The Internal Impact of a Customs Union; Baden and the Zollverein

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Abstract

Tariffs can affect the growth of states. But how do they affect regional growth within states? Using Baden's 1836 entry into the Zollverein, the customs union of German states, I investigate the internal impact of a change in tariffs. With a new data set of regional tax revenues I demonstrate that poorer regions, concentrated near remaining foreign borders, saw stronger growth after the entry into the Zollverein. Three particular mechanisms for this regional effect are investigated. Manufacturing saw an increase in employment through the increased protection, but not in a regionally differentiated way. Occupational changes within the crafts sector explain general and regional growth patterns, while urbanization explains regional variation in economic activity but not differential growth.

Acknowledgements

1 Introduction

Trade barriers influence economic activity. Customs and tariffs are central obstacles to international and historically also domestic trade. The negative influence of these barriers on trade and therefore growth has led to the development of institutional structures like trade agreements and customs unions to overcome them. The emergence of these institutions however focused the attention on the effect of customs on the growth of whole states. The economics literature has now begun to look at another important characteristic of tariffs, namely the spatial heterogeneity of their impact. Regions within states might experience different effects when the whole country joins a customs union, free trade agreements or experiences another trade barrier change. A major example, which also spawned theoretical developments, are the effects of NAFTA in Mexico (Hanson, 1996, 2005).

Although the economic history literature has long been interested in the relationship between tariffs and growth, the main focus in this literature is on the growth experience of whole nations[1]. The focus of this analysis on whole states is also due to the use of a particular economic framework. The analysis of growth effects relies predominantly on the structure of the Solow growth model, which focuses on the growth paths of distinct whole states rather than regional economies within them.

This paper uses a suitable historical case to answer whether tariff changes have a spatially heterogeneous impact. The state of Baden joined the Zollverein, the customs union between German states, on January 1st, 1836. This significant change in the customs structure was not accompanied by other major political, fiscal or other structural reforms. The differences between Baden's prior tariff structure and the Zollverein's custom system were far reaching and affected the whole economy, not just a small number of producers or consumers. Baden's geographic location, situated next to France and Switzerland, foreign states that were not Zollverein members, added a further dimension to the impact. The borders with France and Switzerland saw an increase in trade barriers, while those with other German states saw a complete removal of tariffs. This implies that regions in the South and Southwest of Baden expe-

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[1] One example is the literature on the tariff growth correlation (Bairoch, 1989; O'Rourke, 2000; Irwin, 2002; Lehmann and O'Rourke, 2011).

rienced an increase in barriers with their direct neighbours, while the regions in the North, surrounded by other German states, experienced the complete removal of barriers with their direct neighbours.

The analysis shows that Baden's entry into the Zollverein had indeed a spatially heterogeneous impact on regional growth. The effect resembles a short term convergence effect, but tests show no evidence for capital convergence, the central mechanism behind convergence. It did however have a spatial pattern which corresponds to the differential changes to Baden's tariff borders.

These results are based on information from Baden's tax system, in particular on newly collected data derived from the state's commercial tax. These report contemporary tax revenues, predominantly from the commercial tax but also from a number of other direct taxes. The sources for this information are archival records from Baden's Ministry of Finance, which cover a time period of two decades between the late 1820s and the late 1840s. The commercial tax system had central components related to the income of wide swaths of the population. These income related revenues are used as an annual measure of economic activity within 20 tax districts for the time period from 1829 to 1847. These revenue data are complemented by information about the underlying economic realities, in particular occupational structures and manufacturing establishments. Baden's government collected such information at different times before and after the Zollverein, the results were published in a number of different outlets.

I will use this data to test for three mechanisms that can explain the observed spatial pattern of the Zollverein impact.

The first is a shift in the allocation of labour between sectors, in particular an increase in manufacturing.[2] The analysis focuses therefore on the impact of the Zollverein on the industrialization process. Baden was in the early stages of its industrialization, the time around its entry into the customs union saw a considerable change of the manufacturing sectors firms were active in. Although there is not much evidence that the tariff structure of the Zollverein influenced the rise of particular manufacturing sectors, the Zollverein did cause a substantial general increase in manufacturing employment. This

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[2]The appendix clarifies how the different sectors, including manufacturing and crafts are defined. In short I follow the contemporary classification used by Baden's authorities.

rise furthermore affected the state as a whole rather than particular regions.

Second, I look at occupational shifts within sectors. Given its considerable size and the importance of trade for its products I focus on the crafts sector. Using data on regional aggregate employment within a large number of crafts occupations it is demonstrated that the Zollverein shifted the occupational structure towards higher income occupations, as designated by their commercial tax classification. The results also show that there was a regional pattern to these shifts, with a stronger growth in the southwest of Baden.

The final mechanism is a shift in the location of economic activity, in particular increases in urbanization. The increased access to larger markets can affect productivity positively and therefore cause economic growth. Different degrees of urbanization explain a substantial part of the different levels of economic activity between Baden's districts. The increase in urbanization after the entry into the customs union also explains a substantial share of the state's growth during the time, though the increase does not explain the observed regional growth pattern.

2   Theoretical Framework and Historical Background

The standard economic growth framework is the Solow Growth model (Solow, 1956). Its main prediction is the convergence of poorer to richer regions. The main mechanism behind that is the convergence of the capital stock due to decreasing marginal returns. The model however assumes closed economies and has no spatial mechanisms (Barro and Sala-i-Martin, 1995). Recent theoretical frameworks overcome such limitation and focus explicitly on spatial factors. Central approaches are New Economic Geography models that use increasing returns and love of variety to incorporate the relations between regional economies (Krugman, 1991). These models can explain spatially heterogeneous impacts of trade barrier changes, for example Redding and Sturm (2008) show the impact of the German separation after WWII. Ploeckl (2010a) uses the same model to demonstrate the impact of the Zollverein. Hansen's work on Mexico and NAFTA further illustrates the spatial nature of the impact of contemporary trade agreements, in particular focusing on wages and industrial

location (Hanson, 1996, 2005). The formal structures of these contemporary trade agreements, which are the focus of these analyzes, have mostly been developed in the 19th century. A major example is the idea of a customs union; the Zollverein of 1834 was the first major customs union between independent states (Viner, 1950).[3]

The congress of Vienna in 1815 redrew borders all over the German states, created the *Deutsche Bund* as a political institution and charged it with coordinating trade (Müller, 2006). The following resurgence of tariff barriers, states faced high debts because of the Napoleonic wars, and the failure of the *Deutsche Bund* to fulfil its economic policy mandate led to trade negotiations between groups of German states in the next two decades. In 1828 Bavaria and Wuerttemberg as well as Prussia and Hesse-Darmstadt concluded separate customs unions agreements. Those two unions and a number of other states agreed to form a common union, which came into existence on January 1st, 1834 and was commonly referred to as the Zollverein. Baden joined in the first round of expansion in 1836 (Henderson, 1984; Hahn, 1984). The state had successfully expanded its territory during the Napoleonic wars and developed into a mid-size state along the French and Swiss border (Müller, 1984). Baden's 1.2 million inhabitants became part of a common market covering more than 25 million people.[4] The Zollverein created this market by abolishing all tariff barriers between and within its member states and reducing transaction costs through measurement and currency coordination. It severely restricted possible state monopolies, harmonized some producer taxes and led to equal treatment of all Zollverein citizens under the respective commercial laws (Ploeckl, 2010b).

3   Regional Growth

The central question is what internal effects the Zollverein and its tariff system had on regions within Baden. I test whether the Zollverein significantly affected Baden's regional growth paths and which factors can explain the potential impact. This requires a determination of regional economies within

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[3]This includes the Bavarian-Wuerttemberg and Prussia- Hesse-Darmstadt unions as origins of the Zollverein (Ploeckl, 2010b).

[4]Shiue (2005) illustrates this by investigating the border effects of the Zollverein.

Baden, an appropriate measure of regional growth, a time frame suitable to analyze the effect of the customs union entry and a number of regional characteristics which potentially influenced the growth paths. The first specification will test whether local economies were converging to each other during the time of the Zollverein as seen in a tax based income measure and whether standard convergence mechanisms like capital convergence can explain the observed growth paths.

This leads to the following specification

$$\frac{1}{6} \log(\frac{IC_{i6}}{IC_i}) = \alpha + \beta \log(IC_i) + \sum_k \gamma_k \log(CS_{ki}) + \varphi \log(Edu_i) + \delta Urb_i + \epsilon_i$$

where IC_i is again the per capita level of Income capital in the base year, IC_{i6} is the same value at the end of the particular time period, and i indicates the tax districts in Baden which serve as units of observation. CS_{ki} is a number of different capital stock measures, Edu_i an indicator for education and Urb_i the degree of urbanization.

As mentioned above, the main data sources are based on Baden's tax system, in particular its commercial tax. The central components of this tax covered income derived from work; the combined per-capita values of these tax components serve as the applied measure of economic activity and growth. One of the characteristics of this tax is the resemblance of some of its components to a general income tax. Generally speaking, the tax was levied on income derived from work as well as from mobile capital and could be described as an occupational poll tax. I combine its work related components, in particular the Earned Income capital component, which predominantly taxed self-employed persons, and the Employee capital components, which taxed the work of employed workers to create a measure of regional income in Baden. The tax assessment was not based on actual income but on notional capital values, such that actual income was seen as the rent coming from this capital. The reported values utilized here are these capital values.[5] The tax had fairly universal coverage, including agriculture, crafts, trade and manufacturing, which makes it a suitable measure for general economic activity. The appendix provides a detailed description of this commercial tax, its individual components and further details about the assessment process.

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[5] This explains the use of 'capital' in labelling the different tax components.

The delineation of local economies is based on Baden's tax administration. The commercial tax, on which the growth measure is based, was collected within approximately thirty tax districts, which for the most part were the combination of a number of smaller, general administrative regions, the *Amtsbezirke*. Due to adjustments between the tax districts over time, I create twenty districts, which remain consistent over the time frame of this analysis. Map 1 shows their borders while Table 1 provides the names, population in 1835 and further statistics about these districts. Since the tax districts were based on underlying administrative regions, it is also possible to match the resulting districts fairly well with larger administrative regions. In particular Baden organized its internal administration in 1832 in four *Kreise*, the *Unterrheinkreis* in the north, the *Mittelrheinkreis* in central Baden, the *Oberrheinkreis* in the southwest and the *Seekreis* in the southeast. Table 1 also shows the distribution of the tax districts into each of these larger regions.[6]

A central part of the question concerns the possible effect of the Zollverein on the relative growth of regions. I investigate this by focusing the analysis on three time periods. The first is 1829 through 1835, the years before Zollverein entry, the second lasts from 1835 through 1841, the first years immediately after Zollverein entry, and thirdly from 1841 through 1847, when the adjustments to the Zollverein were potentially already made. The split into these periods is also made to create periods with a length long enough to avoid short-term fluctuations, furthermore the relevant years 1829, 1835, 1841 and 1847 are all years for which actual population numbers exist.[7]

The first district characteristic included as explanatory factor is the level of economic activity, measured in the same way as the utilized measure for growth. This demonstrates whether richer and poorer regions grew at a different rate before or after the Zollverein. The inclusion of this characteristic makes this specification resemble a convergence regression (Barro and Sala-i-Martin, 1995). The results will allow me to determine whether there was a general convergence process of regional economies during the onset of the industrial revolution and whether it was influenced by trade barrier changes.

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[6]For reasons of simplicity I will call label the four regions based on their geographical position as North, Central, West and South.

[7]A population census was held every three years, I interpolate the numbers to determine population in the intermittent years.

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The next characteristics included are capital stock measures, which are based on three different taxes. The first is operating capital, which was part of the commercial tax. It comprised a tax on any mobile capital, therefore it covered capital items like tools, equipment, inventory, certain licenses, and operating funds. This mobile capital stock measure is complemented by two fixed capital stock measures, which are based on Baden's taxes on land and buildings. The appendix gives a more detailed description about the respective assessment procedures and their implications for the resulting numbers.[8]

The third factor looks at the influence of human capital. Again I utilize a tax measure, in this case the per-capita value of the *Klassensteuer*, the tax on liberal occupations. This tax was complementary to the commercial tax and covered a number of occupations which were exempted by the commercial code. In particular these were predominantly public professionals like civil servants, teachers, clergy, but also lawyers and artists. All of these occupations require further education beyond basic literacy skills. Higher per-capita revenues therefore imply a stronger presence of highly educated professionals. Their general presence, which also implies more professionals in educational occupations, indicates a higher general level of education in the region. Although this was an annual tax the archival records only provide a district level breakdown for the year 1838. All specifications will therefore contain the same values for this variable.

The final characteristic is the degree of urbanization in each district. Urban areas differed in their economic structures from rural areas; changes in the trade environment by the Zollverein might have therefore influenced growth differently. This structural difference between urban and rural locations is reflected in the details of the commercial code, as explained in the appendix. Due to the limited availability of detailed urbanization data I only use the district level of 1835 in all three specifications. The focus here is on the level of urbanization, a more detailed discussion of the impact of changes in urbanization is given in section 6.

The results, shown in Table 2, confirm that the Zollverein had an impact on the regional growth paths in Baden. The absence of any effect before the entry

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[8]Baden's taxes were also used to derive a capital stock for all of Germany by Hoffmann (1965)

and after the initial membership period confirms that the effect was an adjustment to the impact of the Zollverein. The level of income is the only variable with a significant coefficient, while none of the remaining characteristics, capital stock measures, urbanization and human capital, had an influence. This implies that the impact of the Zollverein looks like a temporary convergence effect, poorer regions grew faster than their richer counterparts. The absence of any other effect, in particular a missing impact of the capital stock, however implies that the standard growth model is not a good choice to analyze the growth paths.

As map 2 demonstrates districts in the north and central regions of Baden had substantially higher levels of economic activity than those in the west and south. This implies that the growth paths in the wake of the Zollverein entry had the inverse spatial pattern. The following specification focuses on these regional patterns by introducing dummies for the major administrative regions:

$$\frac{1}{6}\log(\frac{IC_{i6}}{IC_i}) = \alpha + \sum_r \beta_r R_{ri} + \epsilon_i$$

where IC_i is the per capita level of combined Income capital in the base year, IC_{i6} is the same value six years later, R_{ir} is a set of dummies for the major administrative regions and i indicates the tax districts in Baden, which I use to delineate regional economies.

Table 3 shows the results for three time periods, which again show the different growth behaviour between the regional economies within Baden after the entry into the Zollverein. During the first period, the six years prior to the customs union, there was again no differential growth between the regions, similar for the time period after 1841. The results indicate statistically significant faster growth of the districts in the southern region relative to the central region, with a smaller, though statistically not significant, effect in the western region.[9]

This geographic pattern of the impact on economic activity correlates with changes in the customs borders the regions experienced. The slower growing northern districts all bordered other German states, therefore experiencing a decrease in tariff barriers for imports as well as exports. The southern districts, however, bordered Switzerland and therefore saw no change in the

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[9]These results are confirmed by the use of robust standard errors and a median regression.

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tariff barriers for exports to this neighbour and an increase in the barriers for imports.

Thus far I have shown that the Zollverein had a regionally differentiated impact on growth. The standard explanations based on the Solow growth model cannot explain it, since neither capital stock, nor human capital, nor the urbanization level shaped the impact. The pattern correlates with changes in regional market access through the introduction of the Zollverein tariffs. This leads me to test for three mechanisms through which these tariff changes could cause such growth paths. First, I investigate whether the Zollverein caused sectoral shifts, in particular industrialization, in a regional differentiated way. Secondly, I look at occupational changes within the crafts sectors; the Zollverein and its impact on trade potentially drove stronger occupational upgrading in the poorer regions. And thirdly, even if the level of urbanization didn't affect growth, changes in urbanization might have done so.

4   Industrialization

The Zollverein was founded during the onset of the industrial revolution in the German states. Industrialization was a regionally uneven process; some of the regions were already on the path to become industrial centres, while others were still very much stuck in a pre-industrial setting. In the early decades after the Napoleonic wars Baden was not a centre of industrialization, its level of manufacturing activity was quite small. This is especially evident when compared to its Swiss and French neighbour regions, both of which were substantially further industrialized.[10] This section tests whether the Zollverein and its changes to the trade relationships with Switzerland and France had a significant impact on the industrialization process within Baden. And if it did, what were its regional and sectoral characteristics?

Although Baden had substantial activity in the crafts sector, the number of people active was almost equal to those in agriculture, it was clearly not a highly industrialized state. Baden's government used the commercial tax records in 1829 and 1844 to publish information about the manufacturing

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[10]Some quantitative evidence for this comparison will be given in the discussion of Foreign Direct Investment.

sector, the numbers already give some indication of the changes caused by the Zollverein. The number of manufacturing enterprises, as classified by Baden's commercial regulations, increased from 161 to 405 and the number of workers employed increased from 2756 to 8745. This represents an increase from 0.23% to 0.66% in terms of population share, though more appropriately in terms of families, the unit on which the tax is levied and therefore the basis for these counts, it represents a rise from 1.16% to 3.35%.

The rise of the number of manufacturing employees between 1829 and 1844 shows that Baden's industry received an considerable impulse during the time period. The next step shows that the Zollverein was the cause of this increase. The Employee capital component of the commercial tax allows the calculation of the number of employees, which were the 6th or higher employee in their respective establishments. Table 1 shows the number of these workers, labelled category II employees, for each district in 1835. The total number does obviously contain some employees from the crafts and trade sector and misses some manufacturing workers, but nevertheless gives a fairly good indication of the extent of manufacturing employment and especially its development over time. Figure 2 shows the absolute number of these employees, as well as separately that of male and female workers. Figure 3 shows the number in the major geographic regions, while Figure 4 shows the same as relative population share. All graphs show a very similar development over time. The pattern shows no significant change or growth during the years before the Zollverein. Once Baden joins the customs union strong growth sets in until the early 1840's, after which growth peters out. Stagnation sets in first in the southern and northern regions, though the other two regions only last slightly longer. The Zollverein had clearly a substantial impact, leading to a substantial increase in the size of the sector and its share in Baden's economy.

Although the development pattern is fairly consistent for larger regions, there is a substantial variation between individual districts. In 1829 the number of category II workers in the respective tax districts ranged from 17 to 503, or from 0.06% to 1.5% in terms of population share. The index of dissimilarity[11] between the regions for 1829 is 35.5, which confirms that manufacturing

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[11]The actual formula is $\frac{1}{2}\sum_{i=1}^{N}|\frac{M_i}{M_B} - \frac{pop_i}{pop_B}|$, where i indexes the districts, B the whole of Baden, M is manufacturing employment and $\frac{pop_i}{pop_B}$ is the population of the district relative

was somewhat spatially concentrated. The development of this index, depicted in Figure 5 for 1829 to 1847, shows a clear upward trend, which confirms spatially differential development paths between the tax districts.

The results clearly show that the Zollverein caused an increase in Baden's manufacturing sector. The size of the impact appears to have been similar between the major regions, though was characterized by different developments within them.

This raises questions about the industrial composition of the manufacturing sector; did the Zollverein protect existing product industries, or did new products get introduced? The 1849 overview listed 41 production sectors, ranging from textiles to sugar production and distinguished between establishments founded prior to the 1836 entry into the Zollverein and those created afterwards. Tables 4 and 5 provide summary statistics. 30 sectors had surviving establishments, which were founded prior to the Zollverein. 17 of these saw additional enterprises founded after the accession, while 13 had no surviving establishments created under the protection of the Zollverein. This obviously leaves 11 sectors, where the oldest surviving establishment was created after 1836. The large change of what sectors saw new and successful establishments show the immense structural changes the onset of the industrial revolution and the Zollverein caused. This becomes also evident when the change is linked to changes in the ad-valorem tariff rates through the Zollverein. The statistical overview also allows the calculation of ad-valorem tariff rates for Baden and the Zollverein for individual sectors using 1849 average sectoral prices.[12] Linking median absolute tariff rate increases with the above described pattern of surviving establishments shows that sectors that did not have any new establishments surviving had an increase of 1.4%, while sectors that had establishments founded before and after the Zollverein entry had an increase of 10.9%, and sectors that only had new establishments had a median increase of 26.5%. This implies that the structure of the Zollverein tariffs did influence the creation of new manufacturing sectors in Baden.

The Zollverein led to an introduction of new sectors and an increase in

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to the whole of Baden.

[12]The overview contains the total output of the sector measured in the standard weight unit, the *Zentner*, as well as the total value of this output. The numbers are additionally split into values only for establishments founded before or after the Zollverein entry.

manufacturing employment. I will therefore test whether the particular tariff rates of the Zollverein and regional effects explain these two effects on a manufacturing sector level.

Baden's government used the commercial tax records in 1829 and 1844 to publish more information about individual sectors as well as their regional distribution. In particular it lists information about 68 sectors, stating the total number of factories and workers for each of the four regions. Although the listed sectors differ considerably from those 41 used in 1849 I combine them with the derived ad-valorem tax rates.

Table 6 shows the results of three probit regressions which investigate whether the regional spread of particular sectors is driven by regional or tariff differences. The first links the regional presence in 1829 with Baden's tariff rates and regional dummies, the second links the appearance of new sectors within regions to Baden's tariff rates, the change in rates by the Zollverein and regional dummies, and the third links the regional presence in 1844 with Baden's prior rates, the change through the Zollverein and regional dummies. The results show that Baden's tariff rates before the Zollverein influenced the regional spread of manufacturing sectors, the effect however disappeared with the entry into the customs union. The further spread of the regional presence of sectors was however not related to the changes in the tariff structures through the Zollverein. The number of sectors present in the southern region was significantly lower than that of the central region, an effect which increased through the Zollverein. The western region caught up to the central region, though neither the initial difference nor the catch-up effect is statistically significant. In general there is no evidence that the tariff structure of the Zollverein had an impact on the regional introduction of new manufacturing sectors.

Table 7 reports the result of a specification that explains the changes in employment in manufacturing sectors in each region.[13] Tested explanatory factors are the size of the regional sector workforce in 1829, Baden's tariff and the changes through the Zollverein as well as regional dummies. The results demonstrate that the protection afforded by Baden's tariffs increased the employment within sectors. The effect was still recognizable in the employment

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[13]The absolute changes are normalized by the population of each region

numbers in 1844, but the changes through the Zollverein were beginning to show an effect. This implies that the tariff structure of the Zollverein was changing the sectoral employment distribution within manufacturing but its influence was not very strong.

4.1 Foreign Direct Investment

The observed effect of the Zollverein on manufacturing does not have a specific regional component. This is in seeming contradiction to theoretical approaches that link relative changes in market access to relative growth paths. The standard view of these models however does not include an important factor which can explain the observed phenomenon, namely Foreign Direct Investment. One effect of the Zollverein's structural changes was the emergence of Foreign Direct Investment through entrepreneurs from neighbouring states. It focused on the southern half of Baden, thereby compensating the advantages the northern half had through the reduction of trade barriers.

This difference in growth factors is also reflected by the manufacturing sectors that were growing. The statistical information indicates that the growth in manufacturing employment in the southwest of Baden was driven predominantly by textile industries, mainly cotton, but also silk and wool. While these production sectors centred in the southwest, other sectors that saw large absolute increases in terms of employment were located in northern and central Baden. The statistical overview lists, for example, gold and jewellery establishments, as located in Pforzheim, a town which had a long tradition in the production of these products, as well as in Karlsruhe, home of the court. Another example is sugar and tobacco factories, which were located near the large towns in the north. Other growing sectors however did not have a clear geographical concentration; for example, machinery factories were located close to the Swiss border as well as close to the large towns Karlsruhe and Heidelberg in the north.

One main reason for the spatial concentration of rising textile industry in the southwest were Baden's foreign neighbours, namely Switzerland and the French province of Alsace. Both of these already had substantial textile industries at the time of the Zollverein,[14] though these regions were substantially

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[14]For example, the number of manufacturing workers in Upper Alsace was about 85000

very similar to southwest Baden with regard to endowments and transportation access. The change in market access through the Zollverein tariff barrier changes led to a significant reaction, especially from Swiss entrepreneurs. The new rules specified significantly higher tariffs for exports to Baden, but opened comparatively much larger markets in the other Zollverein member states for goods produced in Baden. This newly possible access led to an extensive investment by Swiss firms in the southwest of Baden, which is an early example of Foreign Direct Investment. Baden's Minister of Finance publicly stated in 1835, half a year before the actual entry, the following: "But also new establishments will be founded; already the hope of our entry has motivated rich Swiss to buy (into Baden) and to petition for a concession" (Fischer, 1962, p.130). Eusterbrock (1968) also gives a quantitative indication of the extent of foreign investment, identifying the ownership of 23 new industrial enterprises, all in the textile sector, founded between 1834 and 1848 in the Oberrheingebiet, the southwest part of Baden bordering Switzerland and France. Sixteen of these 23 establishments were owned by foreigners, 13 by Swiss and three by French investors.[15] A major factor supporting FDI was the permissive attitude of Baden's government with regard to concessions. The nationality of the petitioner, regardless of whether he came from other German states in the Zollverein, Switzerland or France, did not matter (Eusterbrock, 1968; Fischer, 1962). In general, the southwest of Baden profited from the accession into the Zollverein due to the changes in market access – neighbours were no longer able to export as freely as before and therefore had to reallocate capital and invest it in Zollverein territory. The region was the main recipient due to the close geographical proximity and supportive government policies.

5 Occupational shifts

The described increase in manufacturing employment represents a sectoral shift. But such shifts between sectors were potentially accompanied by shifts within them. Labour moved between different occupations, especially within

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in 1835, out of a total population of about 430000. In contrast, the southwest of Baden had about 2500, with a likely total population of around 300000 (Eusterbrock, 1968).

[15]The three French enterprises actually belonged to the same French firm, Koechlin, located in Mulhouse.

the same sector. Such internal shifts may influence growth if labour is reallocated to more productive occupations. Baden's commercial tax assigned each occupation into a specific tax class, an assignment which was based on the potential income from this occupation. If the occupational structure changed in such a way that high tax class occupations grew faster than low tax class ones the Earned Income capital values, and therefore the above used measure of economic activity, grew as well. This represents real economic growth if tax classes reflected the average income and, therefore, productivity properly, which is assumed to hold. In the following I test the hypothesis that there was an occupational shift in Baden's crafts sector towards higher tax classes around the time of the Zollverein. Furthermore I test whether such a shift had a regional pattern.

For the empirical estimation I use data about individual crafts occupations, described in more detail in the appendix. The data contains the number of workers, split according to their status. This distinction of *Meister*, master craftsmen with the necessary qualifications to own their own shops, and *Gehilfen*, employees with a lower level of qualification, allows the calculation of the average size of a shop as the ratio of employees to shops. This number is calculated for each occupation for each region and included as an explanatory variable. The tax code assigns each occupation to a specific tax class and related earned income capital value. Since these classes change according to location size, I assign each occupation to the class it would have been assigned to if the shop was in a village. The number of persons working in occupations in tax categories 5 and higher is quite small, therefore I include these occupations with those in tax class 4 to avoid making statements about general effects based on a very small number of persons. I restrict the sample to occupation/region observations, which show at least 10 persons working in that particular occupation in that particular region. This restriction of a minimum size of activity in a district is made to avoid the issue of large variations in the growth rates due to minimal changes.[16]

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[16]To illustrate the problem, assume there was a single Meister in an occupation in 1829 (and 1844). If he took on a Gehilfe in 1844, the growth rate would be 100%, while taken on in 1845 the growth rate would have been 0%. These drastic differences in the growth rates are the result of the indivisibility problem and are the stronger the smaller the number of original employees.

Next to the outcome variable – the growth of occupations – there are three main explanatory factors. These are the assigned tax class of the particular occupation, the region from which the observation comes, and the average size of the shops for this occupation in this region. The first two are specified with dummies and the third as the aforementioned ratio. Additionally, I include pairwise interactions of these three factors, all of which results in the following formal specification:

$$log(\frac{M_{OR44} + G_{OR44}}{M_{OR29} + G_{OR29}}) = \alpha + \sum_i \beta_i T_{iOR} + \sum_j \beta_j R_{iOR} + \delta \frac{G_{OR29}}{M_{OR29}} +$$

$$+ \sum_{i,j} \phi_{ij}(T_i * R_j)_{OR} + \sum_{i,k} \mu_i T_{iOR} * \frac{G_{OR29}}{M_{OR29}} + \sum_j \nu_{ij} R_{jOR} * \frac{G_{OR29}}{M_{OR29}} + \epsilon_{OR}$$

where M_{OR44}, G_{OR29} are the number of Meister and Gehilfen in occupation O in region R in the years 1844 and 1829. T_i are dummies for the tax class of an occupation, which is the same for all four regions. The reference categories are tax class 1, the lowest classification, and the *Mittelrheinkreis*, the central region.

The results in Table 8 show the influence of the three explanatory factors and their interactions on occupational growth in the regions. There is a clear indication that occupations in tax class 4, which contains occupations classified in categories 4 and higher, grew significantly faster than occupations in class 1.[17] This indicates that nationwide there was an increase in productivity through changes in the occupational structure caused by an increase in the relative size of occupations in higher tax categories.[18] This result implies that Baden's economy in general grew through the reallocation of labour towards occupations with higher incomes.

The regional dummies indicate that occupations in the Oberrheinkreis, the western region of Baden bordering on France and Switzerland, grew significantly faster than occupations in the central region.[19] Further results show

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[17]F-tests of the hypotheses that occupations in class 4 grow the same as occupations in class 2 or class 3 reject the hypotheses with F(1,284)=3.16 for class 2 and F(1,284)=3.65 for class 3.

[18]F-tests also show that the effect worked in all four regions.

[19]F-tests show that also the effects in the other two regions are statistically different from the effect in the Oberrheinkreis, with the following est statistics: F(1,284)=5.54 and F(1,284)=12.86.

that this effect holds for almost all tax categories,[20] which implies that the whole crafts and trade sectors grew stronger in this region than in the others.

The results for the third explanatory factor show no general effect of average occupational shop size. Nevertheless, a regional or class effect may exist. F-tests for the hypothesis that the combinations of general effect and an interactions are not different from zero can be rejected in only two cases, namely for the the region in the northern and the southern regions. The resulting effect in both cases is positive, this implies that occupations with a higher relative number of employees grew faster than those with a higher number of master craftsmen.

The limitation of the data with regard to the years they are available, as well as a lack of information about the agricultural workforce, prevents a determination whether the Zollverein was the main cause of these occupational shifts. Nevertheless, the results establish that Baden's occupational structure saw changes during the time of the Zollverein. In particular, the result of the stronger growth of occupations in the highest tax class implies that the Zollverein had a positive effect on economic growth through an impact on the occupational structure. This is compounded by the stronger growth in the western region, bordering Switzerland. This southern neighbour was a major trade partner, especially for closeby regions within Baden. The available trade data[21] show that in terms of quantity Baden's net exports, in general but also to Switzerland, were a number of agricultural goods as well as natural resources, while its major imports were a whole range of different goods (Müller, 1984). The introduction of the Zollverein tariff structure, which protected finished goods but not raw materials, can explain the observed results. Its protection of finished goods led to an increase in high tax class production, which covers a number of these goods, and the general protection effect led to a substitution from Swiss imports to domestic crafts production in the western districts, which had stronger trade relationships with the southern neighbour.

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[20]F-tests show only the effect for class 3 is with a $F(1,284)=2.40$ is slightly outside the 90% significance level

[21]See Müller (1984) for a discussion about the availability of trade data from the period.

6 Urbanization

The growth regressions imply that the level of urbanization did not matter for the effect of the Zollverein. This however does not preclude that changes in urbanization rather than the level influenced the growth paths of regions. I therefore test whether increases in urbanization explain the observed growth after the Zollverein, in particular the absolute growth and regional differentiation.

Baden's commercial tax, in particular its Earned Income capital component, was strongly influenced by the location of the taxed economic activity. More precisely, the assessed tax was dependent on the status and population size of the location in question. Based on the belief of Baden's government that work in towns and larger settlements was more profitable, the tax obligation of identical businesses was higher in towns than in villages. This implies that the level of income related tax components were affected by the degree of urbanization, while their growth was influenced by changes in the share of the population living in an urban environment.

Information about the degree of urbanization in each district allows me to determine whether urbanization explains the variation in Earned Income capital across districts and whether the increase in said capital was due to increases in urbanization after the entry into the Zollverein. This information is then used to investigate the influence of these increases in urbanization on the growth path of districts, demonstrating to what extent they explain the observed differential growth.

The first step is to calculate the average tax assessment per taxed household net of urbanization, which requires a determination of the number of actual tax payers and the impact of urbanization. Additionally I correct for the influence of agriculture, since all farmers were classified into the same tax class, which was independent of location size. The resulting number indicates whether tax payers in the different districts had on average occupations with higher tax classifications or occupations with the same average tax assessment but exercised them in locations with a higher size classification.

A necessary assumption concerns the number of tax payers in agriculture as well as crafts and trade. Using information about the total number of agricultural and other tax payers in 1829 and 1844, I first interpolate numbers for

1835 and 1847 and then distribute the resulting number across the districts according to district population. This is based on data from 1844 which show that the variation across the four major regions in the relative share of agriculture and other tax payers is minor.[22] All agricultural tax payers were assessed with tax class 1, which implies an assessed Earned Income capital of 500fl. Deducting the resulting agricultural capital from the total reported value and dividing by the number other tax payers, results in a first average tax capital assessment for each district. The values range between 502 and 960, with a mean of 749. These values have the right magnitude when compared to the listed values for the tax classes, which started at 500.

The next step is to correct for the influence of urbanization. The assessment procedure classified locations into four categories, villages, towns below 3000 inhabitants, towns between 3000 and 6000, and towns with a population of more than 6000. Information about town population in 1835 and 1852 are used to derive the respective rates of urbanization in each district.[23] This is combined with an assumption about the increase in tax capital through a higher location category. I use the differences between tax classes I, II, III and IV.[24] This balances the higher increases for occupations which start out in a higher tax class with the downward effect of occupations that did not get reclassified. Using these numbers I calculate the underlying average tax assessment for each district. The magnitude of these values is still within the expected range close to the lower tax classes. The correlation between the average assessment without correcting for urbanization and the average with such a correction is 0.75, still quite high but substantially reduced. Similar, regressing the average assessment before correction on the urban component shows that urbanization explains one third of the variation.[25]

The total increase in urbanization after the Zollverein allows me to determine the influence of these changes on the average assessment after the

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[22] The shares are within 2% for agriculture and within 4% for other occupations.

[23] The location category covering small tows below 3000 inhabitants technically also contains *Marktflecken*, larger villages with rights to hold some trade fairs. In 1844 there were 44 of these, compared to 115 towns. However since it wasn't possible to fully determine their population I did not include them in the calculation. This puts a downward bias on the degree of urbanization and the resulting influence.

[24] The numerical values of the increases are 125, 250 and 375.

[25] The R^2 is 0.365.

Zollverein. To do this I calculate by how much the average assessment for 1835 changes when the urbanization rates are replaced by those derived for 1847. The average of the district urbanization rates increases from 22.0% to 23.5%, while the state-wide average assessment increases from 751fl to 800fl in 1847. Applying the later urbanization rates implies a state-wide assessment of 768fl. This shows that 35% of the observed increase in the average assessment in the wake of the Zollverein can be explained by increases in urbanization. This shows that the Zollverein had a significant impact on observed growth within Baden.

This leads to the final step, testing whether the increases in urbanization in the wake of the Zollverein can explain the differential growth paths found above. There is only a small correlation between the increase in the urban component and the average assessment, regardless whether measured in absolute or relative terms.[26] The correlation between the increase in urbanization and the growth rate of the Income measure used above is similarly very small. These results lead to the conclusion that increases in urbanization in the wake of the Zollverein did affect economic growth, but do not explain the observed regional growth pattern.

7 Conclusion

Entry into the Zollverein caused a considerable change to the economic situation of the new member states. Trade and tariff barriers were removed, changed or newly erected. Moreover, these influences on external trade relationships also impacted the domestic economic environment in a considerable way. Since the institutional changes to external trade differed between various neighbour states, the impact of the Zollverein had a strong regional differentiation. Baden offers a clear case for this differentiation, with the northern parts of the state experiencing only barrier removals and an increase in market access, while the south saw increases in trade barriers towards its foreign neighbours France and Switzerland. This regional differentiation of the impact is reflected to some degree in Baden's economy, as seen in regional growth and the transmission mechanisms.

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[26]Formally the numbers are around 0.14.

The Zollverein affected regional growth in a way that created a short-term convergence effect; poorer regions were catching up with richer districts in the aftermath of the entry into the customs union. Since the variation of economic activity had a clear regional distribution, districts in the southern half of the state had lower levels than those in the northern half, did the effect of the Zollverein also create a corresponding regional growth pattern. The temporary nature of this pattern also indicates that it was an adjustment effect to the new tariff situation rather than a major structural change to Baden's economy.

One of the central effects of the Zollverein was an impulse for Baden's manufacturing sector. Employment went all over Baden, though the size of the sector remained minor in comparison to agriculture and crafts. The impact caused a considerable change in the particular manufacturing sectors firms were active, though there is only limited evidence that the tariff structure of the Zollverein had a significant influence on the emergence of new sectors. Similar the regional presence and employment distribution over sectors shows some influence of Baden's tariff structure with an effect of the Zollverein tariffs emerging but not yet dominating. In general Baden's industrialization saw a small but noticeable increase all over the state without developing a strong regional pattern.

The changes in the trade barriers towards the Swiss are however a possible explanation for the second transmission mechanism, namely occupational shifts within the crafts sector. The whole sector grew faster in the southwest, occupations in the highest tax categories grew faster state-wide. Especially the regional pattern, which explains part of the observed regional growth path, implies that the Zollverein not only affected manufacturing but the whole crafts sector.

The observed measure of economic activity, which was based on Baden's commercial tax, was also influenced by the degree of urbanization. Differences between the sectors explain a third of the variation in measured economic activity between the districts. Increases in urbanization in the wake of the Zollverein also influenced general growth pattern, but there is not much evidence that this growth due to urbanization caused the observed regional growth path. Urbanization did not play a significant role to transmit a regional effect of the Zollverein.

The Zollverein was the most important institutional development for Germany's economic unification during the middle of the 19th century. It had a strong impact on regional development, changing regional fortunes by the opening and closing of markets. However as Baden shows, these long-term structural effects were initially overshadowed by a short-term adjustment process that saw regionally differential growth, a general increase in manufacturing employment and occupational shifts towards more productive occupations.

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Tables

Table 1: Descriptive Statistics of Tax Districts for the year 1835

District	Region	Pop.	Income	Urban	Emp.cat.II
Bischofsheim	N	29754	103.27	0.27	10
Bonndorf	S	74445	92.68	0.21	273
Boxberg	N	71297	109.9	0.21	43
Bruchsal	C	124897	106.07	0.24	120
Emmendingen	W	46900	103.51	0.21	57
Freiburg	W	42854	107.96	0.31	388
Gengenbach	C	226618	96.42	0.18	518
Heidelberg	N	46736	123.15	0.32	160
Karlsruhe	C	72234	115.93	0.4	607
Konstanz	S	57310	105.01	0.19	233
Lahr	N	46188	95.08	0.2	236
Loerrach	N	39103	99.65	0.12	485
Mannheim	N	67087	128.14	0.45	521
Mosbach	N	39962	113.59	0.17	37
Muellheim	W	62609	104.12	0.18	101
Pforzheim	C	41881	111.2	0.15	497
Pfullendorf	S	43258	89.72	0.18	80
St.Blasien	W	24278	96.03	0.15	262
Thiengen	W	51421	79.79	0.08	95
Waldkirch	W	20512	84.15	0.17	33

The table lists the resulting tax districts after combining the original ones to make them consistent over the time period in question. It lists the total population, the per capita level of earned income capital, the per capita level of operating capital, the number of employees in category II, and the level of urbanization. The second column lists the regional assignment of each district, North (N), Central (C), West (W), South (S). All of these values are for the year 1835.

Table 2: Regional Growth with District Characteristics

	1829	1835	1841
Constant	-0.0053	0.2097***	-0.0216
	(0.0905)	(0.0586)	(0.0668)
Income Capital	0.0075	-0.0418**	-0.0017
	(0.0200)	(0.0150)	(0.0169)
Operating Capital	-0.0034	0.0089	0.0011
	(0.0117)	(0.0072)	(0.0054)
Land Capital	0.0119	-0.0049	0.0001
	(0.0108)	(0.0071)	(0.0045)
Buildings Capital	-0.0179	-0.0043	0.0041
	(0.0134)	(0.0101)	(0.0063)
Urbanization	0.0369	0.0258	-0.0111
	(0.0596)	(0.0316)	(0.0273)
Liberal Occupations tax	0.0026	-0.0021	-0.0016
	(0.0057)	(0.0035)	(0.0022)
Observations	20	20	20
R-squared	-0.04	0.36	-0.08

Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1
All specifications are estimated with OLS with robust standard errors.

Table 3: Regional Growth

	1829	1835	1841
Constant	0.0047**	0.0045*	-0.0026*
	(0.0019)	(0.0023)	(0.0014)
North	0.0007	-0.0023	-0.0007
	(0.0030)	(0.0028)	(0.0017)
West	-0.0023	0.0014	-0.0017
	(0.0035)	(0.0032)	(0.0017)
South	0.0030	0.0061**	0.0017
	(0.0027)	(0.0027)	(0.0034)
Observations	20	20	20
R-squared	-0.04	0.19	0.03

Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1
All specifications are estimated with OLS and robust standard errors, the
reference category for the regional dummy is the central region.

Table 4: Descriptive Statistics of Manufacturing Sectors in 1849

Sector		Factories		Workers	
		<1836	>1836	<1836	>1836
Baumwolle	Cotton Textiles	32	78	2875	5351
Blechwaren	Tinplate	1	0	3	0
Cartonage	Cardboard	1	0	76	0
Chemische	Chemicals	5	0	93	0
Cichorien	Chicory Coffee	4	3	238	45
Eisen	Iron	22	8	631	116
Glas	Glas	5	0	296	0
Goldwaaren	Jewellery	9	12	559	298
Kamm	Combs	3	0	27	0
Karten	Playing Cards	1	1	1	2
Knopf	Buttons	0	1	0	272
Krapp	Madder	2	0	12	0
Kratzen	Spinning Equipment	1	0	20	0
Kunstmahl-Dampfmuehlen	Steam Mills	0	1	0	15
Kunstmahl-Wassermuehlen	Water Mills	0	7	0	36
Kupferhammerwerk	Copper Forges	4	0	9	0
Lederfabriken	Leather	2	4	69	25
Leimsiedereien	Glue	0	1	0	20
Leinengarn	Linen Yarn	1	0	17	0
Maschinenfabriken	Machinery	3	5	58	667
Metallgewebe	Metallic Mesh	0	1	0	22
Moebel	Furniture	1	0	18	0
Nadel	Needles	1	1	33	14
Naegel	Nails	0	2	0	24
Papier	Paper	18	10	364	164
Schaumwein	Sparkling Wine	0	2	0	7
Seiden	Silk Textiles	3	9	116	1187
Staerke	Starch	1	3	3	22
Stahlwaaren	Steel Goods	1	2	30	18
Stearin	Stearin	0	1	0	4
Steingut	Earthenware	2	1	182	50
Strohflecht	Straw Weaving	2	0	824	0
Stueckgiessereien	Foundries	1	0	6	0
Tabak	Tobacco	15	9	812	178
Tapeten	Wall Paper	2	6	33	78
Wachswaaren	Candles	1	0	7	0
Wagen	Coaches	1	2	4	96
Weberblaetter	Weaving Equipment	0	1	0	2
Wollen	Wool Textiles	7	6	227	168
Zucker (import)	Cane Sugar	0	1	0	48
Zucker (Rueben)	Beet Sugar	0	2	0	531

Table 5: Descriptive Statistics of Manufacturing Sectors in 1849

Sector	Value			Ad Valorem rate	
	<1836	>1836	Average	Baden	ZV
Baumwolle	99.83	46.16	56.30	0.12	0.18
Blechwaren	200.00	0.00	200.00	0.01	0.03
Cartonage	250.00	0.00	250.00	0.01	0.01
Chemische	6.14	0.00	6.14	0.27	1.02
Cichorien	8.16	8.92	8.29	0.16	1.37
Eisen	8.73	8.75	8.73	0.24	0.19
Glas	12.86	0.00	12.86	0.26	0.40
Goldwaaren	38250.00	26736.36	34164.52	0.00	0.00
Kamm	469.44	0.00	469.44	0.01	0.04
Karten	400.00	66.67	200.00	0.03	0.08
Knopf	0.00	40.91	40.91	0.16	0.42
Krapp	5.98	0.00	5.98	0.28	0.05
Kratzen	250.00	0.00	250.00	0.03	0.04
Kunstmahl-Dampfmuehlen	0.00	5.00	5.00	0.42	0.69
Kunstmahl-Wassermuehlen	0.00	5.10	5.10	0.41	0.67
Kupferhammerwerk	90.32	0.00	90.32	0.04	0.11
Lederfabriken	85.53	4.38	40.23	0.17	2.33
Leimsiedereien	0.00	15.00	15.00	0.11	0.42
Leinengarn	50.00	0.00	50.00	0.03	0.03
Maschinenfabriken	11.78	35.81	34.25	0.19	0.30
Metallgewebe	0.00	850.94	850.94	0.00	0.01
Moebel	65.36	0.00	65.36	0.10	0.08
Nadel	1083.33	400.00	810.00	0.00	0.02
Naegel	0.00	20.40	20.40	0.02	0.50
Papier	15.19	18.19	16.00	0.10	0.53
Schaumwein	0.00	41.56	41.56	0.06	0.33
Seiden	1000.00	411.94	482.79	0.01	0.02
Staerke	8.00	9.48	9.36	0.22	0.37
Stahlwaaren	0.00	82.19	82.19	0.03	0.02
Stearin	0.00	45.15	45.15	0.15	0.15
Steingut	15.00	8.33	12.65	0.40	1.34
Strohflecht	933.33	0.00	933.33	0.01	0.02
Stueckgiessereien	50.00	0.00	50.00	0.02	0.03
Tabak	24.48	26.88	24.70	0.27	0.38
Tapeten	47.37	92.79	73.03	0.02	0.23
Wachswaaren	94.12	0.00	94.12	0.03	0.18
Wagen	39.58	21.00	21.09	0.32	0.48
Weberblaetter	0.00	50.00	50.00	0.13	0.20
Wollen	275.84	240.73	258.45	0.01	0.20
Zucker (import)	0.00	34.00	34.00	0.04	0.55
Zucker (Rueben)	0.00	23.21	23.21	0.06	0.81

Table 6: Regional Presence of Manufacturing Sectors

	1829	Change	1844
Constant	-0.8438***	-0.2620	-0.0245
	(0.1987)	(0.2051)	(0.1791)
Tariff Baden	1.9123**	-0.5173	0.4473
	(0.8366)	(0.9551)	(0.7811)
Tariff Change		0.1737	0.0223
		(0.2641)	(0.2112)
North	-0.3998	-0.3456	-0.3364
	(0.2459)	(0.2556)	(0.2168)
West	-0.1812	0.1641	-0.0002
	(0.2365)	(0.2514)	(0.2151)
South	-0.4616*	-0.5941**	-0.5383**
	(0.2492)	(0.2638)	(0.2202)
Observations	272	217	272
AIC	274.03	271.95	374.53

Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1
All specifications are estimated with a Probit regression, the reference
category for the regional dummy is the central region.

Table 7: Regional Employment in Manufacturing Sectors

	1829	Change	1844
Constant	0.0091	0.0736**	0.872**
	(0.0100)	(0.0354)	(0.0437)
Tariff Baden	0.0949**	0.0407	0.1988**
	(0.0458)	(0.0766)	(0.0957)
Tariff Change		-0.0306	-0.0676**
		(0.0237)	(0.0316)
1829 Workers		0.2052	
		(0.2484)	
North	-0.0039	-0.0472	-0.0519
	(0.0116)	(0.363)	(0.0444)
West	0.0456	0.0049	0.0599
	(0.0302)	(0.0670)	(0.0733)
South	0.0152	-0.0160	0.0023
	(0.0175)	(0.0438)	(0.0512)
Observations	272	272	272
R-squared	0.01	0.00	0.00

Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1
All specifications are estimated with an OLS regression with robust standard errors, the reference category for the regional dummy is the central region. The number of workers per sector per region is normalized by the population of that region.

Table 8: Determinants of Occupational Growth

	Coefficients	SE
West	0.838**	(0.354)
South	-0.265	(0.400)
North	0.045	(0.363)
Tax class 2	0.372	(0.455)
Tax class 3	0.277	(0.458)
Tax class 4	1.070**	(0.423)
Tax class 2 X West	0.055	(0.241)
Tax class 3 X West	-0.186	(0.288)
Tax class 4 X West	0.009	(0.342)
Tax class 2 X South	0.171	(0.250)
Tax class 3 X South	-0.263	(0.298)
Tax class 4 X South	-0.092	(0.338)
Tax class 2 X North	-0.130	(0.248)
Tax class 3 X North	-0.460	(0.288)
Tax class 4 X North	-0.229	(0.331)
Average shop size	0.160	(0.263)
Shop size X tax West	-0.409*	(0.244)
Shop size X tax South	0.274	(0.276)
Shop size X tax North	0.224	(0.247)
Shop size X tax class 2	-0.033	(0.313)
Shop size X tax class 3	0.115	(0.306)
Shop size X tax class 4	-0.494**	(0.247)
Constant	-0.524	(0.358)
Observations	307	
R-squared	0.193	

*** $p<0.01$, ** $p<0.05$, * $p<0.1$

The specification estimates the impact of the tax class, region and average shop size on the growth of an occupation in a region.

Figures

Figure 1: Gender ratio of Category II employees
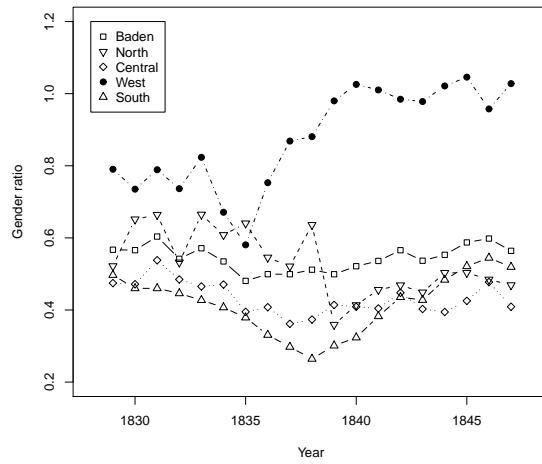
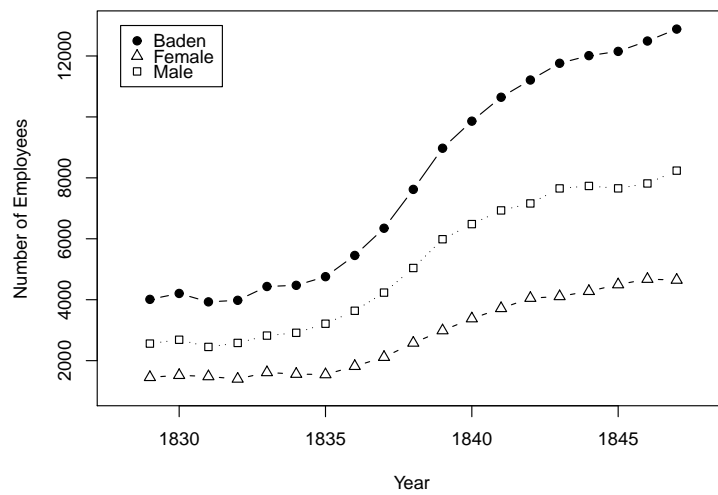Figure 2: Number of Category II employees
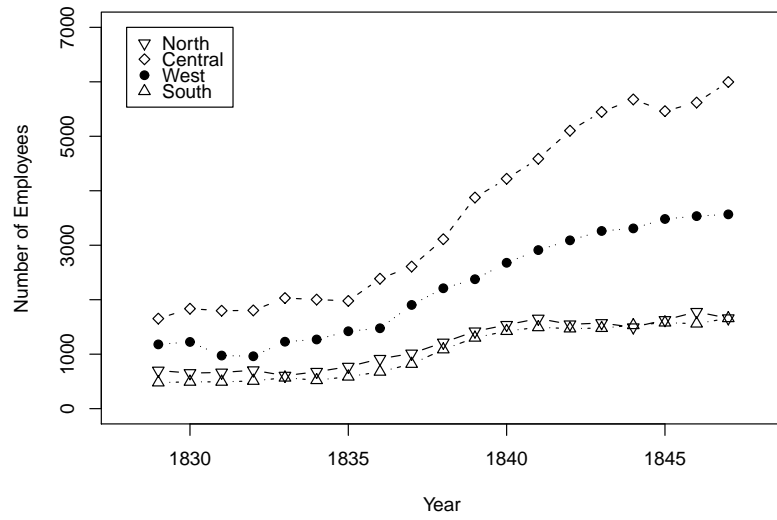
Figure 3: Number of Category II employees in major regions

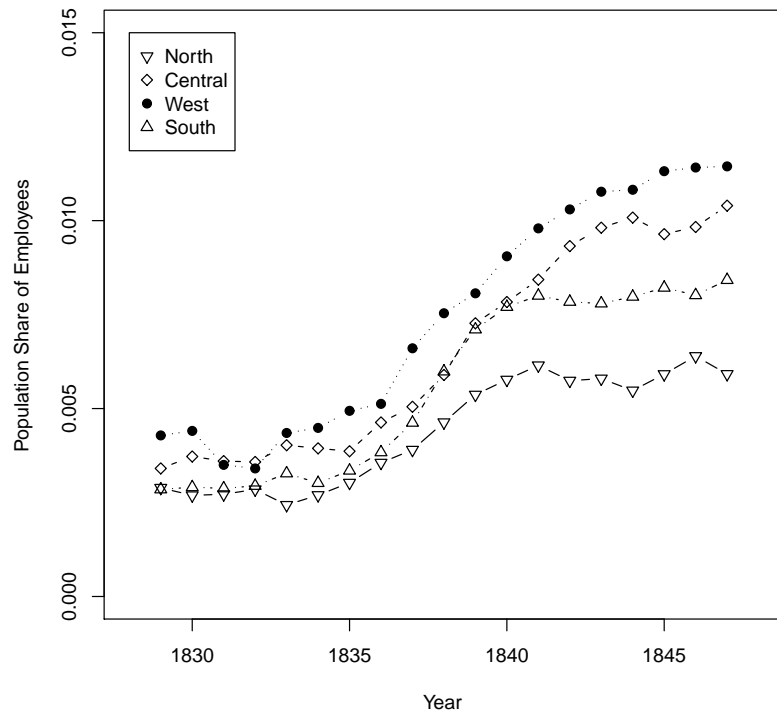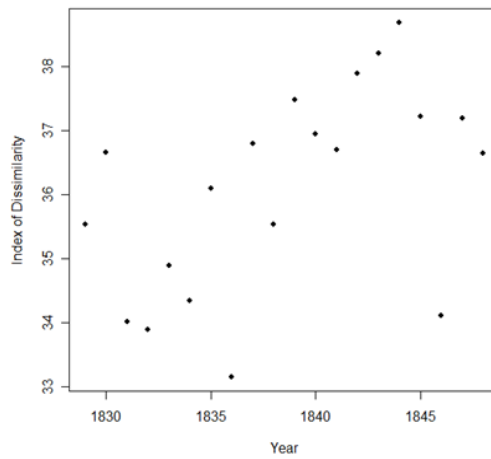Figure 4: Number of Category II employees in major regions

Figure 5: Index of dissimilarity for regional manufacturing employment

The plot depicts the index of dissimilarity for regional manufacturing employment, $\frac{1}{2}\sum_{i=1}^{N}\left|\frac{M_i}{M_B}-\frac{pop_i}{pop_B}\right|$, for each year. The index indicates how much of the total manufacturing employment needs to move so that the distribution over the regions is equal to the regional population distribution.
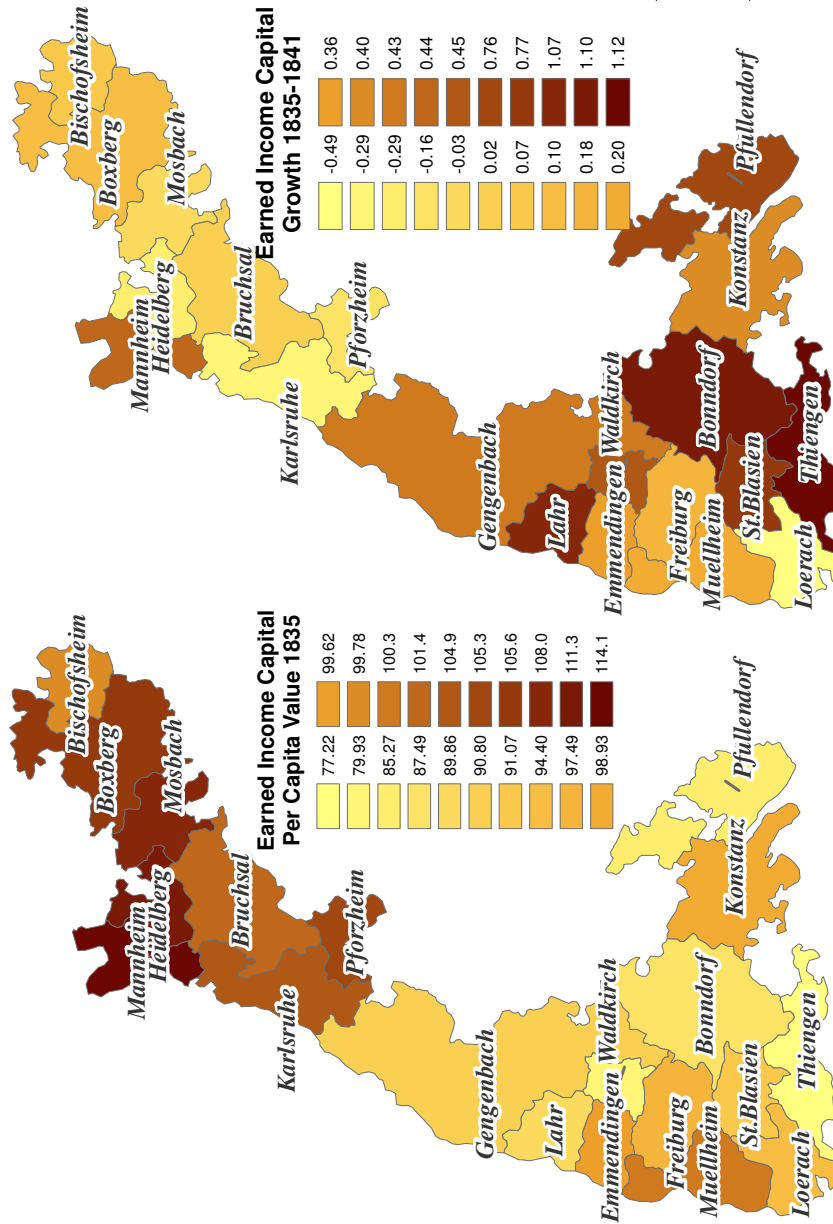
Maps

Figure 6: Map of Baden (Map 1)
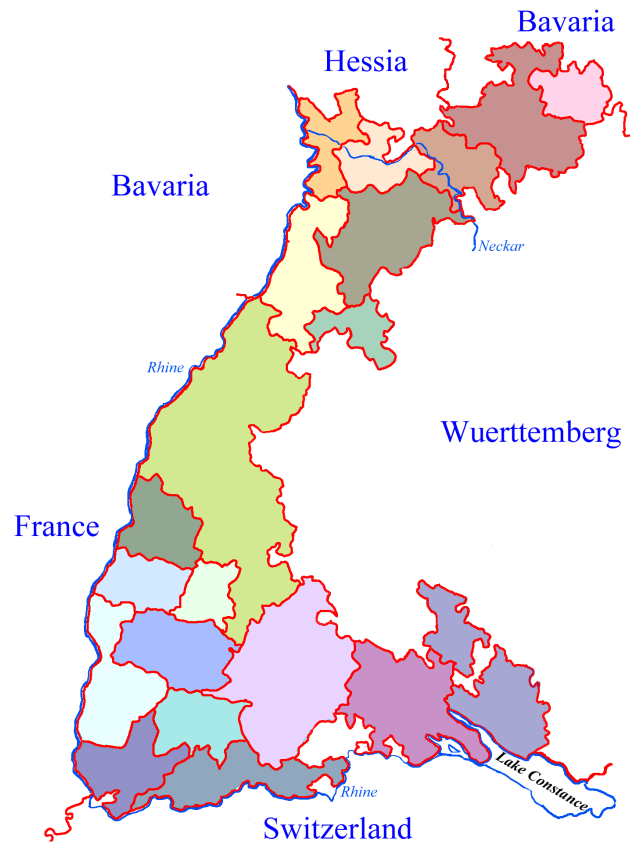
The map depicts Baden, the borders with respective neighbour states and the two major rivers, the Rhine and the Neckar. Within Baden the individual tax districts are shown.

Figure 7: Map of tax districts in Baden (Map 2)

The maps in both panels depict all tax districts within Baden. The color scales show the per capita level of Earned Income capital in 1835 in the lower panel and its annualized growth from 1835 to 1841 in the upper one.

Appendix

Tax system

This appendix explains certain characteristics of Baden's tax system, which is the source and basis for most data used in this paper. The description is based on historical legislative and executive texts as well as secondary literature by Dietz (1847), Fischer (1962), Regenauer (1863), Schremmer (1987), and Volz (1835).

Baden's tax system combined like most comparable tax structures a number of direct and indirect taxes. The following description centers on direct taxes, since these are utilized as the central data sources. Baden's system of direct taxation was an *Ertragsteuer*-system, following the French tax system at the time. Such a system does not use actual income as a basis for taxation, but rather the potential income which could be derived from an underlying source. These sources are then assessed with a specific capital value such that the potential income can be interpreted as the return to an explicit capital value. These capital values can measure physical capital, for example land and buildings, but also immaterial values, in particular labour as well as concessions and privileges. The choice of such a system was motivated by a number of concerns, in particular the low volatility of the revenues and the equal taxation of capital and labour. Another potential advantage is of administrative nature, potential income is easier to be standardized and calculated with a number of simple characteristics, for example occupation or location and size of a plot of land, that do not change from year to year, while actual income requires more extensive accounting practices.

Baden's system of direct taxation consisted of a number of a number of taxes covering different income sources. The relevant ones are the *Gewerbesteuer*, the commercial tax covering predominantly labour income, the *Land- und Gebaeudesteuer*, the tax on land and buildings, and the *Klassensteuer*, another tax on income from specific occupations. In 1850 all direct taxes had combined revenues of 3120276fl., while indirect taxes contributed 5028890fl..[27] The tax on land and buildings constitutes the largest direct tax with revenues of 1933352fl., while the commercial tax raised 652825fl. The tax on liberal occupations saw revenues of 192027fl..

Administration

The general administration of the tax system rested with the ministry of finance, situated in Karlsruhe. The ministry organized the regional tax administration by creating a number of regional tax districts. Each district was supervised by a tax official, who collaborated with local municipal authorities to organize and update the relevant tax rolls, in particular those for land,

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[27]Tariff revenues constitute 45% of the mentioned indirect tax revenues.

buildings and the commercial tax. The tax officials reported annually to the ministry, detailing the actual revenues of the different taxes. The tax assessment was based on self-reported information by households and enterprises, however the tax official had the right to make his own determination if he doubted the self-reported values.

Commercial Tax

The commercial tax code was introduced in 1815, providing a consolidated tax for all of Baden's territory, which had just seen a very substantial increase at the Congress of Vienna. After some minor revisions in 1816, the tax code stayed essentially the same until a major revision in 1854. The tax was designed to extend tax coverage beyond the existing taxes on land and buildings and did so by identifying and taxing additional income sources, most importantly labour. In particular, this tax recognized three income sources: *Verdienstkapital*, Earned Income capital which covered a person's own work, *Betriebskapital*, Operating capital which covered the value of his tools, and *Gehilfenkapital*, Employee capital which represented a tax on the work of employees.

This commercial tax had far-reaching coverage, making its name slightly misleading. The tax covered almost all occupations, resembling therefore a general income or occupational poll tax. There was one systematic exception though, namely liberal occupations such as civil servants, lawyers, doctors, clergy or teachers, who were instead covered by a separate tax, the *Klassensteuer*. A second issue concerns the tax obligation regarding *Gehilfsgesellen*, employees in crafts shops. The tax differed in the treatment of employees in agriculture versus crafts and manufacturing. Agricultural employees were taxed as individuals and were therefore responsible for the tax obligations themselves. In crafts,manufacturing and trade the individual employee was not assessed directly but the tax had to be paid by the employer. There were also a few exemptions based on the personal situation of an individual, for example for widows, seniors, veterans, or notorious poor. Quantitatively, the total population in 1829 was assumed to be 1171294 inhabitants, which represented, according to tax statistics, 236265 families, the unit used for the tax assessment. Of these families, at least 197416 were classified as working in agriculture, crafts, trade, or manufacturing.[28] Of those, only 23216 families, about 11.8%, were tax exempt, which demonstrates the far-reaching coverage of the commercial tax with regard to economic activity in Baden. Additionally, the statistics listed 33269 *Gewerbsgehilfen*, employees in crafts, trade and manufacturing, which were covered through their employers

As mentioned above, the tax assessment covers three components, the work itself, operating capital and the work of employees. The tax was assessed on a household or family level, therefore secondary sources of income, in particular

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[28]23801 widows are separately listed without reference to income or occupation.

some form of agriculture, were not taxed if they didn't represent the main occupation.

The first component was the Earned Income capital, which covers the income from the main occupation. Each liable family was assigned to a specific occupation, of which there were over two hundred. Some of these were very specific, for example in 1829 there was a listing for a *Mausfallenmacher*, makers of mouse traps. There was a single *Meister* active in this occupation in the whole of Baden at that time. Once the occupation had been determined, the next step was to use the size of the location in terms of population. Each settlement was classified either as a village, a town below 3000 inhabitants, a town with 3000 to 6000 inhabitants, or as a town larger than 6000. The tax code contained a matrix of occupation and location size combinations, which listed a tax class value for each combination. This class value was then turned into a fixed capital value. For example, a smith in a village was assigned to class II, which implies a capital value of 625fl, while a book printer in a town with over 6000 inhabitants was slotted into class VIII, implying a value of 4000fl. There were two main exceptions – firstly, a few occupations were assigned values without regard to the location, for example bankers and most notably farmers. Secondly, the occupational classification of trade and manufacturing depended on the level of operating capital and the organization of the business. For example a trade establishment without a public store was assigned based on its level of operating capital, while those with an open store were assessed according to operating capital as well as location size.

The second component was the Operating capital. It assessed the value of any mobile capital, therefore it covered capital items like tools, equipment, inventory, certain licenses, and operating funds. This mobile capital stock measure is complementary to the fixed capital stock, which was covered by the tax on land and buildings. The value was estimated and then slotted into value bands, each of which had a corresponding actual capital value assigned to it. For example, if the estimated value was 700fl, the person would be assigned into band 2, which had a range from 600fl to 800fl and resulted in a tax capital value of 500fl. The highest category, over 22000fl, was open-ended and assigned the actual estimate as tax capital. These examples show that the capital values had a slight progression, which was due to the intended exemption of a subsistence level of capital. Any value below 400fl was tax exempt, while above that the band capital values reflected some of this exemption. The subsistence value was actually fairly generous – about 81% of families in 1829 did not have to pay any taxes on operating capital. The existence of an exempt subsistence capital level and the systematic exemption of agricultural capital[29] implies that the aggregate operating capital values represent particularly operating capital employed in manufacturing, crafts and trading beyond subsistence pretty well.

The third component was the Employee capital. It assessed a capital value on the income an employer derived from its employees. As noted above, this

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[29]Agricultural capital was specifically taxed through the land and building taxes

did not apply to agriculture, where employees were taxed directly. Employees were classified into two categories, category I covered the first five employees, category II covered any employee beyond the fifth. So an enterprise with ten employees had five category I employees and five category II employees, while an enterprise with 2 employees has only two category I employees. This distinction had then consequences for the assessed value, each category I employee was assessed with 1/5 of the Earned Income capital of the employer, while each category II employee was assessed a fixed amount, 100fl for a male employee, 50fl for a female one. The actual tax obligation was then a fixed percentage of this capital value. The resulting tax payments were relatively small in comparison to actual income.

Land

Baden introduced in 1810 a new land and buildings tax, which remained the most important direct tax. It covered the fixed capital stock, land used for agriculture, mining or forestry and buildings used for any purpose. The building tax also covered any fixed installations within or attached to buildings. Similar to the commercial tax, the actual return from land or buildings, for example harvest results or rents, did not matter for the tax assessment. In contrast to the commercial tax, where changes in occupation or operating capital led to a change in the annual assessment, the land and buildings tax was annually assessed but not fully updated. Renovations, improvements to the land and similar changes did not affect the assessment, only major changes like a new building triggered such an update.

Klassensteuer

Another direct tax was the *Klassensteuer*, covering liberal professions that were not included under the commercial tax. This included occupations which are either directly public or closely related, for example civil servants, teachers, clergy, lawyers or artists. These occupations also usually required a certain degree of higher education. The assessment procedure was similar to the commercial tax, each occupation was assigned a certain tax class and thereby a specific capital value. This value was then the basis for the actual tax obligation.

Sectoral definitions

The commercial tax code distinguished four different sectors, namely agriculture, crafts, trade, and manufacturing. The separate classification of agriculture was relatively clear, but the differences between the other three were somewhat more complex. The main difference between crafts and trade was occupation-specific and had only minor differences with regard to Earned Income capital assessment; there were no substantial underlying differences with

regard to general commercial regulations. The difference between crafts and manufacturing, however, rested on such an underlying legal distinction, namely whether an occupation was regulated under guild rules or through a concession system for larger establishments outside the purview of the local guilds. Baden's commercial code in the first half of the 19th century was no longer a strict guild system, but commercial freedom was not instituted before the 1860s. As such, the system was fairly liberal, the powers of the guilds were restricted and concessions were granted fairly easily. The details of the system were fairly complex due to the local nature of the guild regulations, which had hundreds of regional variations, as well as the different public authorities granting concessions. The complexity of the system is illustrated by the fact that Baden was unable to provide a concise version when asked by other German and foreign governments during the 1830s and 1840s. In general I follow the contemporary classification scheme, subsuming under crafts any occupation within crafts and trade which was under the guild regulations, while manufacturing describes commercial activity based on the concession scheme.

Data

Districts

The basic unit of observation are tax districts. The tax administration organized the state into about 30 districts, each labeled according the location within the district where the responsible tax official resided. These districts were in general based on smaller administrative districts. I construct 20 districts which were consistent over time. This was done by linking tax districts to administrative districts. Tax districts got occasionally reorganized, the smaller administrative districts were shifted between tax districts. Using official announcements as well as changes in the district population I combine districts such that all resulting districts did not change over time. This results in the districts shown in Map 1 with their characteristics shown in Table 1. Additionally I aggregate the districts into four regions. This aggregation is done such that resulting regions resemble the four official administrative regions introduced in 1832 as much as possible.

The district data are taken from archival records at Generallandesarchiv Karlsruhe, Nr 416 / 48-69 and 237/ 13929

Information about districts are given in Steuerdirektion Baden, *Das Grossherzogthum Baden nach seiner Eintheilung in Steuerobererhebungsbezirke (Obereinnehmereien und Hauptsteuerämter) und Untersteuereinnehmereien (Stationen und Untersteuerämter) mit den zu diesen gehörigen Orten, Höfen, Zinken, Weilern und einzelnen Häusern* by the Steuerdirektion Baden, Carlsruhe, 1837

Boundaries and location of administrative districts are based on *Historischer Atlas von Baden-Württemberg, Karten und Erläuterungsbände*, by Kommission für Geschichtliche Landeskunde in Baden-Württemberg, Stuttgart,1979

Tax revenues

The afore mentioned tax official reported their annual aggregate revenues to the ministry to finance, which compiled a state-wide list containing all districts. Archival records of these overviews are available from 1827 to 1849. Due to major revisions of the rolls in 1828 and considerable political unrest in 1848/49 I utilize the records for the time period from 1829 to 1847. The overviews contain for each district the aggregate revenues for the land and building tax as well as the commercial tax, both split into individual components. This results in annual observations for the total amount of revenues raised by the commercial tax, split into Earned Income capital, Operating capital, Employee capital for employees of category I and Employee capital for employees of category II, which was again split into a male and a female component. Given that the capital assessment for the Employee II category is a fixed value, the total tax revenues allows the calculation of the number of male and female employees taxed in this category. The overview also contains an annual observation of the population in each district, though starting in 1834 these numbers are based on censuses held every three years. I linearly interpolate the population for each of the intermittent years. The tax revenues are taken from archival records at Generallandesarchiv Karlsruhe, Nr 416 / 48-69 and 237/ 13929

The tax details are based on *Gewerb-Steuer-Ordnung*, 1815, Grossherzoglich-Badisches Regierungsblatt (V): 25-36. and on *Änderungen und nähere Bestimmungen in der Gewerbs-Steuer-Ordnung*, 1816, Grossherzoglich-Badisches Regierungsblatt: 69-72.

Manufacturing

The commercial tax covered not only crafts but also manufacturing. This allowed Baden's government to collect and publish detailed information about manufacturing enterprises in the state. Due to the costs involved this only happened in 1829 and 1844. Further information about the situation in 1849 was released when Baden began to publish an official statistical publication series. The information for 1829 and 1844 contained the number of enterprises and the number of employees for 68 sectors with sufficient information about establishment location to derive the aggregate number of enterprises and employees for each sector in each of the four major administrative regions. The information published by the statistical office in 1851 lists 41 manufacturing sectors, differing from those of the other publications. It does not contain sufficient location information to derive regional information, but the listed sector characteristics are split into aggregates for all establishments founded before the Zollverein entry as well as after the entry. Sector characteristics are

the number of enterprises, the number of workers split into male, female and children as well as within the factory and outside. Furthermore the combined weight of the output as well as its total monetary value is listed.

The 1829 data are reported in *Gewerbs-Taschenbuch : für das Jahr 1835.* by Wilhelm Ludwig Volz, Karlsruhe,1835

The 1844 data are reported in *Bericht über die Gewerbeausstellung für das Grossherzogthum Baden, welche, durch den Gewerbeverein zu Karlsruhe veranstaltet, im September 1846 daselbst stattfand,* by Rudolph Dietz, 1847

The 1849 data are reported in *Amtliche Beiträge zur Statistik der Staatsfinanzen des Grossherzogthums Baden,* by the Finanzministerium Baden, Karlsruhe, 1851

Tariffs

Baden's and the Zollverein's tariff rates were based on the weight of the good. The calculation of ad valorem tariff rates requires the value of the goods per unit of weight as well as the relevant tariff rates.[30] I use the total weight, measured in *Zentner,* and output value to calculate the average price for each sector. The resulting numbers correspond relatively well to those listed by Dieterici in 1842 in connection with the major import and export goods. Table 5 lists the resulting tariff rates for the 41 sectors of the 1849 data. The weight and value data are taken from *Amtliche Beiträge zur Statistik der Staatsfinanzen des Grossherzogthums Baden,* by the Finanzministerium Baden, Karlsruhe, 1851

Baden's tariff rates are from Müller (1984) and Regenauer (1863)

Zollverein tariff rates are from *Der grosse Preussisch-Deutsche Zollverein in besonderer Beziehung auf den Thüringischen Zollverband : oder, Auszügliche Mittheilung der wichtigsten darauf Bezug habenden Tractaten, Verhandlungen, der einschlagenden Gesetze beschlossenen Ausgleichungen, Entschädigungen und festgestellten Tarife.*by Georg Friedrich Krause, Ilmenau, 1834.

The prices are compared to those reported in *Statistische Uebersicht der wichtigsten Gegenstände des Verkehrs und Verbrauchs im Preussischen Staate und im deutschen Zollverbande in dem Zeitraume von 1831 bis 1836 : aus amtlichen Quellen dargestellt.* Volume 2, by Karl Friedrich Wilhelm Dieterici, Berlin, 1842

Occupations

The commercial tax data for 1829 and 1844 not only contain information about manufacturing, but also about all crafts occupations. The overview lists for

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[30]Some of the sectors didn't match specific categories, I assigned Baden's maximum rate to these sectors.

each occupation the aggregate number of *Meister* and *Gehilfen,* independent master craftsmen and their employees. These aggregate numbers are given separately for major administrative regions. Due to administrative reforms in the 1832 the statistics for 1844 were reported for four above mentioned regions, which only partially resembled the six used in 1829. I construct consistent numbers of *Meister* and *Gehilfen* for each occupation in 1829 and 1844 for each of the four regions. In particular I use the above described tax districts to merge the six regions of 1829 into the four of 1844, two of which needed to be adjusted for an area that had been reassigned between them; I use the relevant population numbers and the assumption of a uniform distribution of workers over the whole district to weigh the numbers in both accordingly. If the population of the reassigned area was 10% of the whole district population, I reassigned 10% of all *Meister* and *Gesellen* in each occupation. The ministry changed the list between 1829 and 1844; the total number of occupations that were listed on both and had active *Meister* in both years are 107.

The 1829 data are reported in *Gewerbs-Taschenbuch : für das Jahr 1835.* by Wilhelm Ludwig Volz, Karlsruhe,1835

The 1844 data are reported in *Bericht über die Gewerbeausstellung für das Grossherzogthum Baden, welche, durch den Gewerbeverein zu Karlsruhe veranstaltet, im September 1846 daselbst stattfand,* by Rudolph Dietz, 1847

Other Direct Taxes

The utilized data are the annual revenues of the land and buildings tax and come from the ministry of finance records that also contain the commercial tax revenues. The data is available for the same periods and districts as the commercial tax data. The tax revenues are split into separate revenues for the land and the buildings tax component. This allows the calculation of per capita values for each district between 1829 and 1847. Records for the tax on liberal professions result in one observation for the year 1838, which contains the per-capital level of tax assessment for each district.

The tax revenues are taken from archival records at Generallandesarchiv Karlsruhe, Nr 416 / 48-69 and 237/ 13929

Urbanization

Urbanization is calculated based on the respective district population for the various years and the number of inhabitants for Baden's towns in 1836 and 1852. The set of towns is based on the list of locations included in the list of towns in the year 1852.

The population size of locations in 1836 is based on the *Hof- und Staats-Handbuch des Grossherzogthums Baden*, Karlsruhe, 1835

Any missing data is taken from *Geographisch-topographische Beschreibung des*

Grossherzogthums Baden by Adam Ignaz Valentin Heunisch, 1833

The data for 1852 is based on *Die Gemeinden des Grossherzogthums Baden, deren Bestandtheile und Bevoelkerung* by Ministerium des Inneren, Karlsruhe,1855