K in 1913 prices, Cisleithania, 1830-1873	46	1.92	0.0000	1867	1841, **1848**, 1854, 1860, 1867
Cotton textiles production, mil K. in 1913 prices, Cisleithania, 1830-1873	96	1.63	0.8774	1861	1840, **1847**, 1853, 1861, 1867
Woollen textiles production, mil K. in 1913 prices, Cisleithania, 1830-1873	112	1.22	0.7453	1866	1836, 1844, 1853, 1859, 1866
Value added in railroad construction, mil K. in 1913 prices, 1837-1873	17	1.64	0.0051	1868	1868
Anthracite production, millions of quintals, Cisleithania, 1819-1873	15	3.11	0.0000	1853	1827, 1836, **1849**, 1857, 1865
Lignite production, millions of quintals, Cisleithania, 1819-1873	11	4.30	0.0000	1863	1827, 1836, **1849**, 1857, 1865
Sugar production, mil K. in 1913 prices, Cisleithania, 1830-1873	3	1.80	0.0000	1867	**1847**, 1867
Flour production, mil K. in 1913 prices, Transleithania, 1830-1873	56	1.06	0.6983	1866	1838, 1844, **1850**, 1859, 1866
Welfare ratio, Vienna, 1827-1873	0.54	1.65	0.0000	1855	1845, 1860
Welfare ratio, Carniola, 1827-1873	0.44	0.96	0.0427	1866	1835, 1845, 1852, 1859, 1866
Welfare ratio, Bohemia, 1827-1873	0.35	1.43	0.0004	1866	1836, 1845, 1852, 1859, 1866
Cost of living in Austrian Krone, Vienna, 1827-1873	800	1.22	0.0000	1844	1835, 1842, **1849**, 1856, 1863
Cost of living in Austrian Krone, Carinthia, 1827-1873	660	1.45	0.0000	**1849**	1835, 1845, 1852, 1859, 1866
Cost of living in Austrian Krone, Bohemia, 1827-1873	679	1.19	0.0008	**1850**	1834, 1844, **1851**, 1859, 1866
Cost of living - Foodstuffs, Vienna, 1827-1873	484	1.20	0.0002	1844	1835, 1842, **1849**, 1856, 1863
Cost of living - Foodstuffs, Carniola, 1827-1873	490	1.43	0.0000	1846	1835, 1845, 1852, 1859, 1866
Cost of living - Foodstuffs, Bohemia, 1827-1873	416	1.08	0.1676	1862	1834, 1844, **1851**, 1859, 1866
Source: See Appendix 2. Test 1 reports the p-value for the H_0 that 1848 did not represent a break in the time series. The "Test 2" column reports the year identified by the Bai-Perron test as the most prominent single break in the time series. Test 3 reports up to five time series breaks, using the Bai-Perron structural breaks test. Highlighted in bold are breaks that fall into the revolutionary period of 1848–1851.					

Table 3 – Tests for structural breaks: Selected education series					
Variable	$\emptyset_{1857-59}$	$\frac{\emptyset_{1857-59}}{\emptyset_{1845-47}}$	**Test 1: p-val**	**Test 2:**	**Test 3:**
Number of *Realschulen*, 1815-1872	29	3.58	0.0000	**1850**	1822, 1832, 1840, **1850**, 1863
Number of students at *Realschulen*, 1828-1872	8259	6.04	0.0000	**1850**	1833, 1841, **1849**, 1859, 1866
Number of Gymnasia, 1829-1872	86	0.87	0.0000	**1848**	1834, 1842, **1848**, 1855, 1866
Number of Gymnasium students,1829-1872	22414	1.06	0.0067	1860	1834, 1845, **1851**, 1858, 1866
Number of polytechnics students, 1818-1872	3485	1.15	0.0000	**1847**	1825, 1835, 1843, 1852, 1860
Number of major schools (*Hauptschulen*), 1818-1871	340	1.73	0.0000	**1849**	1825, 1834, 1842, **1849**, 1861
Number of elementary schools (*Volksschulen*), 1821-1871	13791	1.08	0.0103	**1850**	1827, 1839, 1846, 1854, 1862
Number of non-German elementary schools, 1821-1871	4861	1.00	0.0000	1831	1828, 1836, **1847**, 1855, 1862
Number of non-German and bilingual elementary schools, 1821-1871	7633	1.11	0.0410	1862	1862
Elementary school enrollment ratio, Lower Austria, 1815-1871	59.4%	0.99	0.0150	1822	1822, 1833, 1841, **1850**, 1861
Elementary school enrollment ratio, Bohemia, 1815-1871	58.5%	1.03	0.0000	1824	1822, 1832, 1841, **1849**, 1861

Source: See Appendix 2. Test 1 reports the p-value for the H_0 that 1848 did not represent a break in the time series. The "Test 2" column reports the year identified by the Bai-Perron test as the most prominent single break in the time series. Test 3 reports up to five time series breaks, using the Bai-Perron structural breaks test. Highlighted in bold are breaks that fall into the revolutionary period of 1848–1851.

Table 4 – Tests for structural breaks: Selected periodicals series						
Variable		$\emptyset_{1857-59}$	$\frac{\emptyset_{1857-59}}{\emptyset_{1845-47}}$	**Test 1: p-val**	**Test 2:**	**Test 3:**
All periodicals, 1817-1873	titles	238	2.84	0.0000	1857	1824, 1841, **1849**, 1857, 1865
	issues	25895	2.78	0.0000	1846	1824, 1837, **1847**, 1857, 1865
Political periodicals, 1817-1873	titles	49	2.39	0.0000	1857	1827, 1839, **1847**, 1857, 1865
	issues	11977	3.14	0.0000	**1847**	1824, 1839, **1847**, 1856, 1864
Business periodicals, 1817-1873	titles	42	2.54	0.0000	1861	1826, 1834, **1848**, 1856, 1865
	issues	2812	2.63	0.0000	1861	1824, 1834, **1848**, 1856, 1865
Scientific, technical and expertise periodicals, 1817-1873	titles	36	2.95	0.0000	1854	1824, 1836, **1847**, 1855, 1865
	issues	1559	3.01	0.0000	1843	1829, 1839, **1847**, 1855, 1865
Association periodicals, 1817-1873	titles	19	3.11	0.0000	1860	1830, 1838, **1849**, 1857, 1865
	issues	919	8.33	0.0000	1861	1824, 1839, **1847**, 1855, 1865
Local-news periodicals, 1817-1873	titles	38	3.65	0.0000	1853	1827, 1838, 1846, 1857, 1865
	issues	5311	3.52	0.0000	1846	1825, 1834, 1845, 1853, 1864
Religious periodicals, 1817-1873	titles	16	6.86	0.0000	1856	1827, 1839, **1847**, 1857, 1865
	issues	1008	13.75	0.0000	**1847**	1831, 1839, **1847**, 1855, 1863
Literary periodicals, 1817-1873	titles	33	2.58	0.0000	**1848**	1828, 1840, **1848**, 1856, 1865
	issues	2984	1.54	0.0000	1852	1852
Artistic periodicals, 1817-1873	titles	12	2.00	0.0000	**1848**	1826, 1835, **1848**, 1857, 1865
	issues	871	0.88	0.0000	**1848**	1824, 1834, 1844, 1852, 1863
Satirical periodicals, 1817-1873	titles	9	3.38	0.0000	1855	1855
	issues	664	1.79	0.0001	1863	1828, 1836, **1847**, 1857, 1865
Women's and fashion periodicals, 1817-1873	titles	4	1.00	0.0014	1865	1865
	issues	125	1.70	0.0000	1839	1832, 1840, **1848**, 1856, 1864
Periodicals published in German, 1817-1873	titles	185	2.78	0.0000	1857	1824, 1841, **1849**, 1857, 1865
	issues	21037	2.77	0.0000	1846	1824, 1837, **1847**, 1856, 1864
Periodicals published in non-German languages, 1817-1873	titles	53	3.06	0.0000	1857	1826, 1837, 1845, 1857, 1865
	issues	4857	2.81	0.0000	1854	1824, 1834, 1842, **1850**, 1860
Periodicals published in Vienna, 1817-1873	titles	95	2.80	0.0000	1858	1824, 1840, **1849**, 1857, 1865
	issues	10264	2.65	0.0000	1846	1824, 1837, **1847**, 1856, 1864
Periodicals published in the Cisleithanian countryside, 1817-1873	titles	40	4.48	0.0000	1858	1825, 1835, **1847**, 1857, 1865
	issues	3720	5.76	0.0000	1852	1828, 1839, **1847**, 1857, 1865
Source: See Appendix 2. Highlighted in bold are breaks that fall into the revolutionary period of 1848–1851.						

Table 5 – Tests for structural breaks: Selected associations series					
Variable	$\emptyset_{1857-59}$	$\frac{\emptyset_{1857-59}}{\emptyset_{1845-47}}$	**Test 1: p-val**	**Test 2:**	**Test 3:**
Voluntary associations, Cisleithania, 1815-1875	1247	2.00	0.0000	1862	1833, 1841, **1849**, 1857, 1865
Voluntary associations, Vienna, 1815-1875	267	1.47	0.0000	1860	1828, 1836, 1844, 1857, 1865
Voluntary associations, provincial capitals outside Vienna, 1815-1875	235	1.80	0.0000	1861	1826, 1836, 1845, 1857, 1865
Voluntary associations, Cisleithanian countryside, 1815-1875	745	2.39	0.0000	1862	1827, 1838, **1848**, 1857, 1865
Voluntary associations, Bohemia, 1815-1875	315	1.70	0.0000	1862	1831, 1841, **1849**, 1857, 1865
Useful human capital-related associations, Vienna, 1815-1875	13	1.95	0.0000	1862	1823, 1836, **1848**, 1857, 1866
Useful human capital-related associations, provincial capitals excl. Vienna, 1815-1875	34	1.58	0.0000	1859	1826, 1836, **1847**, 1857, 1866
Useful human capital-related associations, Cisleithanian countryside, 1815-1875	145	4.40	0.0000	1863	1823, 1837, **1848**, 1857, 1866
Useful human capital-related associations, Cisleithania, 1815-1875	193	3.14	0.0000	1862	1823, 1836, **1848**, 1857, 1866
Self-improvement and educational associations, Cisleithania, 1815-1875	31	15.67	0.0000	1864	1864
Clubs and table societies, Cisleithania, 1815-1875	51	2.70	0.0000	1861	1830, 1838, **1849**, 1857, 1865
Professional associations, Cisleithania, 1815-1875	3	2.67	0.0000	1865	1831, 1840, **1848**, 1856, 1865
Business and trade associations, Cisleithania, 1815-1875	10	1.72	0.0000	1863	1828, 1836, 1845, 1856, 1865
Agricultural associations, Cisleithania, 1815-1875	131	3.85	0.0000	1862	1822, 1840, **1848**, 1856, 1865
Reading clubs and associations, Cisleithania, 1815-1875	34	2.89	0.0000	1862	1832, 1840, **1849**, 1857, 1865
Scientific & research associations, Cisleithania, 1815-1875	18	1.83	0.0000	1860	1822, 1833, **1848**, 1857, 1865
Source: See Appendix 2. Test 1 reports the p-value for the H_0 that 1848 did not represent a break in the time series. The "Test 2" column reports the year identified by the Bai-Perron test as the most prominent single break in the time series. Test 3 reports up to five time series breaks, using the Bai-Perron structural breaks test. Highlighted in bold are breaks that fall into the revolutionary period of 1848–1851.					

Table 6 – Composition of membership of the Nieder-Oesterreichische Gewerbeverein			
	1840	**1849**	**1859**
Total membership	658	859	841
Factory owners ("Fabrikant")	218 (33.1%)	249 (29.0%)	242 (28.8%)
Businessmen & traders ("Kaufmann")	140 (21.3%)	179 (20.8%)	206 (24.5%)
Craftsmen ("Cabinet maker, Clockmaker, Jeweller")	56 (8.5%)	76 (8.8%)	78 (9.3%)
Technology professionals ("Ingenieur, Professor der Polytechnik/Realschule, Mechaniker, Architekt")	41 (6.2%)	71 (8.3%)	76 (9.0%)
Members with tertiary education ("Professor, JUDr, Doktor, Architekt")	60 (9.1%)	106 (12.3%)	112 (13.3%)
Public administration officials ("Minister, Staatsrat")	106 (16.1%)	127 (14.8%)	111 (13.2%)
Aristocrats	105 (16.0%)	97 (11.3%)	70 (8.3%)
Living outside Vienna		226 (26.4%)	182 (21.7%)
Living outside Lower Austria		76 (8.9%)	46 (5.5%)

Note: The categories of membership are not mutually exclusive.
Source: NÖGV (1840: 167 – 185), NÖGV (1850: Verzeichnis der ordentlichen Mitglieder des nied. Öster. Gewerb-Vereins (Geschlossen Ende December 1849). NÖGV (1859: Verzeichnis der Mitglieder des nied. Öster. Gewerb-Vereins. Geschlossen mit Ende Mai 1859.)

Table 7 - *Realschule* students per million inhabitants

	1847	**1851**	**1860**
Lower Austria	291	410	1057
Upper Austria	0	0	373
Salzburg	0	0	927
Styria	81	201	491
Carinthia	0	357	749
Carniola	0	351	325
Austrian Littoral	426	0	0
Tyrol & Vorarlberg	0	0	268
Bohemia	113	241	556
Moravia	0	295	799
Silesia	0	0	1115
Galicia	46	49	163
Bukovina	0	294	0
Dalmatia	0	241	116
Total	**82**	**178**	**479**

Source: Tafeln zur Statistik der Oesterreichischen Monarchie, 1847 – 1865.

Table 8 – Diffusion of stationary steam power in the Habsburg Monarchy, 1841 – 1863						
	Number of steam engines			Total steam engine horsepower		
Sector	**1841**	**1852**	**1863**	**1841**	**1852**	**1863**
Agriculture	0	9	358	0	59	3284
Mining	34	111	461	509	1833	10581
Industry	188	633	2842	2294	8379	44418
of which:						
Machinery	6	61	168	37	381	2192
Metallurgy	22	74	488	302	1687	13355
Food processing	27	234	1239	359	2538	13172
Textiles	109	185	493	1394	3030	10310
Public utilities (pumps etc.)	15	38	131	208	281	1107
Total	**237**	**791**	**3792**	**3011**	**10552**	**59390**
Source: See Appendix 2.						

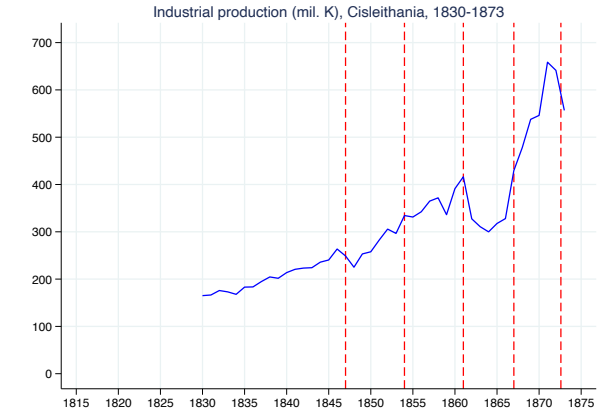
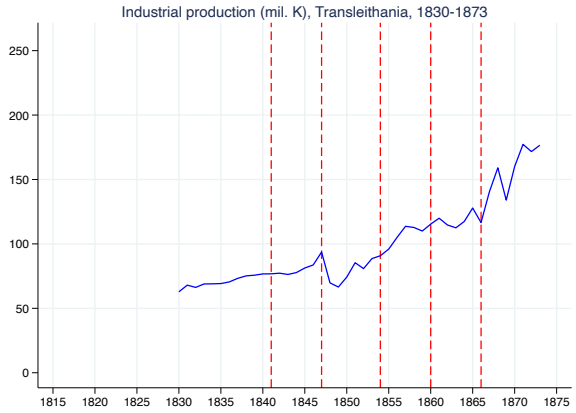
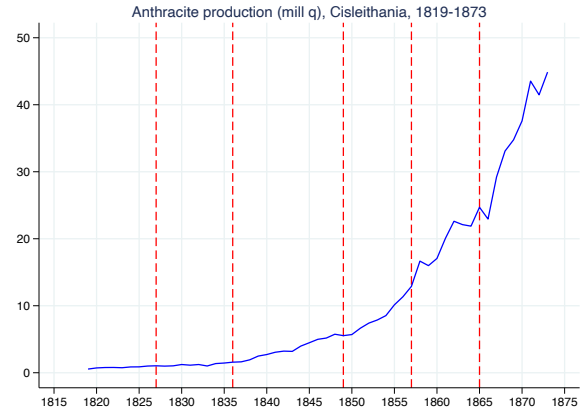
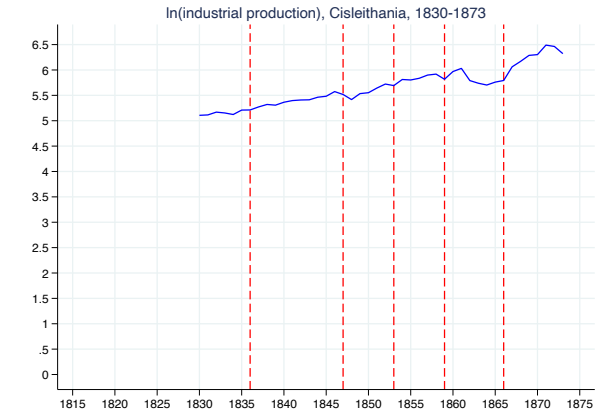
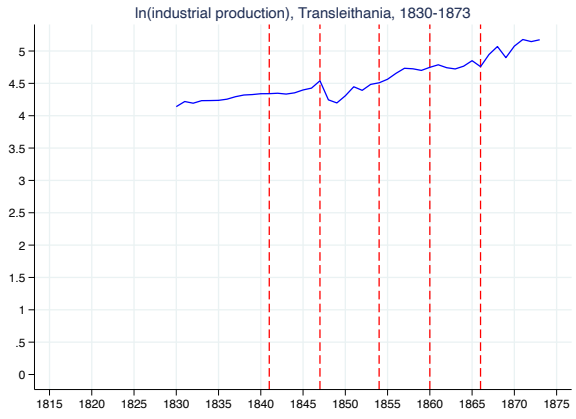
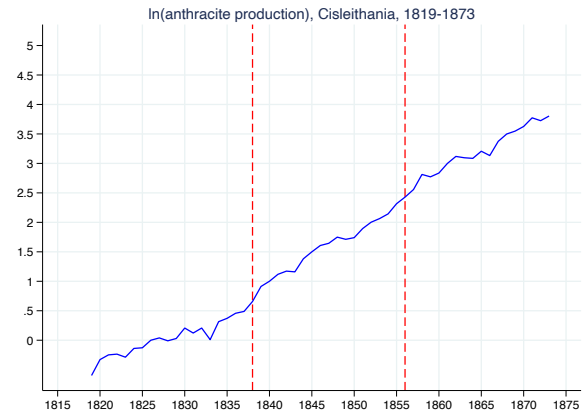
Table 9 - Means and standard deviations of relevant variables, Bohemia				
	1841	1847	1851	1863
# Steam engines in district	0.383 (1.121)	0.660 (1.639)	1.167 (2.472)	5.703 (10.810)
Avg horsepower in district	5.148 (16.449)	10.522 (27.057)	17.311 (43.401)	87.871 (201.174)
# districts with steam power	34	56	75	133
Realschule students ($S_{i,t}$)	1.737 (4.431)	2.287 (5.943)	4.220 (11.287)	9.861 (23.683)
Realschule availability ($RSA_{i,t}$)	1.588 (22.076)	1.563 (21.600)	1.870 (24.696)	2.655 (32.977)
N	209	209	209	209
Note: Standard deviations in brackets. "*Realschule* students" refers to the number of students at a Bohemian *Realschule* with a place of birth in a given district. For explanation of *Realschule* availability see Eq. 2 in the text. Source: See Appendix 2.				

Table 10 – Estimation results								
Dependent variable:	# steam engines in district				Total horsepower in steam engines in district			
	(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)	(viii)
	OLS	IV	Tobit	IV Tobit	OLS	IV	Tobit	IV Tobit
# *Realschule* students ($S_{i,t}$)	0.475 [0.050]	0.876 [0.124]	0.589 [0.085]	0.568 [0.173]	6.447 [1.018]	12.328 [2.476]	7.001 [1.794]	5.405 [3.582]
1(year = 1847)	0.054 [0.438]	-0.107 [0.463]	2.897 [1.017]	2.903 [1.019]	2.178 [8.917]	-0.186 [9.258]	61.201 [22.030]	61.869 [22.100]
1(year = 1851)	-0.190 [0.447]	-0.924 [0.513]	4.139 [1.007]	4.183 [1.057]	-0.628 [9.154]	-11.411 [10.263]	94.661 [21.791]	98.129 [22.867]
1(year = 1863)	2.239 [0.524]	-0.083 [0.853]	11.901 [1.132]	12.038 [1.495]	42.800 [10.732]	8.694 [17.057]	248.273 [24.547]	258.597 [31.818]
Intercept	2.167 [2.226]	-0.792 [0.364]	-2.355 [2.819]	-2.343 [2.820]	41.433 [45.591]	-11.345 [7.282]	-50.037 [60.540]	-49.261 [60.649]
Observations	4x204	4x204	4x204	4x204	4x204	4x204	4x204	4x204
District f.e.	yes	yes	yes	yes	yes	yes	yes	yes
IV First stage: dep. var. = # *Realschule* students ($S_{i,t}$)								
Realschule availability ($RSA_{i,t}$)		6.524 [0.490]		6.524 [0.490]		6.524 [0.490]		6.524 [0.490]
First-stage F(1,608)		131.97		131.97		131.97		131.97
Note: The coefficients are estimated using fixed-effects models, with standard errors reported in square brackets. The estimation sample consists of a balanced panel of 204 districts (out of a total of 209) that did not establish a *Realschule* before 1860.								

Table 11 - Average Marginal Effects, IV-Tobit estimation		
	$\frac{\partial E(SE\|SE>0)}{\partial \#RS}$	$\frac{\partial P(SE>0\|SE=0)}{\partial \#RS}$
Across all years	0.140	0.0140
1841	0.086	0.0116
1847	0.111	0.0150
1851	0.125	0.0163
1863	0.229	0.0164
Note: These average marginal effects are estimated using coefficients from column (iv) of Table 10.		

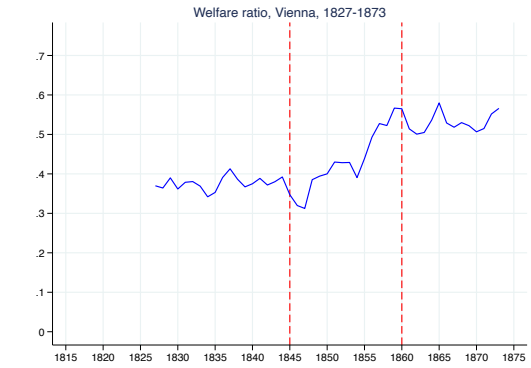
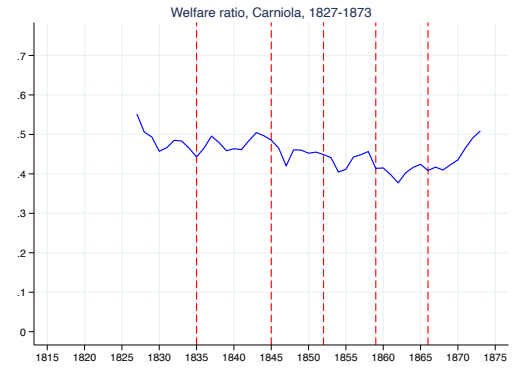
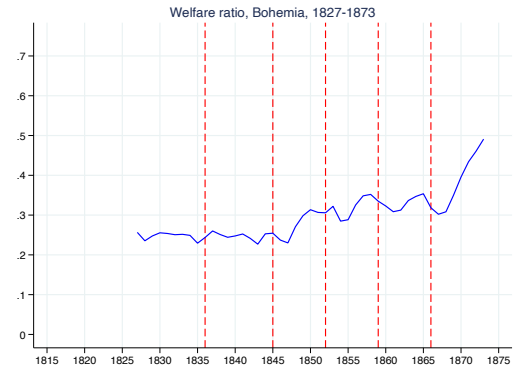
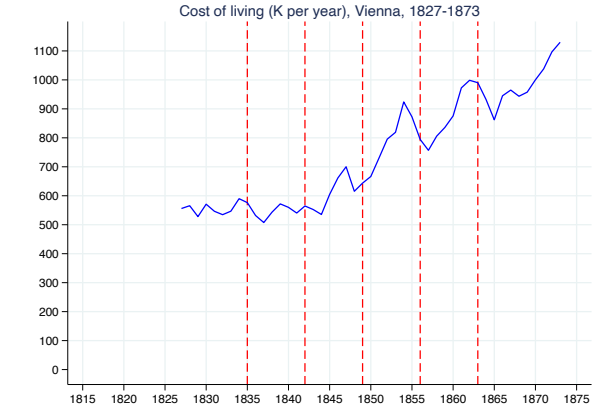
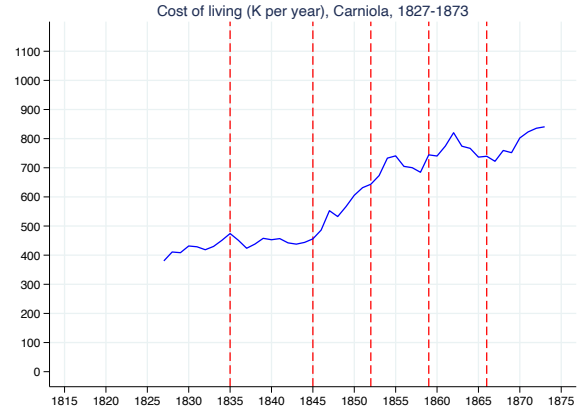
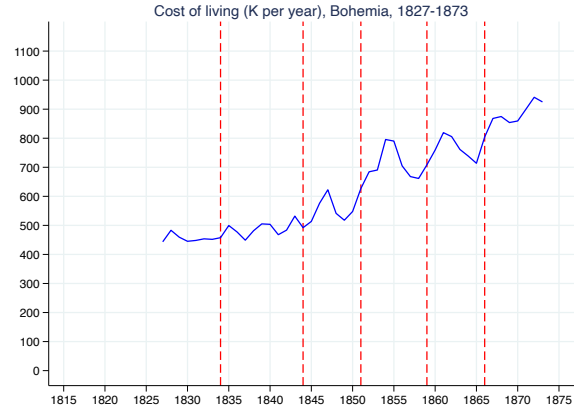
Table 12 - Estimation in annual change				
	Average annual change in…			
Dep.var.:	steam engines		total horsepower	
	OLS	IV	OLS	IV
Δ RS students p.a.	0.334 [0.062]	1.037 [0.206]	4.287 [1.224]	11.424 [3.585]
1(post-1848 period)	0.194 [0.049]	-0.069 [0.100]	3.353 [0.972]	0.686 [1.670]
Intercept	0.018 [0.031]	-0.029 [0.042]	0.508 [0.612]	0.030 [0.701]
N	2x204	2x204	2x204	2x204
District f.e.	yes	yes	yes	yes
IV First stage: dep. Var. = Δ RS students p.a.				
Δ RSA p.a.		9.019 [1.666]		9.019 [1.666]
First-stage F (1,202)		29.30		29.30
Note: Standard errors are reported in brackets.				

Figure 1 – Tests for structural breaks: Selected output time series

Industrial production	Industrial Production	Anthracite production
		
		

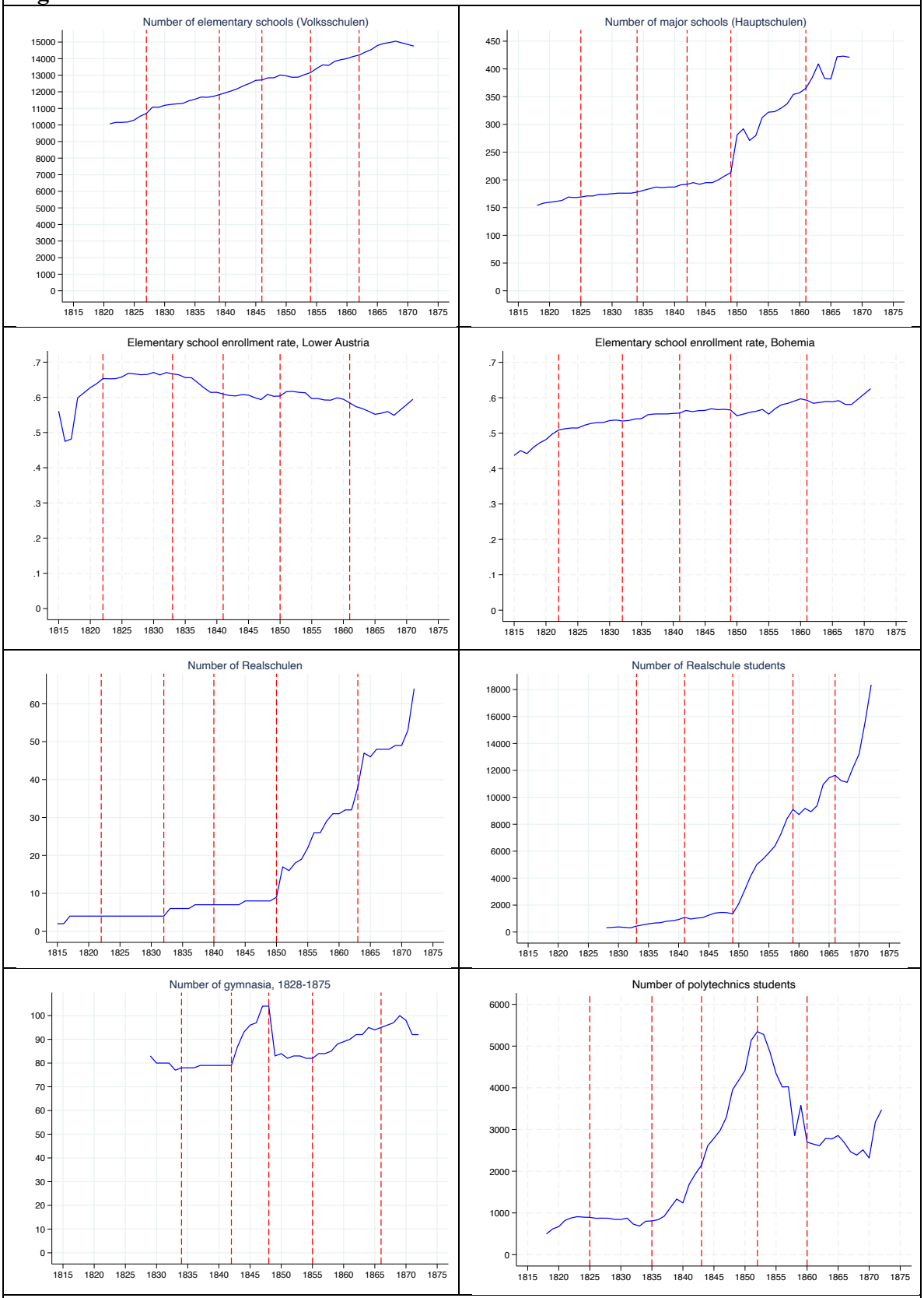
Note: Red dotted lines indicate the estimated trend breaks according to Test 3 formulation of the Bai-Perron test of structural breaks.

Figure 2 – Tests for structural breaks: Selected series of living standards indicators

Vienna	Carniola	Bohemia
		
		

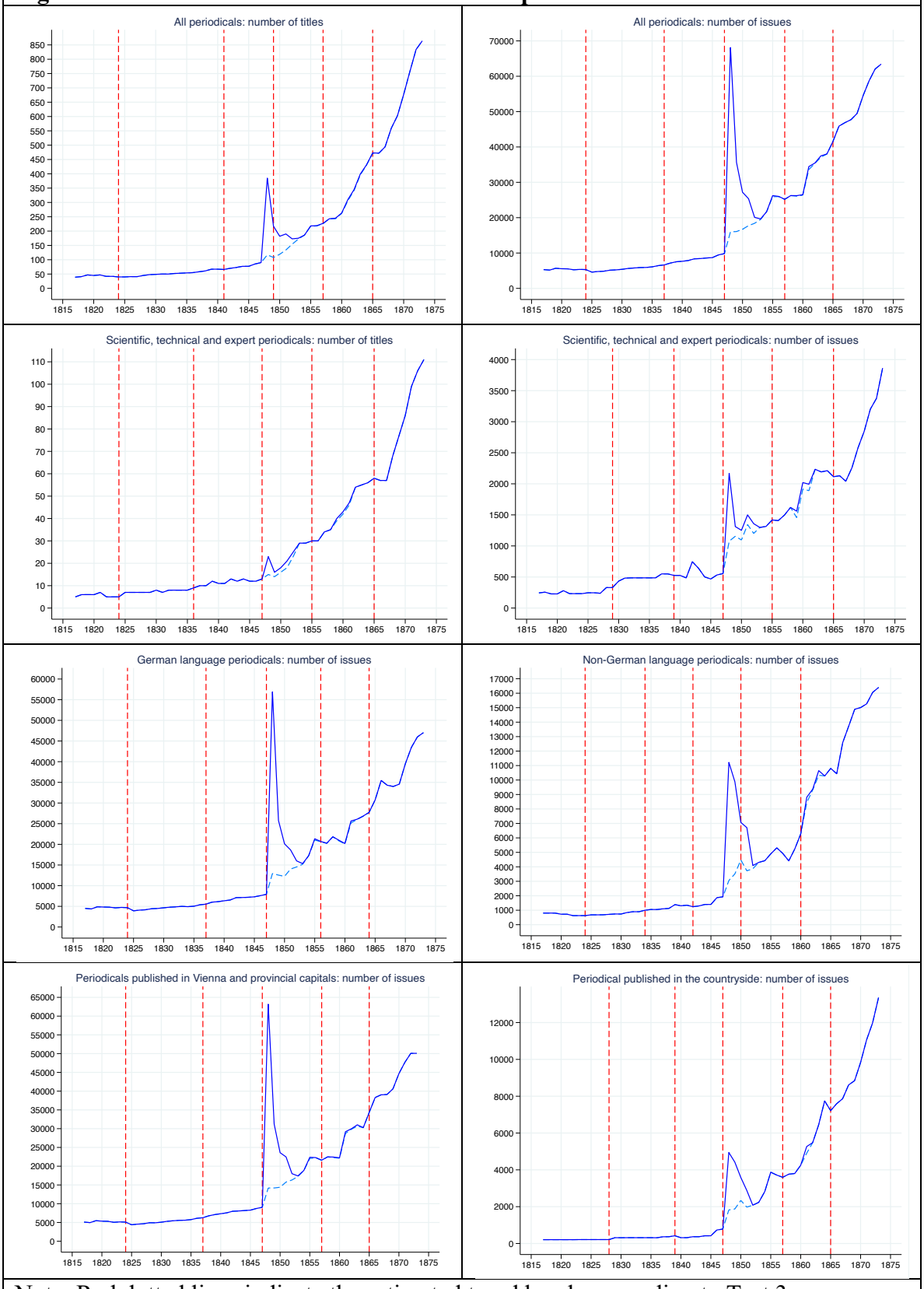
Note: Red dotted lines indicate the estimated trend breaks according to Test 3 formulation of the Bai-Perron test of structural breaks.

Figure 3 – Tests for structural breaks: Selected educational series



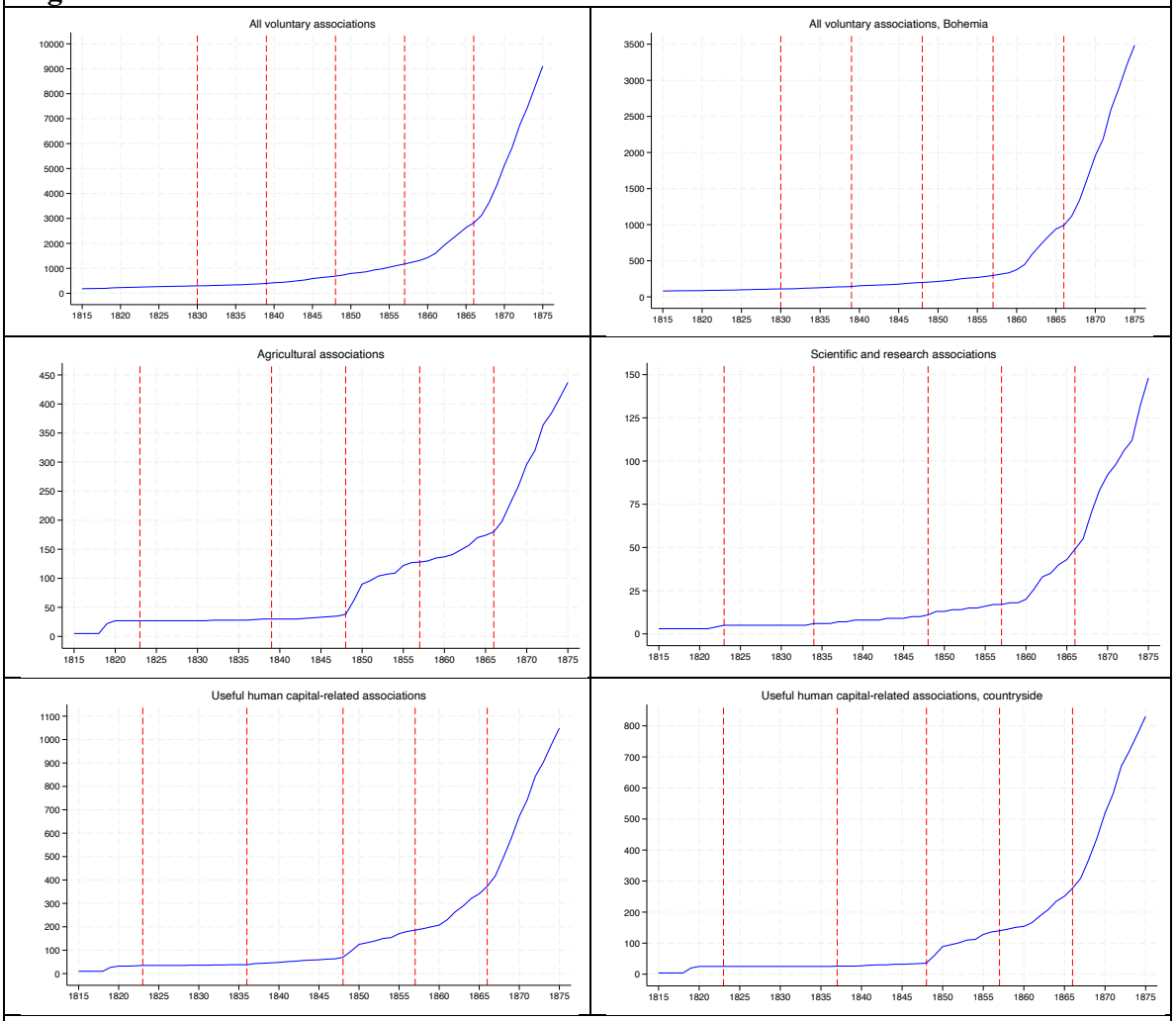
Note: Red dotted lines indicate the estimated trend breaks according to Test 3 formulation of the Bai-Perron test of structural breaks.

Figure 4 – Tests for structural breaks: Selected periodicals series



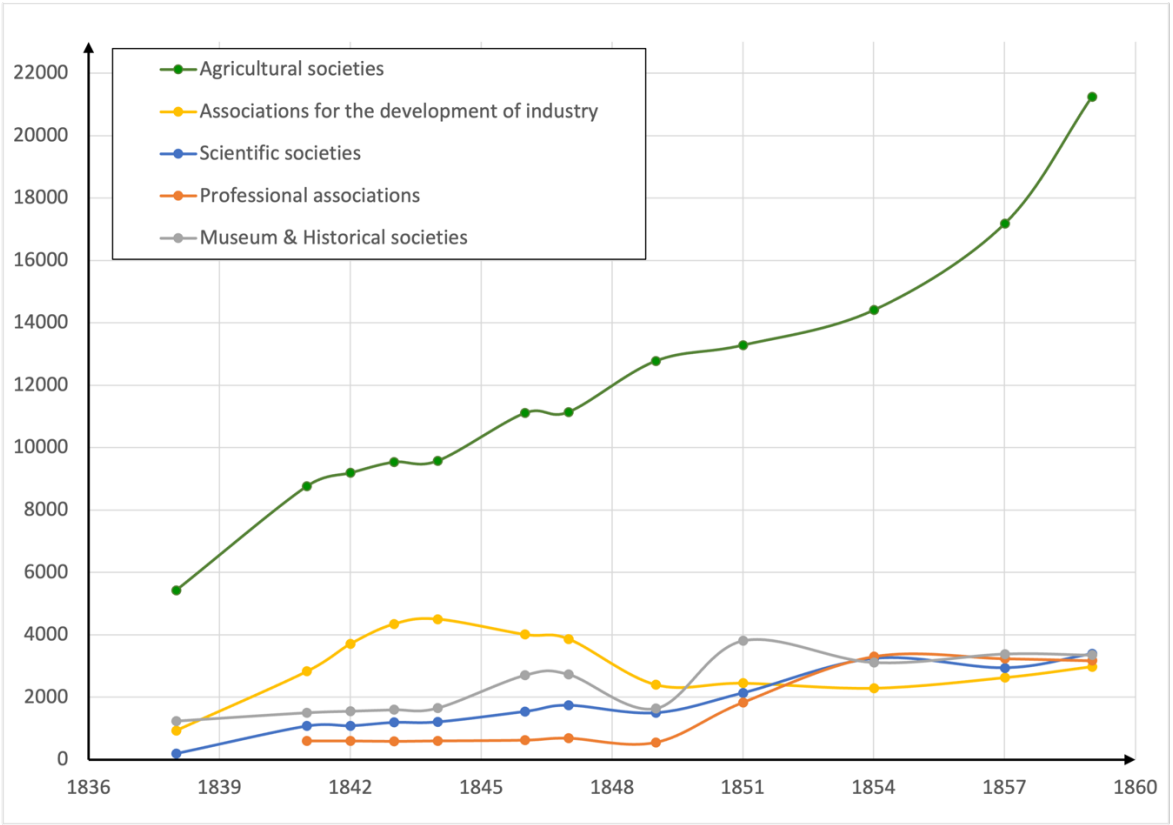
Note: Red dotted lines indicate the estimated trend breaks according to Test 3 formulation of the Bai-Perron test of structural breaks. Light blue dotted line indicates the long-term trend in periodicals, cleaned off the revlutionary bulge.

Figure 5 – Tests for structural breaks: Selected association series



Note: Red dotted lines indicate the estimated trend breaks according to Test 3 formulation of the Bai-Perron test of structural breaks.

Figure 6 – Membership in selected voluntary associations in Cisleithania, 1838–59



Note: The graph includes membership of associations that the Austrian government considered "Bildungsvereine", i.e. knowledge-diffusing societies.
Source: Tafeln zur Statistik der Oesterreichischen Monarchie, 1838–59

Appendix 1. Institutional changes in the context of the 1848 revolutions

After thirty years at the helm of Austrian government, Metternich's rule came to an end quickly and thoroughly in March 1848. As rioting spread across major Austrian cities, the emperor dismissed Metternich and promised a constitution containing all the standard civic freedoms (incl. of press, association and assembly). Such provisional constitution was indeed granted by the end of April. A more permanent document was to arise from the work of the Reichstag, the first Austrian parliament elected under an extended (though indirect) suffrage, which met in July 1848. This body duly submitted a constitutional draft for first reading by the end of the year, while also stepping somewhat out of its narrow agenda in September to pass a law abolishing *robota*, or serf labour. However, by October, the Viennese street turned more radical, thereby fracturing the revolutionary coalition.

By March 1849, the conservatives, now under the leadership of a newly crowned Emperor Franz Joseph I, fully regained the initiative: the Reichstag was disbanded before it finished its task and a new so-called March Constitution was imposed by the emperor. It still contained a liberal bill of rights and provisions for political representation, alongside numerous articles pertaining to the administrative organization of the empire. However, over the next two and a half years, the emperor and his prime minister Felix Schwarzenberg focused overwhelmingly on the implementation of its administrative features, such as the reorganization of the courts and the introduction of new civil districts in place of the pre-1848 feudal *dominia*, while ignoring its political stipulations, such as holding elections for the envisioned representative bodies. The counter-revolutionary *coup de grace* came in December 1851, when the emperor retracted his own March Constitution and replaced it with the so-called Sylvester Decrees, which fully dispensed with any of the civic freedoms and political representation, while retaining the modernizing administrative reforms of the Schwarzenberg ministry.

Here follows a more detailed overview of some of the reforms, as are relevant to this paper, comparing the pre- and post-1848 situations.

<u>Censorship</u>

The pre-1848 censorship rested on the following principles:[16] (i) preventive censorship – all publications, including reprints, advertisements or maps, had to receive an imprimatur first before being marketed to the public; (ii) paternalism – censors could request changes to text, blacking-out of certain passages or forbid open advertising of an approved publication; (iii) elitism – "learned works" containing scientific discoveries and aimed at academic audience were to be overseen lightly,[17] in contrast to the general reading for the common public, which was to be screened for any content attacking the Christian religion, the dynasty, the existing form of government or public morality ("reasonable criticism" of government was allowed, however).[18] The operation of the system was cumbersome and opaque. Internal censorship regulations, in addition to being hidden from the public, were open to varying interpretation and censors were not obliged to provide explanation for their

[16] They were embodied mainly in two regulations: the 1795 law titled *Erneuerte Censur-Ordnung* and the government's internal *Vorschrift für die Leitung des Censurwesens* (Instruction for the conduct of censorship), issued in 1810.

[17] This seemingly open formulation does not mean that scientific and technical knowledge could flow into the realm unhindered. Article 3 clarified that scientific works which did not report any new advances and were no more than compilations of established knowledge should be treated as common reading, meaning that textbooks and technical manuals did not necessarily qualify as "learned works".

[18] Various other piecemeal regulations, pertaining specifically to periodicals, also introduced a ban on public reading rooms (1798), a ban on political reporting beyond what was published in official government bulletins (1803) and the introduction of the newspaper stamp (1803) (Winckler, 1875: 57 – 60).

decisions. Wait times could be quite long because censors were relatively few. For example, in 1830, only five censors served all of Bohemia, a province of almost 4 million people.[19]

In March 1848, this system was abolished overnight with no replacement at first.[20] By March 1849, a temporary "Law against the abuse of the press" was issued, which outlawed libel, obscenity, *lèse majesté*, incitement to insurrection, fanning ethnic hatred and attacks on religion but, in contrast to the pre-1848 situation, made these provisions enforceable and contestable through courts. Newspaper publishing did not require a license, only a registration with the authorities, but publishers of political dailies were additionally obliged to deposit a surety of up to 10.000 fl. with the government, which they would forfeit if printing outlawed content.[21] By Spring 1852, this temporary law was replaced with a permanent one, which retained most of the provisions but stiffened the penalties against outlawed content and further restricted market entry. Newspaper publishing as well as dissemination of printed material were now reclassified again as licensed occupations. Surety amounts for periodicals published outside major cities were increased and they now applied not only to political periodicals but also to those dealing with religious and social matters. In addition, an advertisements tax was introduced in 1850 and the newspaper stamp, dormant since 1848, was brought back in 1857 (Winckler, 1875: 90). These measures obviously affected the economic viability of the periodicals, giving the government potential editorial leverage, but note that this applied expressly to papers dealing in political, social and religious commentary. Business, and scientific publications were not targeted in this way, as long as they scrupulously avoided publishing anything construable as political etc.

Technical and other schooling

The pre-1848 secondary education, including technical education, was informed by laws and regulations forged during and shortly after the Napoleonic Wars. But unlike Prussia, which was spurred by her defeats to modernize, Austria worked to more thoroughly shield its education system from the corrosive ideas of both the French and the Industrial Revolutions. The *Gymnasium* – the chief institution of secondary education – was reorganized in 1805–8 into a five-year course, which prepared boys for further study of law, medicine or theology. While the curriculum was already conservative by contemporary standards, its revision in 1819, though expanding the course to six years, led to an even stronger focus on Latin, Greek and Religion at the expense of natural and social sciences (Ficker, 1873: 127–133). It also required teachers to be generalists, instead of subject specialists, which must have affected the quality of instruction. In 1819–24, the number of *Gymnasia* was reduced, further constricting access to education. This structure then stayed in place, with cosmetic modifications, until the fundamental Exner-Bonitz reform of 1849, a fruit of the 1848 revolution. This reform granted the right to establish secondary schools to provincial governments, municipalities as well as private parties. It boosted the share of mathematics, geography, physics and biology in the curriculum and capped the eight-year *Gymnasium* study with a leaving exam (*Maturitätsprüfung*). This basic framework remained in place for the rest of the monarchy's existence.

Technical schooling followed a similar trajectory. Late 18th century efforts to build a network of practically oriented schools for middle-class sons, focused more on natural sciences, led to the introduction of the *Realschule* into the structure of the Austrian education system in 1805 but its curriculum was much watered down, compared to original plans, with

[19] See Schematismus Böhmen for 1830, page 18.

[20] Lifting of censorship was one of the first and the most widespread revolutionary demand in 1848 (Judson, 2016: 165,168, 173).

[21] This was a non-trivial amount. For comparison, at the time, 10.000 fl. could purchase an estate of almost 1 km^2 or a steam engine of 18 horse-power (Jonák, 1865: 24; MGS 01 1852 pdfp 301).

only a two- or at most three-year course of study (Cvrcek, 2020: 45). Moreover, the *Realschule*'s formal anchoring in the law notwithstanding, the government exercised its powers to (not) approve new educational institutions and so only eight *Realschulen* were in operation as of 1847. Even those that had been established in areas under French or Bavarian control during the Napoleonic Wars were dismantled post-1815 (Cvrcek, 2020: 45–47). The Exner-Bonitz reform of 1849 applied to these schools as much as to the *Gymnasia*, except that the course of study was set at six years (up from three) without an exam at the end. The *Realschule*'s expanded curriculum devoted no time to Latin or Greek but taught mathematics, descriptive geometry, physics, chemistry, machine design and accounting. Additionally, the reform also gave smaller enterprising municipalities the option to establish only the lower three grades of the *Realschule* and attach them to an existing elementary school, thereby significantly expanding the educational offerings to its local schoolchildren.[22]

Additionally, the 1848–51 period saw the expansion of the *Hauptschule*, a type of primary school with a curriculum extensive enough to serve as a stepping stone for secondary education.[23] While this type of school had already existed before 1848 (mainly in towns and cities), it was expanded from three-grade to four-grade school in August 1851, when the curriculum was updated to tie in more smoothly into the *Realschule* curriculum (Ficker 1873: 39).

Voluntary associations

Up until 1843, The Austrian Empire did not have much dedicated legislation regarding voluntary associations, except for regulations pertaining to joint stock companies and a general ban on "secret societies", which dated back to the 18th century (Schmitt, 1869: 79). Whatever voluntary associations arose during that time required a personal approval from the emperor himself and various members of the imperial family were frequently entreated to serve as patrons to ensure appropriate "political cover" for the association's activity. An imperial decree, issued in 1843, formalized the existing practice, while also delegating some powers to grant concessions to the Court Chancellery and provincial governors.

As with censorship, this tightly controlled concessional approach ended overnight with the outbreak of the revolution in Spring 1848. The April 1848 constitution declared the principle of freedom of association, leaving the details to be fleshed out in a separate law. This did not appear until March 1849, by which time the young emperor was in a position to start rolling some of the civil freedoms back: while non-political association were obligated to do no more than report their formation to the authorities to start operating (no official approval required!), politically oriented associations were subjected to a number of regulations with potentially stiff fines and imprisonment penalties for non-compliance. After the counter-revolution's victory in 1851, even this relatively liberal law was replaced with a new one in November 1852. More than in the areas of education and the press, the regulations of voluntary association now harked back to the status quo before 1848, with more than a half of the 1852 law's text brought over from the 1843 decree: the concession system was reintroduced, politically oriented associations were outright forbidden and the authorities acquired the power to shut down any association deemed in breach of the law

[22] These schools then offered up to eight grades of schooling to children aged 6 to 14 and were called either *Hauptschule mit Unter-Realschule* (HURS) or *Bürgerschule*. Since these schools nonetheless remained primary schools and were considered a part of primary education, I do not count them among the *Realschulen* proper, which were secondary schools.

[23] The (mostly urban) *Hauptschule* stood in contrast to the rural *Trivialschule*, a two-year elementary school which was not supposed to enable pupils to progress to any further stages of formal schooling.

without any recourse to courts (although a complaint could be filed at the Interior Ministry). These regulations remained in force until 1867.

The overview of institutional changes documents that revolutionary years 1848–51 brought about a real, lasting change in institutions governing Austria's information space. The change was uneven across areas: in maters of education, the neo-absolutist regime by and large adopted the agenda of the revolutionaries wholesale and pursued it even after it solidified its grip on power. Matters of the press witnessed a piecemeal liberalization with the censorship becoming formalized (as opposed to informal and murky in the pre-1848 years), more transparent and more narrowly focused on political publication. The sphere of voluntary association saw the least pronounced change, since the formal regulation mostly remained unchanged, but the state exercised its prohibitive powers more leniently, compared to the pre-1848 period – especially when it came to associations that were non-political.

Appendix 2. Data sources

Time series for tests of structural breaks

I put together 259 time series covering a wide range of indicators of social and economic development of the monarchy in the years 1815–1875. Not all series span the whole period and the 1848–51 revolution is not the only period of major institutional change.[24] The data come from a range of sources.

The data pertaining to economic activity, such as indices of real output, come from Komlos (1983). Measures of living standards, such as welfare ratios and prices of individual products, are taken from Cvrcek (2013).

Educational data were collected as part of my work on Cvrcek (2020) and from contemporary published sources, such as the *Tafeln zur Statistik der Oesterreichische Monarchie* (1830–1865) and the *Statistisches Jahrbuch der Oesterreichisches Monarchie* (1863–1875). From the 1850s, the Austrian Ministry of Education also published a separate series on secondary education, titled *Statistische Uebersicht ueber die Oesterreichische Gymnasien und Realschulen*, which I also use.

Data on the publication of periodicals from 1848 onwards were constructed from annual lists of circulating periodicals in Winckler (1875). The data for pre-1848 periodicals were constructed from the national periodicals dabases of various Habsburg successor states. These include Lang (2003, 2006) and the ANNO (2023) database of the Österreichische Nationalbibliothek for the territories of modern-day Austrian Republic, the Kramerius (2023) database and Digitální knihovna for the Czech Republic (Moravská zemská knihovna, 2023), the Jagellonian Digital Library for Galicia (Uniwersytet Jagielloński, 2023) and Digitalna Knižnica Slovenije for the periodicals in Slovenian and published on the territory of modern-day Slovenia (Narodna in univerzitetna knjižnica, 2023). In addition, partial annual information on pre-1848 publications were carried by the contemporary annual statistical publication of the monarchy, the Tafeln zus Statistik der Oesterreichischen Monarchie, which had a section on periodicals, "Zeitungswesen". It should be noted that the periodicals' data pertain to the western, Austrian part of the Habsburg monarchy.

The main data source for voluntary associations is Handbuch der Vereine für die im Reichsrathe vertretene Königreiche und Länder nach dem Stand an der Schlusse des Jahres 1890 (K.k. Statistische Central-Commission, 1892). The data in this publication list the name, location, date of establishment and sphere of activity of every voluntary association in Cisleithania in 1890. Consequently, the finding of the number active associations in, say, year 1857, amounts to counting associations whose year of establishment predates or equals 1857. This source is therefore not allowing us to capture any associations that may have existed and then ceased operation before 1890. To counter this problem, I cross-check the numbers based on the 1890 data against the few existing piecemeal and partial sources on associational life from earlier dates. This includes Stubenrauch (1857), Schmitt (1869) and the section on "Bildungsanstalten" in the *Tafeln zur Statistik der Oesterreichischen Monarchie* (1830 – 1865). These auxiliary sources provide at least a „spotcheck" on the number of associations operating in a particular year in the 1840s and 1850. While the different sources do not line up perfectly – mainly on account of changing classification of the various associations and different treatment of association branches in their accounting – they broadly paint the same picture. In other words, the 1890 survey indeed misses some of the associations that did not

[24] Other instances of substantial institutional change include the re-introduction of constitutional representative government into Austria in 1861 and the forging of the Austro-Hungarian compromise and the attendance constitutional reforms of 1865-67. The subsequent statistical analysis keeps the door open for the identification of these periods as sources of breaks in the time series.

survive for long or that merged with other societies but the discrepancy thereby produced is, in my estimation, less than 10% of the totals inferred from my survey-based tallies. Certainly, the measurement error is unlikely to invalidate the tests for structural break around 1848.

Data on *Realschule* students in Bohemia

After 1848, secondary school widely adopted the practice of publishing annual reports on their own activities. These usually (but not always) included lists of their current students together with a note on their place of origin. This is the case for the *Realschule* in Loket/Elbogen (academic year 1858–59), the Czech *Realschule* in Prague (academic year 1858–59), Liberec/Reichenberg (academic year 1859–60) and the German Realschule in Prague (academic year 1863–64). Ideally, one would prefer for all the student lists to come from the same academic year but, as can be seen, not all schools published the lists consistently in every academic year and so the dataset suffers from some variation on this score.

In other cases, I relied on archival sources. This was the case of the students of the Czech *Realschule* in Prague for the academic year 1850–51, the German Realschule in Prague for academic years 1840–41, 1846–47 and 1850–51 and those in the *Realschule* in Kutná Hora (academic year 1859–60). Unfortunately, the archival record in Kutná Hora was incomplete and only data for one class (out of six) has been preserved.

In case of the *Realschule* in Rakovník, I made use of their excellent centenary publication (100 let rakovnické reálky – Soukup, 1933), which listed all students, together with their place of origin, as well as a note on their subsequent employment. Thus, data for all relevant academic years (1840–41, 1846–47, 1850–51 and 1859–60) could be sourced from it. A similar publication (Album, 1862) served as my source for the students of the *Realschule* in Liberec for the academic years 1840–41, 1846–47 and 1850–51.

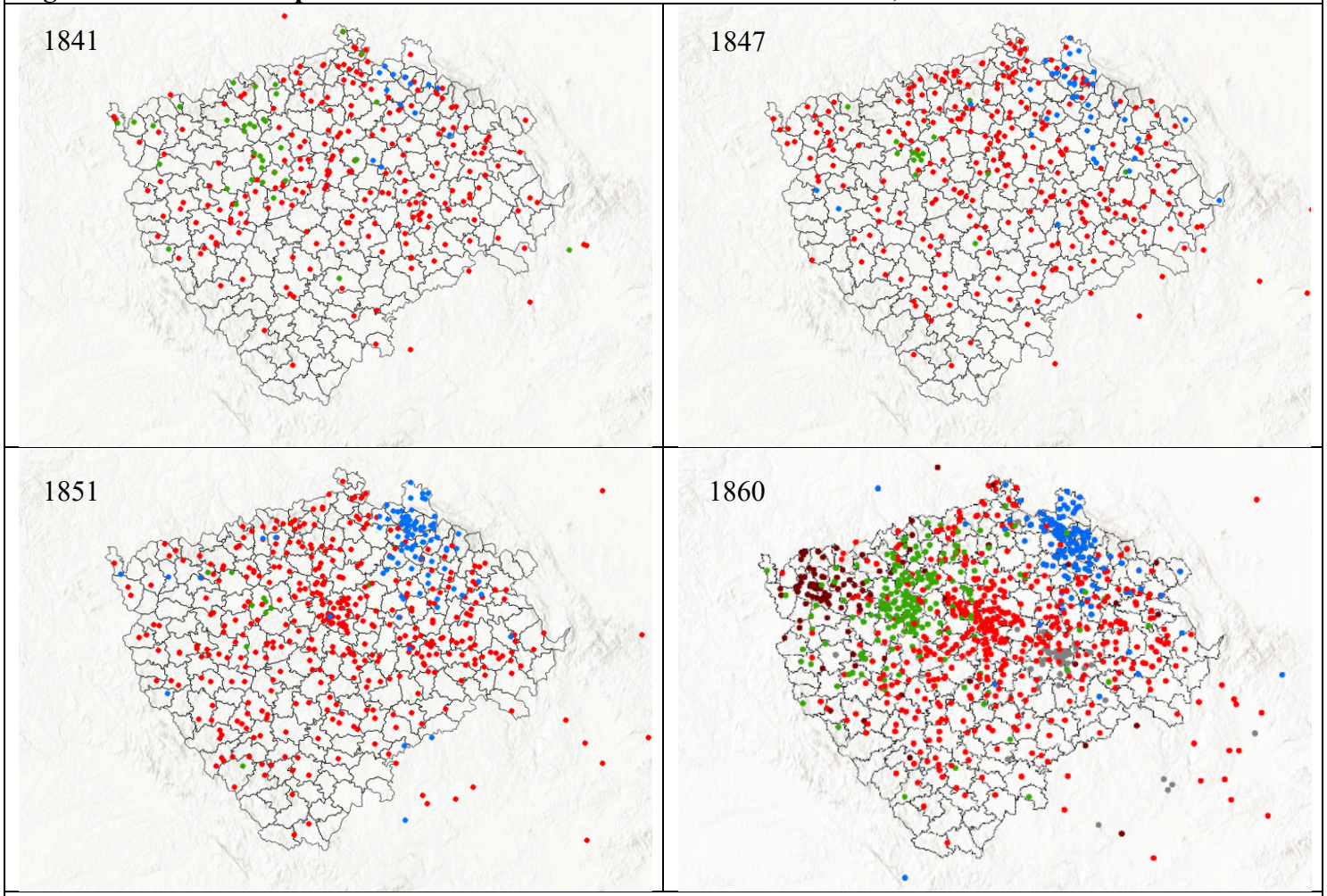
In 95% of all cases, the locations of birth were easily identified and they were located with certainty. The remaining 5% cases involved students coming from places that have common names ("Neudorf", "Lhota", "Janovice"), where the proper location was based on high probability rather than certainty (for example, on the basis of the student's last name frequently recurring in the locality today – see kdejsme.cz for the source on the surnames). When even such aids were unavailable and a student's place of birth was ambiguous on account of there being several candidate places, I assigned the student to that candidate place that was closest to the school he was attending.

Data on factories with *Fabriksprivilegium* in 1841 and on steam engine locations

The data on the factories with *Fabrikspriviligium* come from the *Tafeln zur Statistik der Oesterreichischen Monarchie* 1841, Tafel 51. The data were cross-checked against the list of *Fabriksprivilegium* holders in *Schematismus des Königreiches Böhmen für das Jahr 1841*, pp. 642–701. Earlier editions were also used in a few cases.

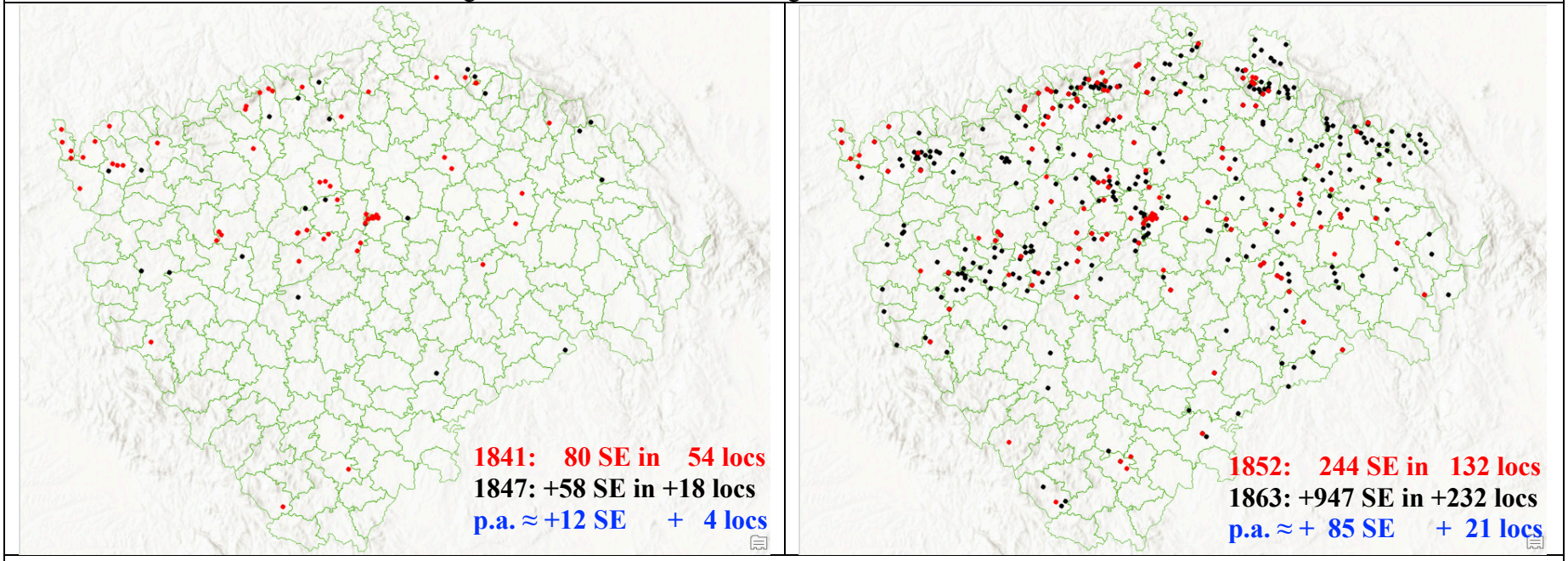
The steam engine data are based on two surveys, conducted by the Austrian Statistical Commission, one in 1851/2 and another one in 1863. The same data were also published in the *Tafeln zur Statistik der Oesterreichischen Monarchie* for 1851 and *Statistisches Jahrbuch der Oesterreichischen Monarchie* (1863). The Bohemian survey for 1847 was published by Schnabel (1848: Tafeln 46–48). For 1841, I rely on the list of steam engines in *Tafeln zur Statistik der Oesterreichischen Monarchie* for 1841.

Figure 7 – Location of places of birth of *Realschule* students in Bohemia, 1841–1859



Note: Students' places of birth are colour-coded according to the *Realschule* they attended: red for Prague (two *Realschulen* from 1849 onwards), blue for Liberec, green for Rakovník, brown for Loket, grey for Kutná Hora.
Source: See Appendix 2.

Figure 8 – Location of steam engines in Bohemia, 1841 – 1863



Note: Each dot is a location of one or more steam engines.

Source: See Appendix 2

Appendix table A1						
		$\emptyset_{1857-59}$	$\frac{\emptyset_{1857-59}}{\emptyset_{1845-47}}$	Test 1	Test 2	Test 3
				H_0: no break in 1848		
Series #	Variables			p-value	single break	multiple breaks
	Economy					
	Production indices					
1	Anthracite production, millions of quintals, Cisleithania, 1819-1873	15.2	3.11	0.0000	1853	1827, 1836, 1849, 1857, 1865
	ln(anthracite production, millions of quintals), Cisleithania, 1819-1873	2.7	1.71	0.0028	1838	1838, 1856
2	Lignite production, millions of quintals, Cisleithania, 1819-1873	11.3	4.30	0.0000	1863	1827, 1836, 1849, 1857, 1865
	ln(lignite production, millions of quintals), Cisleithania, 1819-1873	2.4	2.51	0.0000	1832	1832, 1840, 1848, 1856, 1864
3	Industrial production, mil. K. in 1913 prices, Cisleithania,1830-1873	357.6	1.42	0.0070	1862	1847, 1854, 1861, 1867
	ln(industrial production, mil. K. in 1913 prices), Cisleithania,1830-1873	5.9	1.06	0.5543	1861	1836, 1847, 1853, 1859, 1866
4	Industrial production, mil. K. in 1913 prices, Transleithania,1830-1873	112.1	1.30	0.0000	1847	1841, 1847, 1854, 1860, 1866
	ln(industrial production, mil. K. in 1913 prices), Transleithania,1830-1873	4.7	1.06	0.0000	1847	1841, 1847, 1854, 1860, 1866
5	Iron production, mil. K in 1913 prices, Cisleithania, 1830-1873	45.9	1.92	0.0000	1867	1841, 1848, 1854, 1860, 1867
	ln(iron production, mil. K in 1913 prices), Cisleithania, 1830-1873	3.8	1.21	0.2438	1863	1861, 1867
6	Cotton textiles production, mil K. in 1913 prices, Cisleithania, 1830-1873	95.8	1.63	0.8774	1861	1840, 1847, 1853, 1861, 1867
	ln(cotton textiles production, mil K. in 1913 prices), Cisleithania, 1830-1873	4.6	1.12	0.0009	1861	1835, 1861
7	Woollen textiles production, mil K. in 1913 prices, Cisleithania, 1830-1873	111.7	1.22	0.7453	1866	1836, 1844, 1853, 1859, 1866
	ln(woollen textiles production, mil K. in 1913 prices), Cisleithania, 1830-1873	4.7	1.04	0.6804	1866	1836, 1844, 1853, 1859, 1866
8	Value added in Railroad construction and Repair, mil K. in 1913 prices, 1913 prices, 1837-1873	17.0	1.64	0.0051	1868	1868
9	Sugar production, mil K. in 1913 prices, Cisleithania, 1830-1873	2.8	1.80	0.0000	1867	1847, 1867
	ln(sugar production, mil K. in 1913 prices, Cisleithania), 1830-1873	1.0	2.28	0.2444	1867	1867
10	Flour production, mil K. in 1913 prices, Transleithania, 1830-1873	56.0	1.06	0.6983	1866	1838, 1844, 1850, 1859, 1866
	ln(flour production, mil K. in 1913 prices), Transleithania, 1830-1873	4.0	1.01	0.6822	1866	1838, 1844, 1850, 1860, 1866
	Measures of living standards					
11	Welfare ratio, Vienna, 1827-1873	0.539	1.65	0.0000	1855	1845, 1860
12	Welfare ratio, Lower Austria, 1827-1873	0.437	1.16	0.0000	1864	1833, 1845, 1852, 1859, 1866
13	Welfare ratio, Upper Austria, 1827-1873	0.463	1.06	0.9177	1857	1851, 1863
14	Welfare ratio, Salzburg, 1827-1873	0.516	0.96	0.0000	1849	1850, 1866
15	Welfare ratio, Styria, 1827-1873	0.479	1.09	0.4827	1861	1835, 1842, 1849, 1856, 1863
16	Welfare ratio, Carinthia, 1827-1873	0.459	0.95	0.0000	1862	1835, 1842, 1849, 1858, 1866
17	Welfare ratio, Carniola, 1827-1873	0.440	0.96	0.0427	1866	1835, 1845, 1852, 1859, 1866
18	Welfare ratio, Austrian Littoral, 1827-1873	0.436	0.93	0.0137	1860	1833, 1842, 1852, 1859, 1866
19	Welfare ratio, Tyrol and Vorarlberg, 1827-1873	0.490	1.04	0.0001	1853	1835, 1842, 1852, 1859, 1866
20	Welfare ratio, Bohemia, 1827-1873	0.345	1.43	0.0004	1866	1836, 1845, 1852, 1859, 1866
21	Welfare ratio, Moravia, 1827-1873	0.295	1.11	0.0003	1864	1856, 1863
22	Welfare ratio, Silesia, 1827-1873	0.269	1.14	0.0000	1864	1835, 1842, 1849, 1856, 1865
23	Welfare ratio, Galicia, 1827-1873	0.333	1.39	0.0662	1860	1860

24	Welfare ratio, Bukovina, 1827-1873	0.404	1.38	0.0000	1847	1834, 1844, 1852, 1859, 1866
25	Welfare ratio, Dalmatia, 1827-1873	0.652	1.04	0.0000	1854	1833, 1854
26	Welfare ratio, Hungary, 1827-1873	0.436	1.08	0.6176	1858	1858
27	Welfare ratio, Western Slovakia, 1827-1873	0.469	1.13	0.9842	1858	1835, 1845, 1852, 1859, 1866
28	Welfare ratio, Eastern Slovakia, 1827-1873	0.450	1.14	0.1485	1858	1859, 1866
29	Welfare ratio, Croatia Slavonia, 1827-1873	0.565	1.06	0.2590	1860	1860
30	Welfare ratio, Temeser Banat, 1827-1873	0.555	1.22	0.0011	1849	1837, 1849, 1856, 1863
31	Welfare ratio, Transylvania, 1827-1873	0.476	1.01	0.0044	1860	1833, 1842, 1851, 1858, 1866
	Consumer price index					
32	Cost of living in Austrian Krone, Vienna, 1827-1873	800	1.22	0.0000	1844	1835, 1842, 1849, 1856, 1863
33	Cost of living in Austrian Krone, Lower Austria, 1827-1873	778	1.35	0.0001	1850	1833, 1842, 1849, 1856, 1863
34	Cost of living in Austrian Krone, Upper Austria, 1827-1873	629	1.32	0.0000	1850	1850
35	Cost of living in Austrian Krone, Salzburg, 1827-1873	621	1.29	0.0001	1845	1836, 1843, 1852, 1859, 1866
36	Cost of living in Austrian Krone, Styria, 1827-1873	637	1.40	0.0000	1846	1844, 1863
37	Cost of living in Austrian Krone, Carinthia, 1827-1873	660	1.45	0.0000	1849	1835, 1845, 1852, 1859, 1866
38	Cost of living in Austrian Krone, Carniola, 1827-1873	710	1.42	0.0000	1849	1835, 1845, 1852, 1859, 1866
39	Cost of living in Austrian Krone, Austrian Littoral, 1827-1873	816	1.35	0.0000	1852	1836, 1845, 1852, 1859, 1866
40	Cost of living in Austrian Krone, Tyrol and Vorarlberg, 1827-1873	722	1.18	0.0012	1851	1851, 1859
41	Cost of living in Austrian Krone, Bohemia, 1827-1873	679	1.19	0.0008	1850	1834, 1844, 1851, 1859, 1866
42	Cost of living in Austrian Krone, Moravia, 1827-1873	661	1.31	0.0045	1851	1835, 1842, 1849, 1856, 1864
43	Cost of living in Austrian Krone, Silesia, 1827-1873	652	1.28	0.0112	1851	1835, 1842, 1849, 1856, 1864
44	Cost of living in Austrian Krone, Galicia, 1827-1873	548	1.22	0.0014	1845	1835, 1842, 1849, 1856, 1863
45	Cost of living in Austrian Krone, Bukovina, 1827-1873	550	1.39	0.0002	1846	1835, 1842, 1849, 1857, 1866
46	Cost of living in Austrian Krone, Dalmatia, 1827-1873	664	1.59	0.0000	1853	1834, 1842, 1849, 1856, 1863
47	Cost of living in Austrian Krone, Hungary, 1827-1873	702	1.44	0.0000	1851	1835, 1842, 1849, 1856, 1864
48	Cost of living in Austrian Krone, Western Slovakia, 1827-1873	588	1.37	0.0001	1851	1851
49	Cost of living in Austrian Krone, Eastern Slovakia, 1827-1873	600	1.38	0.0004	1851	1835, 1842, 1852, 1859, 1866
50	Cost of living in Austrian Krone, Croatia Slavonia, 1827-1873	686	1.60	0.0000	1848	1833, 1842, 1849, 1856, 1864
51	Cost of living in Austrian Krone, Temeser Banat, 1827-1873	636	1.48	0.0000	1848	1833, 1842, 1849, 1856, 1863
52	Cost of living in Austrian Krone, Transylvania, 1827-1873	586	1.59	0.0001	1849	1835, 1845, 1852, 1859, 1866
	Consumer prices index - Foodstuffs only					
53	Cost of living - Foodstuffs, Vienna, 1827-1873	484	1.20	0.0002	1844	1835, 1842, 1849, 1856, 1863
54	Cost of living - Foodstuffs, Lower Austria, 1827-1873	467	1.35	0.0039	1850	1833, 1845, 1852, 1859, 1866
55	Cost of living - Foodstuffs, Upper Austria, 1827-1873	396	1.28	0.0000	1844	1835, 1842, 1849, 1856, 1863
56	Cost of living - Foodstuffs, Salzburg, 1827-1873	438	1.20	0.0305	1845	1836, 1845, 1852, 1859, 1866
57	Cost of living - Foodstuffs, Styria, 1827-1873	407	1.38	0.0006	1845	1836, 1845, 1852, 1859, 1866
58	Cost of living - Foodstuffs, Carinthia, 1827-1873	470	1.46	0.0001	1846	1835, 1845, 1852, 1859, 1866
59	Cost of living - Foodstuffs, Carniola, 1827-1873	490	1.43	0.0000	1846	1835, 1845, 1852, 1859, 1866
60	Cost of living - Foodstuffs, Austrian Littoral, 1827-1873	547	1.41	0.0000	1852	1835, 1845, 1852, 1859, 1866
61	Cost of living - Foodstuffs, Tyrol and Vorarlberg, 1827-1873	484	1.06	0.2015	1851	1835, 1843, 1852, 1859, 1866
62	Cost of living - Foodstuffs, Bohemia, 1827-1873	416	1.08	0.1676	1862	1834, 1844, 1851, 1859, 1866

63	Cost of living - Foodstuffs, Moravia, 1827-1873	413	1.25	0.1068	1851	1835, 1842, 1849, 1856, 1863
64	Cost of living - Foodstuffs, Silesia, 1827-1873	439	1.22	0.0998	1851	1851
65	Cost of living - Foodstuffs, Galicia, 1827-1873	329	1.18	0.0089	1845	1835, 1842, 1849, 1856, 1863
66	Cost of living - Foodstuffs, Bukovina, 1827-1873	361	1.39	0.0090	1845	1835, 1842, 1849, 1856, 1863
67	Cost of living - Foodstuffs, Dalmatia, 1827-1873	481	1.63	0.0001	1853	1833, 1842, 1852, 1859, 1866
68	Cost of living - Foodstuffs, Hungary, 1827-1873	429	1.47	0.0000	1851	1851
69	Cost of living - Foodstuffs, Western Slovakia, 1827-1873	352	1.34	0.0013	1851	1851
70	Cost of living - Foodstuffs, Eastern Slovakia, 1827-1873	378	1.38	0.0057	1851	1842, 1862
71	Cost of living - Foodstuffs, Croatia Slavonia, 1827-1873	439	1.57	0.0000	1850	1833, 1842, 1849, 1856, 1863
72	Cost of living - Foodstuffs, Temeser Banat, 1827-1873	359	1.47	0.0001	1847	1833, 1842, 1849, 1856, 1863
73	Cost of living - Foodstuffs, Transylvania, 1827-1873	357	1.69	0.0010	1849	1835, 1845, 1852, 1859, 1866
	Periodicals - Titles					
	By type					
74	Titles of all periodicals, Number per year, Cisleithania, 1817-1873	238	2.84	0.0000	1857	1824, 1841, 1849, 1857, 1865
75	Titles of political periodicals, Number per year, Cisleithania, 1817-1873	49	2.39	0.0000	1857	1827, 1839, 1847, 1857, 1865
76	Titles of local-news periodicals, Number per year, Cisleithania, 1817-1873	38	3.65	0.0000	1853	1827, 1838, 1846, 1857, 1865
77	Titles of business periodicals, Number per year, Cisleithania, 1817-1873	42	2.54	0.0000	1861	1826, 1834, 1848, 1856, 1865
78	Titles of literary periodicals, Number per year, Cisleithania, 1817-1873	33	2.58	0.0000	1848	1828, 1840, 1848, 1856, 1865
79	Titles of religious periodicals, Number per year, Cisleithania, 1817-1873	16	6.86	0.0000	1856	1827, 1839, 1847, 1857, 1865
80	Titles of satirical periodicals, Number per year, Cisleithania, 1817-1873	9	3.38	0.0000	1855	1855
81	Titles of scientific, expert and technical periodicals, Number per year, Cisleithania, 1817-1873	36	2.95	0.0000	1854	1824, 1836, 1847, 1855, 1865
82	Titles of artistic periodicals, Number per year, Cisleithania, 1817-1873	12	2.00	0.0000	1848	1826, 1835, 1848, 1857, 1865
83	Titles of association periodicals, Number per year, Cisleithania, 1817-1873	19	3.11	0.0000	1860	1830, 1838, 1849, 1857, 1865
84	Titles of women's and fashion periodicals, Number per year, Cisleithania, 1817-1873	4	1.00	0.0014	1865	1865
	By language of publication					
85	Titles of periodicals in German, Number per year, Cisleithania, 1817-1873	185	2.78	0.0000	1857	1824, 1841, 1849, 1857, 1865
86	Titles of all periodicals NOT in German, Number per year, Cisleithania, 1817-1873	53	3.06	0.0000	1857	1826, 1837, 1845, 1857, 1865
87	Titles of periodicals in Czech, Number per year, Cisleithania, 1817-1873	15	1.76	0.0000	1859	1826, 1835, 1848, 1857, 1865
88	Titles of periodicals in Italian, Number per year, Cisleithania, 1817-1873	17	4.73	0.0000	1858	1829, 1837, 1845, 1854, 1864
89	Titles of periodicals in Polish, Number per year, Cisleithania, 1817-1873	9	2.45	0.0000	1856	1825, 1836, 1848, 1856, 1864
90	Titles of all periodicals in Ukrainian, Croatian and Slovenian, Number per year, Cisleithania, 1817-1873	8	8.00	0.0000	1860	1860
91	Titles of periodicals in Ruthenian or Ukrainian, Number per year, Cisleithania, 1817-1873	2	NA[a]	0.0000	1861	1861
92	Titles of periodicals in Croatian, Number per year, Cisleithania, 1817-1873	2	NA[a]	0.0000	1848	1848
93	Titles of periodicals in Slovenian, Number per year, Cisleithania, 1817-1873	4	4.00	0.0000	1860	1860
94	Titles of all periodicals in foreign languages, Number per year, Cisleithania, 1817-1873	2	NA[a]	0.0000	1854	1854
	By location of publication					
95	Titles of periodicals in Lower Austria, Number per year, Lower Austria, 1817-1873	97	2.85	0.0000	1857	1824, 1840, 1849, 1857, 1865
96	Titles of periodicals in Upper Austria, Number per year, Upper Austria, 1817-1873	13	6.33	0.0000	1848	1828, 1838, 1846, 1854, 1865
97	Titles of periodicals in Salzburg, Number per year, Salzburg, 1817-1873	5	4.67	0.0000	1850	1825, 1838, 1846, 1854, 1863
98	Titles of periodicals in Styria, Number per year, Styria, 1817-1873	9	2.55	0.0000	1861	1825, 1838, 1846, 1854, 1865

99	Titles of periodicals in Carinthia, Number per year, Carinthia, 1817-1873	5	1.67	0.0000	1850	1831, 1840, 1848, 1856, 1865
100	Titles of periodicals in Carniola, Number per year, Carniola, 1817-1873	5	1.27	0.0001	1865	1824, 1841, 1849, 1857, 1865
101	Titles of periodicals in Austrian Littoral, Number per year, Austrian Littoral, 1817-1873	17	4.73	0.0000	1858	1824, 1834, 1842, 1850, 1864
102	Titles of periodicals in Tyrol, Number per year, Tyrol, 1817-1873	14	3.91	0.0000	1847	1831, 1839, 1847, 1856, 1864
103	Titles of periodicals in Vorarlberg, Number per year, Vorarlberg, 1817-1873	3	1.33	0.0000	1861	1825, 1835, 1846, 1855, 1863
104	Titles of periodicals in Bohemia, Number per year, Bohemia, 1817-1873	39	2.34	0.0000	1857	1827, 1837, 1849, 1857, 1865
105	Titles of periodicals in Moravia, Number per year, Moravia, 1817-1873	13	4.44	0.0000	1852	1826, 1838, 1848, 1856, 1864
106	Titles of periodicals in Silesia, Number per year, Silesia, 1817-1873	4	4.33	0.0000	1861	1825, 1835, 1847, 1857, 1865
107	Titles of periodicals in Galicia, Number per year, Galicia, 1817-1873	11	2.43	0.0000	1859	1825, 1836, 1844, 1852, 1860
108	Titles of periodicals in Bukovina, Number per year, Bukovina, 1817-1873	0	NA[a]	0.0000	1861	1861
109	Titles of periodicals in Dalmatia, Number per year, Dalmatia, 1817-1873	3	2.67	0.0000	1861	1861
110	Titles of all periodicals in Alpine provinces, Number per year, 1817-1873	146	2.95	0.0000	1856	1824, 1841, 1849, 1857, 1865
111	Titles of all periodicals in the Czech provinces, Number per year, 1817-1873	57	2.74	0.0000	1857	1824, 1835, 1849, 1857, 1865
112	Titles of all periodicals in Eastern provinces, Number per year, 1817-1873	11	2.43	0.0000	1859	1824, 1834, 1842, 1851, 1860
113	Titles of all periodicals in Southern provinces, Number per year, 1817-1873	25	2.96	0.0000	1858	1827, 1835, 1844, 1855, 1864
114	Titles of periodicals in Wien, Number per year, Vienna, 1817-1873	95	2.80	0.0000	1858	1824, 1840, 1849, 1857, 1865
115	Titles of periodicals published in all provincial capitals and Vienna, Number per year, provincial capitals and Vienna, 1817-1873	198	2.64	0.0000	1857	1824, 1841, 1849, 1857, 1865
116	Titles of periodicals published in provincial capitals excl. Vienna, Number per year, provincial capitals excl. Vienna, 1817-1873	103	2.50	0.0000	1855	1846, 1858
117	Titles of periodicals published in the countryside, Number per year, Cisleithania, 1817-1873	40	4.48	0.0000	1858	1825, 1835, 1847, 1857, 1865
	By language and type					
118	Titles of periodicals in German, Number per year, Cisleithania, 1817-1873	185	2.78	0.0000	1857	1824, 1841, 1849, 1857, 1865
119	Titles of all periodicals NOT in German, Number per year, Cisleithania, 1817-1873	53	3.06	0.0000	1857	1826, 1837, 1845, 1857, 1865
120	Titles of scientific, expert and technical periodicals in German, Number per year, Cisleithania, 1817-1873	32	2.85	0.0000	1850	1826, 1836, 1849, 1857, 1865
121	Titles of scientific, expert and technical periodicals NOT in German, Number per year, Cisleithania, 1817-1873	4	4.00	0.0000	1858	1826, 1834, 1849, 1857, 1865
122	Titles of business periodicals in German, Number per year, Cisleithania, 1817-1873	31	2.61	0.0000	1863	1830, 1838, 1848, 1856, 1865
123	Titles of business periodicals NOT in German, Number per year, Cisleithania, 1817-1873	11	2.36	0.0000	1856	1832, 1841, 1849, 1857, 1865
124	Titles of associational/professional periodicals in German, Number per year, Cisleithania, 1817-1873	17	3.47	0.0000	1861	1830, 1838, 1849, 1857, 1865
125	Titles of associational/professional periodicals NOT in German, Number per year, Cisleithania, 1817-1873	1	1.33	0.0000	1859	1859
126	Titles of political periodicals in German, Number per year, Cisleithania, 1817-1873	32	2.04	0.0000	1858	1827, 1839, 1847, 1857, 1865
127	Titles of political periodicals NOT in German, Number per year, Cisleithania, 1817-1873	17	3.57	0.0000	1857	1831, 1840, 1848, 1857, 1865
128	Titles of local-news periodicals in German, Number per year, Cisleithania, 1817-1873	33	3.45	0.0000	1851	1827, 1838, 1847, 1857, 1865
129	Titles of local-news periodicals NOT in German, Number per year, Cisleithania, 1817-1873	4	6.50	0.0000	1863	1863
	Periodicals - Issues					
	By type					
130	Issues of all periodicals, Number per year, Cisleithania, 1817-1873	25895	2.78	0.0000	1846	1824, 1837, 1847, 1857, 1865
131	Issues of political periodicals, Number per year, Cisleithania, 1817-1873	11977	3.14	0.0000	1847	1824, 1839, 1847, 1856, 1864
132	Issues of local-news periodicals, Number per year, Cisleithania, 1817-1873	5311	3.52	0.0000	1846	1825, 1834, 1845, 1853, 1864

133	Issues of business periodicals, Number per year, Cisleithania, 1817-1873	2812	2.63	0.0000	1861	1824, 1834, 1848, 1856, 1865
134	Issues of literary periodicals, Number per year, Cisleithania, 1817-1873	2984	1.54	0.0000	1852	1852
135	Issues of religious periodicals, Number per year, Cisleithania, 1817-1873	1008	13.75	0.0000	1847	1831, 1839, 1847, 1855, 1863
136	Issues of satirical periodicals, Number per year, Cisleithania, 1817-1873	664	1.79	0.0001	1863	1828, 1836, 1847, 1857, 1865
137	Issues of scientific, expert and technical periodicals, Number per year, Cisleithania, 1817-1873	1559	3.01	0.0000	1843	1829, 1839, 1847, 1855, 1865
138	Issues of artistic periodicals, Number per year, Cisleithania, 1817-1873	871	0.88	0.0000	1848	1824, 1834, 1844, 1852, 1863
139	Issues of association periodicals, Number per year, Cisleithania, 1817-1873	919	8.33	0.0000	1861	1824, 1839, 1847, 1855, 1865
140	Issues of women's and fashion periodicals, Number per year, Cisleithania, 1817-1873	125	1.70	0.0000	1839	1832, 1840, 1848, 1856, 1864
	By language of publication					
141	Issues of periodicals in German, Number per year, Cisleithania, 1817-1873	21037	2.77	0.0000	1846	1824, 1837, 1847, 1856, 1864
142	Issues of all periodicals NOT in German, Number per year, Cisleithania, 1817-1873	4857	2.81	0.0000	1854	1824, 1834, 1842, 1850, 1860
143	Issues of periodicals in Czech, Number per year, Cisleithania, 1817-1873	807	1.43	0.0000	1859	1830, 1838, 1847, 1856, 1864
144	Issues of periodicals in Italian, Number per year, Cisleithania, 1817-1873	2175	3.39	0.0000	1847	1831, 1839, 1847, 1857, 1865
145	Issues of periodicals in Polish, Number per year, Cisleithania, 1817-1873	1063	2.41	0.0000	1851	1824, 1836, 1845, 1856, 1864
146	Issues of all periodicals in Ukrainian, Croatian and Slovenian, Number per year, Cisleithania, 1817-1873	533	10.26	0.0000	1847	1847
147	Issues of periodicals in Ruthenian or Ukrainian, Number per year, Cisleithania, 1817-1873	156	NA[a]	0.0000	1847	1847
148	Issues of periodicals in Croatian, Number per year, Cisleithania, 1817-1873	208	NA[a]	0.0000	1848	1848
149	Issues of periodicals in Slovenian, Number per year, Cisleithania, 1817-1873	169	3.26	0.0000	1864	1864
150	Issues of all periodicals in foreign languages, Number per year, Cisleithania, 1817-1873	68	NA[a]	0.0000	1865	1824, 1838, 1846, 1854, 1865
	By location of publication					
151	Issues of periodicals in Lower Austria, Number per year, Lower Austria, 1817-1873	10324	2.66	0.0000	1847	1824, 1837, 1847, 1856, 1864
152	Issues of periodicals in Upper Austria, Number per year, Upper Austria, 1817-1873	1127	2.71	0.0000	1847	1832, 1841, 1849, 1857, 1865
153	Issues of periodicals in Salzburg, Number per year, Salzburg, 1817-1873	636	2.45	0.0000	1850	1825, 1838, 1846, 1854, 1862
154	Issues of periodicals in Styria, Number per year, Styria, 1817-1873	1341	2.67	0.0000	1854	1824, 1838, 1846, 1854, 1865
155	Issues of periodicals in Carinthia, Number per year, Carinthia, 1817-1873	405	2.41	0.0000	1851	1838, 1846, 1854, 1862
156	Issues of periodicals in Carniola, Number per year, Carniola, 1817-1873	457	1.51	0.0003	1865	1824, 1834, 1842, 1850, 1865
157	Issues of periodicals in Austrian Littoral, Number per year, Austrian Littoral, 1817-1873	1817	2.50	0.0000	1852	1832, 1840, 1848, 1856, 1864
158	Issues of periodicals in Tyrol, Number per year, Tyrol, 1817-1873	1965	8.10	0.0000	1847	1847, 1865
159	Issues of periodicals in Vorarlberg, Number per year, Vorarlberg, 1817-1873	139	1.33	0.0000	1860	1827, 1835, 1846, 1854, 1862
160	Issues of periodicals in Bohemia, Number per year, Bohemia, 1817-1873	3307	2.65	0.0000	1854	1827, 1838, 1847, 1856, 1864
161	Issues of periodicals in Moravia, Number per year, Moravia, 1817-1873	1780	3.11	0.0000	1850	1824, 1838, 1846, 1854, 1862
162	Issues of periodicals in Silesia, Number per year, Silesia, 1817-1873	480	4.62	0.0000	1850	1827, 1835, 1847, 1856, 1865
163	Issues of periodicals in Galicia, Number per year, Galicia, 1817-1873	1804	3.02	0.0000	1845	1824, 1834, 1842, 1850, 1860
164	Issues of periodicals in Bukovina, Number per year, Bukovina, 1817-1873	0	NA[a]	0.0000	1861	1861
165	Issues of periodicals in Dalmatia, Number per year, Dalmatia, 1817-1873	312	3.00	0.0000	1848	1848
166	Issues of all periodicals in Alpine provinces, Number per year, 1817-1873	15937	2.86	0.0000	1845	1824, 1837, 1847, 1856, 1864
167	Issues of all periodicals in the Czech provinces, Number per year, 1817-1873	5567	2.89	0.0000	1850	1829, 1838, 1846, 1856, 1864
168	Issues of all periodicals in Eastern provinces, Number per year, 1817-1873	1804	3.02	0.0000	1846	1824, 1834, 1842, 1850, 1860
169	Issues of all periodicals in Southern provinces, Number per year, 1817-1873	2587	2.28	0.0000	1852	1831, 1839, 1847, 1855, 1864
170	Issues of periodicals in Wien, Number per year, Vienna, 1817-1873	10264	2.65	0.0000	1846	1824, 1837, 1847, 1856, 1864

171	Issues of periodicals published in all provincial capitals and Vienna, Number per year, provincial capitals and Vienna, 1817-1873	22175	2.55	0.0000	1846	1824, 1837, 1847, 1857, 1865
172	Issues of periodicals published in provincial capitals excl. Vienna, Number per year, provincial capitals excl. Vienna, 1817-1873	11911	2.48	0.0000	1846	1824, 1835, 1844, 1852, 1860
173	Issues of periodicals published in the countryside, Number per year, Cisleithanian countryside, 1817-1873	3720	5.76	0.0000	1852	1828, 1839, 1847, 1857, 1865
	By language and type					
174	Issues of periodicals in German, Number per year, Cisleithania, 1817-1873	21037	2.77	0.0000	1846	1824, 1837, 1847, 1856, 1864
175	Issues of all periodicals NOT in German, Number per year, Cisleithania, 1817-1873	4857	2.81	0.0000	1854	1824, 1834, 1842, 1850, 1860
176	Issues of scientific, expert and technical periodicals in German, Number per year, Cisleithania, 1817-1873	1499	2.92	0.0000	1847	1829, 1839, 1847, 1857, 1865
177	Issues of scientific, expert and technical periodicals NOT in German, Number per year, Cisleithania, 1817-1873	60	11.25	0.0000	1860	1824, 1834, 1849, 1857, 1865
178	Issues of business periodicals in German, Number per year, Cisleithania, 1817-1873	2191	3.01	0.0000	1863	1824, 1838, 1848, 1856, 1865
179	Issues of business periodicals NOT in German, Number per year, Cisleithania, 1817-1873	621	1.82	0.0000	1864	1831, 1839, 1848, 1857, 1865
180	Issues of association/professional periodicals in German, Number per year, Cisleithania, 1817-1873	911	8.67	0.0000	1862	1824, 1839, 1847, 1855, 1865
181	Issues of association/professional periodicals NOT in German, Number per year, Cisleithania, 1817-1873	8	1.50	0.0000	1860	1826, 1841, 1849, 1857, 1865
182	Issues of political periodicals in German, Number per year, Cisleithania, 1817-1873	8719	2.81	0.0000	1847	1827, 1838, 1847, 1856, 1865
183	Issues of political periodicals NOT in German, Number per year, Cisleithania, 1817-1873	3259	4.59	0.0000	1847	1831, 1840, 1848, 1856, 1864
184	Issues of local-news periodicals in German, Number per year, Cisleithania, 1817-1873	5096	3.92	0.0000	1846	1846, 1865
185	Issues of local-news periodicals NOT in German, Number per year, Cisleithania, 1817-1873	215	1.03	0.0000	1863	1863
	Voluntary associations					
	By location					
186	Voluntary associations, all, Number active, by year, Lower Austria, 1815-1875	382	1.76	0.0000	1859	1832, 1840, 1848, 1857, 1865
187	Voluntary associations, all, Number active, by year, Upper Austria, 1815-1875	128	2.39	0.0000	1859	1827, 1836, 1844, 1857, 1865
188	Voluntary associations, all, Number active, by year, Salzburg, 1815-1875	22	3.72	0.0000	1862	1827, 1835, 1844, 1857, 1865
189	Voluntary associations, all, Number active, by year, Styria, 1815-1875	81	2.49	0.0000	1865	1822, 1841, 1849, 1857, 1865
190	Voluntary associations, all, Number active, by year, Carinthia, 1815-1875	22	1.78	0.0000	1864	1822, 1832, 1849, 1857, 1865
191	Voluntary associations, all, Number active, by year, Carniola, 1815-1875	50	4.55	0.0000	1848	1830, 1838, 1848, 1857, 1865
192	Voluntary associations, all, Number active, by year, Austrian Littoral, 1815-1875	22	1.63	0.0000	1864	1829, 1837, 1848, 1856, 1865
193	Voluntary associations, all, Number active, by year, Tyrol & Vorarlberg, 1815-1875	68	2.59	0.0000	1862	1825, 1836, 1849, 1857, 1865
194	Voluntary associations, all, Number active, by year, Bohemia, 1815-1875	315	1.70	0.0000	1862	1831, 1841, 1849, 1857, 1865
195	Voluntary associations, all, Number active, by year, Moravia, 1815-1875	89	2.67	0.0000	1864	1833, 1841, 1849, 1857, 1865
196	Voluntary associations, all, Number active, by year, Silesia, 1815-1875	25	2.05	0.0000	1860	1830, 1838, 1849, 1857, 1865
197	Voluntary associations, all, Number active, by year, Galicia, 1815-1875	28	2.66	0.0000	1864	1823, 1841, 1849, 1857, 1865
198	Voluntary associations, all, Number active, by year, Bukovina, 1815-1875	5	2.50	0.0000	1865	1824, 1834, 1849, 1857, 1865
199	Voluntary associations, all, Number active, by year, Dalmatia, 1815-1875	9	1.33	0.0000	1864	1828, 1838, 1846, 1857, 1865
200	Voluntary associations, all, Number active, by year, Vienna, 1815-1875	267	1.47	0.0000	1860	1828, 1836, 1844, 1857, 1865
201	Voluntary associations, all, Number active, by year, Provincial capitals outside Vienna, 1815-1875	235	1.80	0.0000	1861	1826, 1836, 1845, 1857, 1865
202	Voluntary associations, all, Number active, by year, Cisleithanian countryside, 1815-1875	745	2.39	0.0000	1862	1827, 1838, 1848, 1857, 1865
203	Voluntary associations, all, Number active, by year, Cisleithania, 1815-1875	1247	2.00	0.0000	1862	1833, 1841, 1849, 1857, 1865

	By focus of activity					
204	Self-improvement & education associations, Number active, by year, Cisleithania, 1815-1875	31	15.67	0.0000	1864	1864
205	Clubs and table societies, Number active, by year, Cisleithania, 1815-1875	51	2.70	0.0000	1861	1830, 1838, 1849, 1857, 1865
206	Cooperatives, Number active, by year, Cisleithania, 1815-1875	7	21.00	0.0000	1863	1863
207	Professional associations, Number active, by year, Cisleithania, 1815-1875	3	2.67	0.0000	1865	1831, 1840, 1848, 1856, 1865
208	Volunteer fire brigades, Number active, by year, Cisleithania, 1815-1875	0	NA[a]	0.0000	1865	1865
209	Choral societies, Number active, by year, Cisleithania, 1815-1875	68	3.36	0.0000	1857	1829, 1837, 1845, 1857, 1865
210	Entertainment associations, troupes, Number active, by year, Cisleithania, 1815-1875	14	2.05	0.0000	1865	1822, 1836, 1844, 1857, 1865
211	Business and trade associations, Number active, by year, Cisleithania, 1815-1875	10	1.72	0.0000	1863	1828, 1836, 1845, 1856, 1865
212	Veterans associations, Number active, by year, Cisleithania, 1815-1875	24	4.06	0.0000	1863	1822, 1840, 1849, 1857, 1865
213	Healthcare associations, Number active, by year, Cisleithania, 1815-1875	369	1.67	0.0000	1860	1832, 1840, 1848, 1857, 1865
214	Arts associations, Number active, by year, Cisleithania, 1815-1875	10	3.33	0.0000	1849	1829, 1841, 1849, 1857, 1865
215	Agricultural associations, Number active, by year, Cisleithania, 1815-1875	131	3.85	0.0000	1862	1822, 1840, 1848, 1856, 1865
216	Teacher associations, Number active, by year, Cisleithania, 1815-1875	0	NA[a]	0.0000	1865	1865
217	Reading clubs and associations, Number active, by year, Cisleithania, 1815-1875	34	2.89	0.0000	1862	1832, 1840, 1849, 1857, 1865
218	Music associations, Number active, by year, Cisleithania, 1815-1875	35	1.63	0.0000	1858	1827, 1839, 1847, 1857, 1865
219	Pensions associations, Number active, by year, Cisleithania, 1815-1875	65	1.37	0.0000	1854	1827, 1836, 1846, 1854, 1865
220	Political associations, Number active, by year, Cisleithania, 1815-1875	1	NA[a]	0.0000	1865	1865
221	Rifle/shooter/gun associations, Number active, by year, Cisleithania, 1815-1875	133	1.24	0.0000	1854	1823, 1835, 1849, 1857, 1865
222	Savings unions, Number active, by year, Cisleithania, 1815-1875	19	1.46	0.0000	1865	1824, 1833, 1841, 1854, 1865
223	Gambling and betting associations, Number active, by year, Cisleithania, 1815-1875	4	13.00	0.0000	1862	1862
224	Stenographer associations, Number active, by year, Cisleithania, 1815-1875	2	NA[a]	0.0000	1860	1860
225	Gym and athletics associations, Number active, by year, Cisleithania, 1815-1875	0	NA[a]	0.0000	1861	1861
226	Associations for public beautification, Number active, by year, Cisleithania, 1815-1875	1	NA[a]	0.0000	1864	1864
227	Insurance associations, Number active, by year, Cisleithania, 1815-1875	69	1.86	0.0000	1859	1822, 1834, 1847, 1856, 1865
228	Scientific & research associations, Number active, by year, Cisleithania, 1815-1875	18	1.83	0.0000	1860	1822, 1833, 1848, 1857, 1865
229	Welfare & charitable associations, Number active, by year, Cisleithania, 1815-1875	141	2.69	0.0000	1864	1827, 1835, 1844, 1852, 1865
	Human capital-related associations					
230	Useful human capital-related associations, Number active, by year, Vienna, 1815-1875	13	1.95	0.0000	1862	1823, 1836, 1848, 1857, 1866
231	Useful human capital-related associations, Number active, by year, provincial capitals excl. Vienna, 1815-1875	34	1.58	0.0000	1859	1826, 1836, 1847, 1857, 1866
232	Useful human capital-related associations, Number active, by year, Cisleithanian countryside, 1815-1875	145	4.40	0.0000	1863	1823, 1837, 1848, 1857, 1866
233	Useful human capital-related associations, Number active, by year, Cisleithania, 1815-1875	193	3.14	0.0000	1862	1823, 1836, 1848, 1857, 1866
	Education					
	Measures of schooling provision					
234	Number of *Realschulen*, 1815-1872	29	3.58	0.0000	1850	1822, 1832, 1840, 1850, 1863
235	Number of students at *Realschulen*, 1828-1872	8259	6.04	0.0000	1850	1833, 1841, 1849, 1859, 1866
236	Number of *Gymnasia*, 1829-1872	86	0.87	0.0000	1848	1834, 1842, 1848, 1855, 1866
237	Number of *Gymnasium* students,1829-1872	22414	1.06	0.0067	1860	1834, 1845, 1851, 1858, 1866
238	Number of polytechnics students, 1818-1872	3485	1.15	0.0000	1847	1825, 1835, 1843, 1852, 1860

239	Number of elementary schools (*Volksschulen*), 1821-1871	13791	1.08	0.0103	1850	1827, 1839, 1846, 1854, 1862
240	Number of major schools (*Hauptschulen*), 1818-1871	340	1.73	0.0000	1849	1825, 1834, 1842, 1849, 1861
241	Number of German elementary schools, 1821-1871	6158	1.05	0.0007	1827	1827, 1836, 1843, 1853, 1862
242	Number of non-German elementary schools, 1821-1871	4861	1.00	.	1831	1828, 1836, 1847, 1855, 1862
243	Number of non-German and bilingual elementary schools, 1821-1871	7633	1.11	0.0410	1862	1862
244	Real total expenditure on elementary schools, 1829-1865	2700000	1.23	0.0000	1851	1833, 1838, 1843, 1847, 1854
245	Real total expenditure on elementary schools per pupil, 1829-1865	1.69	1.09	0.0000	1851	1833, 1838, 1843, 1847, 1854
	Enrollment ratios (fraction of 5.0-14.9 year-old enrolled in school)					
246	Elementary school enrollment ratio, Lower Austria, 1815-1871	0.594	0.99	0.0150	1822	1822, 1833, 1841, 1850, 1861
247	Elementary school enrollment ratio, Upper Austria, 1820-1871	0.618	1.03	0.0000	1859	1859
248	Elementary school enrollment ratio, Salzburg, 1820-1871	0.625	1.19	0.0361	1856	1844, 1862
249	Elementary school enrollment ratio, Styria, 1816-1871	0.501	1.14	0.0001	1856	1823, 1834, 1842, 1850, 1860
250	Elementary school enrollment ratio, Carinthia, 1817-1871	0.431	1.21	0.1680	1860	1827, 1834, 1843, 1850, 1860
251	Elementary school enrollment ratio, Carniola, 1817-1871	0.282	2.42	0.0000	1843	1825, 1834, 1845, 1852, 1860
252	Elementary school enrollment ratio, Austrian Littoral, 1818-1871	0.263	1.13	0.0472	1842	1825, 1839, 1846, 1853, 1861
253	Elementary school enrollment ratio, Tyrol & Vorarlberg, 1818-1871	0.669	1.04	0.4339	1837	1828, 1835, 1842, 1855, 1862
254	Elementary school enrollment ratio, Bohemia, 1815-1871	0.585	1.03	0.0000	1824	1822, 1832, 1841, 1849, 1861
255	Elementary school enrollment ratio, Moravia, 1816-1871	0.608	1.02	0.0000	1831	1826, 1834, 1841, 1853, 1861
256	Elementary school enrollment ratio, Silesia, 1816-1871	0.562	0.95	0.0000	1839	1827, 1836, 1846, 1854, 1862
257	Elementary school enrollment ratio, Galicia, 1829-1871	0.111	1.41	0.0004	1857	1857
258	Elementary school enrollment ratio, Bukovina, 1829-1871	0.062	1.11	0.0003	1858	1838, 1853, 1863
259	Elementary school enrollment ratio, Dalmatia, 1824-1871	0.089	1.30	0.0058	1846	1846

Note: [a]Values for 1845-47 were equal to zero.
Source: See Appendix 2.