The German bank-growth nexus revisited- Savings Banks and the Industrial Revolution in Prussia

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Abstract

We provide evidence that smaller, regional public financial intermediaries contributed to Germany's industrial development, using a new data set of the foundation year and location of Prussian savings banks. This extends the banking-growth nexus beyond its traditional focus on large universal banks. Since saving banks were public financial intermediaries, our results further suggest that state intervention can be successful in the financial sector, particularly at early stages of industrial development when capital requirements are manageable, and access to international capital markets is limited.

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1. Introduction

The German banking system with its universal banks is often considered a key factor for its industrialization. According to Gerschenkron's (1962) seminal work, the German experience can serve as a role model for other moderately backward economies: Governments could trigger economic development by supporting the establishment of modern financial institutions.[1] In the economic literature, we find many cross-country studies that support this hypothesis (see, for instance, King and Levine 1993a,b; Rajan and Zingales 1998, Levine and Zervos 1998). Other works mitigate the potential impact and claim that the effect is endogenously driven and the development of the banking sectors is a result of economic success and not its cause (see, for instance, Greenwood and Jovanovic 1990 and Pagano 1993).

Banks and other financial intermediaries can mobilize savings, reduce risks for investors and improve the allocation of resources. All this activities ease the trading of goods and services and foster technological innovation (King and Levine, 1993a,b). Moreover, Universal banks were typical for the German banking system and since they offered a wider range of services than did U.S. or British banks, it is easy to believe that these banks could particularly foster growth and support firms at an early stage (Guinnane 2002, 81). For instance, by establishing long-run relationships with industrial firms, they were able to allocate credits only to the most promising investment opportunities. However, apart from some rare works by Fohlin (1999, 2007), Guinnane (1997,1998, 2002), Burhop (2006) and Proettel (2013), scholarly discussions about the banking-growth nexus in Germany have not given significant attention to bank types other than universal banks. Although, Fohlin (1999, 311) already pointed out that universal relationship banking only developed after the first wave of industrialization. The present study revisits the banking growth nexus with the focus on savings banks. For a sample of 978 Prussian cities,[2] we find a positive and significant relationship between the existence of savings banks and industrialization as measured by city growth and the number of steam engines per factory around the early period of industrial development (1854 to 1870). It is particularly surprising that earlier research gives savings banks only a limited role since by 1913, they held 24.8 percent of the total assets of all German financial institutions and rank at the top of all bank types in terms of net investments (Wysocki 1980, p.119). Burhop (2006) provided the most

[1] This idea has been formalised for instance by Da Rin and Hellmann (2002). In their model, banks can propel an economy from a self-perpetuating low equilibrium to a sustainable high equilibrium. Banks can thus become the driving force in the big push towards industrialisation.

[2] In 1900, about 60 percent of the total German population lived in Prussia.

recent contribution to this debate. Moreover, he provides the only quantitative investigations of the German-bank-growth nexus for the early years of industrialisation. Although joint stock banks were just about to develop, he finds support for the hypothesis of a vital role of these banks for the early industrial development of 19thcentury Germany. Burhop (2006) also finds a positive impact of savings banks on industrial growth, although only for the later stages of industrial development (1883–1913). Large, multinational firms and coal resources however, were not the only basis of German industrialization: good public infrastructure, a competitive schooling system and small and medium-sized firms were the foundation of German industry. Savings banks as communal financial institutions provided significant funds for public infrastructure projects like railways and buildings and were crucial in financing small and medium-sized local industries. Burhop (2006) analysed the causal influence of financial sector development on economic performance using time series data at country level. Thus, the positive impact of savings banks on the development of small and medium-sized cities for earlier periods is likely to be concealed at this level of aggregation.

The largest challenge for our study is the potential endogeneity: Did savings banks causally influence growth or were they founded when the cities were already beginning to industrialize? To address this issue, we apply an instrumental variable approach that makes use of the fact that savings bank foundations occurred in waves induced by government regulation. In 1854, the Minister for Trade and Commerce issued a decree that introduces a plausible magnitude of exogeneity in the location of banks. The decree enhanced the equal distribution of savings banks, because it demanded the foundation of at least one savings bank per county. It further encouraged poorer local authorities to found a savings bank by offering institutional and financial support (see v. Knebel-Doveritz 1907, 6pp). Following this decree, we observe a wave of savings bank foundations on a much wider geographical distribution than before: While in 1849, we observe savings banks in about half of the counties, this had risen to nearly 95 percent by 1864. Foundations of savings banks during this wave often took place in smaller cities that might not have been able to afford the foundations without this support.

Our results go well with the recent research on the role of private local banks and financial systems on growth and development both during the industrial revolution and today. Guiso et al. (2004), for instance, have shown that differences in local financial development are important determinants of economic success in modern Italy. Coccorese and Shaffer (2018) show that cooperative banks play an important role for the economic performance of Italian

regions in the period from 2001 to 2011. Among the papers studying the impact of local banks on economic development in historical periods, Bodenhorn and Cuberes (2018) provide conclusive evidence that local commercial banks contributed significantly to city growth in early 19th century New York. Heblich and Trew (2018) present similar evidence for England in the same period. We add to this literature by being the first to study the impact of public local banks. We provide conclusive evidence that these small public regional financial intermediaries were as important for the transition to modern economic growth in Germany in the early 19th century as large universal banks and stock markets at the end of the 19th century. Moreover, since saving banks were public financial intermediaries, our results strongly suggest that state intervention can be successful in the financial sector. This is particularly true at the beginning of an industrial take-off, when capital requirements are manageable and access to international capital markets is limited.

2. Historical Background

2.1 Savings Banks in the German Banking System

Table 1 shows the shares of different bank groups in the financial system for the late 19thcentury. It shows how misleading a sole focus on the large joint stock banks is. During the mid of the 19th century until the beginning of World War I, savings banks were the most important pillar of the German banking industry (Burhop 2011, 184). Moreover, they severely expanded in the mid-19th century. Their market share rose from about 12 percent in 1860 to 24.8 percent in 1913.

However, to isolate the causal impact of the foundation of savings banks on the industrial development of a city, we have to address the issue that other banks might also have had a potential impact. Guinnane (2002) already outlines that the different bank types in Germany did not really compete but complemented each other. As previously mentioned, the large universal joint stock banking developed only after the first wave of industrialisation. With a share of about 10 percent of the total assets in 1880, which was about half the share of the savings banks, it can only have played a marginal role for the mid-19th century take-off. Moreover, universal joint stock banks had quite a different target clientele than the savings banks. Tilly (1986, 121) cites a note for the management of the Darmstädter Bank, one of the earlier joint stock banks, in the 1850s, which describes this nicely: "*The task of our bank is not*

to attract the business of industrial and commercial enterprise in general. On the contrary, it will be our mission to establish contract with all government institutions, joint stock companies and wealthy private persons in the hope of obtaining as large a share of business of governments, of princes and principates as well as joint stock companies and wealthy persons as possible."

Most universal joint stock firms were founded by a group of private banks in order to become large enough to be able to fulfil the capital needs of their target group. Among the founders of Deutsche Bank, the largest German universal joint stock bank, for instance, were the private bankers Adelbert Delbrück, Heinrich Hardt and Victor Freiherr von Magnus (Gall 1995, pp.11). We can thus see private banks as the forerunners of joint stock banks. They emerged in the late 18th century in various parts of Germany. Most private bankers were individuals or family groups, or small partnerships (Guinnane 2002, pp. 96). While savings banks experienced an unpreceded expansion during our observation period, private banks constantly lost impact. Their market share fell from 35.5 to about 4 percent from 1860 to 1913 (Burhop 2011, 168-169). We cannot quantitatively control for the impact of private banks. As Guinanne (2002, 96) points out, any estimates of the number and size in different German regions would be imprecise because private banks were rarely incorporated. However, Fohlin (2007, pp.18) points out that – with some exceptions - the availability of secure government business made the conservative banking elite reluctant to finance riskier business. Moreover, private banks originated as adjuncts to trading houses and were therefore mostly present in important trading cities like Cologne or Frankfurt (Tilly 1966). Since we are particularly interested in the impact of the foundation of savings banks in small remote cities, the probability that we mistakenly estimate the impact of private banks and not savings banks is low. Moreover, savings banks had the advantage of being public institutions. Hakenes and Schnabel (2010) describe the advantage theoretically. They argue that because public banks are not profit-driven, they focus their activities towards long-term projects with high social returns. Hakenes et al. (2015) theoretically establish and empirically confirm (using data on contemporary savings banks in Germany) the idea that small regional banks like savings banks or cooperative banks are more efficiently enhancing local economic development than larger private banks do. This is because small local banks have more knowledge about their local customers and creditors and therefore lower screening and monitoring costs than larger banks. They also find that this is especially important for the economic growth of poor, peripheral regions with low initial capital endowments and credit rationing.

Credit cooperatives, as the fourth bank type, were collectively a much smaller part of the banking system than savings banks with a market share of about 4 percent in 1900. They were local, private organisations controlled by their members (Guinnane 2002, pp.89). Like savings banks, they were mainly founded in rural areas and small cities. Most of them, however concentrated on individual small farmers. Moreover, since savings banks often supplied credit to cooperatives, they often acted as complementary institutions. (Burhop 2011, Wolf and Süsse 2019). Wolf and Süsse (2019) study the determinants of the foundation of credit cooperatives in East Prussia. If we compare the foundation trends of savings banks with their data on founding dates of credit cooperatives, we see that credit cooperatives also experienced a foundation wave in our observation period (Figure 1). However, the major foundation wave of credit cooperatives was about 10 years later than the foundation boom of savings banks. Still, since savings banks and credit cooperatives potentially had an overlap in their target group of customers and investment opportunities, we will run a robustness check where we control for the number of credit cooperatives to show that the existence of credit cooperatives does not influence our results.

2.2 Saving banks and Industrialisation

Savings banks mobilized savings, which was particular important in cities and areas where capital was scarce. This newly raised capital was then used to provide private loans to industrialists or finance infrastructure projects. However, one might argue that the overall capital of each individual savings bank was too low to have an impact on a region. However, if we limit our scrutiny to the savings banks established after 1854 this was not the case. In 1875 the average savings bank had assets of about 40 000 Marks, which is on average about 184 Marks per capita if we count all citizens in a town (median 68 Marks per capita) across all cities, and approximately 440 Marks per head for the smallest decile of cities (see Königlich Preußisches Statistisches Bureau 1876).

Moreover, savings banks had a strong regional character, the so-called "*Regionalprinzip*" (Mura 1998, 27; Ashauer 1991, 177). Although this was not codified in every region, in most cases it was not possible to open an account if one did not live in that region. More importantly, investments were also supposed to be regional. This was to ensure that only those who would be liable if the bank failed benefitted from successful investments (Schulz 2005, 24). According to Schulz (2005, 22) savings banks generally existed as dependent departments of the local government up to the 1930s. Guarantor liabilities manifested the strong relationship between

savings banks and communities. The regional authority, which could be either the community, the town or the county, was liable for the obligations of the savings banks (Schulz 2005, 22-23).[3]

Local authorities had several clear reasons for founding savings banks (see Schulz 2005, 27-28): the main purpose was to give poorer people the opportunity to save and thereby gain autonomy and independence.[4] This social target is common to most of the early savings banks (Wysocki 2005, p. 18; Trende 1957).[5] Thus, savings banks created opportunities to take personal precautionary measures by accumulating private savings (see also Lehmann-Hasemeyer and Streb 2017), and this reduced the burden on local funds for poor relief.

Furthermore, because of the local authorities' close relationship to "their" savings banks they had easy access to capital. Figure 2 provides an overview of the financial assets of the Prussian savings banks in our observation period. Unlike government bonds, loans to public authorities were mostly obligations (Schuldscheine) which could not be traded at security exchanges (Proettel 2013, p. 11). These loans financed streets, schools, hospitals, energy infrastructure and railroads (Ashauer 1998, 76; Mura, 1998, 109p; Schulz 2006, 29).[6][7] In 1859, for instance, the savings bank in Saarbrücken granted a loan to install a water pump, build a running well and lay down water pipes. Proettel (2013, 12) describes the savings bank in Kirchheim unter Teck

[3] Often, personal relationships connected savings banks and local authorities. For example, the executive board of the savings bank in Altenburg in 1886 was made up of members of the local government, and bank employees were recruited and paid by the city council (Schulz 2005, Hiller 1996, 33).

[4] The stated purpose of the abovementioned first savings banks in Hamburg was, for instance, "*Die Ersparungsklasse dieser Versorgungsanstalt ist zum Nutzen geringer fleissiger Personen beiderlei Geschlechts, als Dienstboten, Tagelöhner, Handwerker, Seeleute errichtet, um Ihnen Gelegenheit zu geben, auch bei Klenigkeiten etwas zurückzulegen und ihren saer erworbenen Not- und Bautpfennig sicher zu einigen Zinsen belegen zu können, wobei man hoffet, dass sie diese ihnen verschaffte Bequemlichkeit sich zur Aufmunterung gereichen lasse mögen, um durch Fleiss und Sparsamkeit dem Staat nützlich zu sein.*" (§94, Mura 1997, p. 26).

[5] Some banks defined their customers very precisely, while others claimed more generally to serve the poorer members of the population. The Bank in Trier, which was located in the Prussian province of the Rhineland, for instance, defined their target group as day labourers, servants, soldiers up to a certain rank and public servants who earned a yearly salary of less than 12 Thalers (Ashauer 1998, p. 55). Others such as the savings banks in Lübeck, Kiel or Göttingen never restricted their target customers (Wysocki 1980 p. 18, Mura 1995, p. 21). Often we find a stated preference for workers, daily labourers and servants but with a provision for other customers to open saving accounts (Wysocki 1980, p. 19). Furthermore, not all banks followed their statutes or guidelines to the letter. Overall, Wysocki (1980, pp. 77) estimates that the original target group, i.e. the poorer members of the population, held about 40-50 per cent of the overall savings in our observation period. Although 40 per cent is lower than originally intended, it still constitutes a respectable amount. In 1900 for instance, 40 per cent of all savings in Prussia was about 2.298 Billion Marks (see Ashauer 1998, p. 64; Höpker 1924, p. 80). Furthermore, the administrative staff of the savings banks themselves believed that the poorer customers from the working class were important for their business.

[6] See also Proettel (2013, p. 7)

[7] In a recent paper, Atack et al (2014) have also shown that the expansion of banking and railroads in the United States during the industrial revolution were intimately linked and that their relationship evolved over time.

in the South of Germany granting about 70 loans worth 1.8 million Marks to public authorities in the period 1907 to 1913. Of this, 522,850 Marks were for building schools and apartments for teachers, 436,165 Marks for streets, and 108,300 Marks for water pipes. About 10,000 Marks were used to build a gas plant, which was mainly used by industrial firms. We need to take into account that Proettel's (2013) cases are located in Württemberg and focus on a later period. Nevertheless, loans to public authorities made up 8-9 percent of the total investments of Prussian savings banks, which amounted to 190 million Marks in the period 1856 to 1875. It is difficult to estimate the extent to which savings banks were directly involved in financing infrastructure, since in the official statistics summarises all bonds and shares held by the savings banks as "securities" (Ashauer 1991, p. 144). However, a decree issued in September 1844 provides some insight about the typical securities of savings banks. This decree states that a savings bank can grant loans only if the securities offered as collateral were those in which the savings banks invested. These were German covered bonds (*"Pfandbrief")*, national government bonds, guaranteed railway shares and obligations from the community (cited after Trente 1957, p. 118).[8]

Most importantly, Savings banks also provided private loans to tradesman and industrialists. As Proettel (2013) has emphasised, the majority of firms, even by the end of the 19th century, were small and middle sized. By 1882, only 3.5 percent of employees worked in firms with over 1000 employees, while more than 50 percent worked in firms with less than five employees (Burhop 2011, p. 140). It is well known that large universal banks focussed on large industrial firms – mainly from the coal and steel sector (see also Tilly 1986, p. 150). However, it remains unclear how the large number of small and medium-sized firms were financed, and we assume that saving banks mattered a great deal to close this gap. There are many examples of savings banks providing credit to smaller and medium-sized firms (see, for instance, Guinnane 2002, p. 88). Compared to the mortgages, however, these seem rather small and thus earlier historical research has rated them as irrelevant to industry financing (Ashauer 1991, p. 144; Mura 1998, p. 109; Schulz 2006, p. 29). However, even though these personal loans might have been relatively small, they can still have a significant impact since small firms and craftsmen did not

[8] Furthermore, for some cases we have more detailed information on these investments. Schulte-Rentrop (1937, p. 85) provides detailed information on the investment policy of saving banks in Westphalia. For example, in 1887 the savings bank in Warendorf/ Prussia held fixed interest railways obligations of 49,500 Marks, which was about 14 percent of its equity. The remainder consisted of different types of government bonds and smaller investments in gas equities. Based on his findings, Schulte-Rentrop (1937, p. 85) concludes that in the early 19th century, savings banks already contributed a great deal to the German transport network of streets, railways, trams and waterways via government bonds, but also via direct investments.

have large capital requirements. In the years 1858 to 1861, the savings bank in Saarbrücken granted 108 personal loans, with an overall value of about 12,000 Thalers. Nearly half the recipients were craftsmen. Although, we know nothing about the purpose of the loans, it is most likely that they were used to buy land, seeds, machines and raw materials and were therefore important for the local businesses (Thomes 1985, pp. 83). Given the fact that the daily wage of a construction worker was about 1/2 Thalers in 1850 (see Strauss 1963, p. 148), these loans were by far not insignificant.

In terms of the mortgages, Proettel (2013) makes a convincing case that these loans were oftem used for industrial investments and the financing of commercial buildings. The savings bank in *Kirchheim unter Teck*, for instance, often granted mortgages to workers, machinists, gas plant employees, artisans and other industrialists. For example, in 1908, the textile mill "*W.F. Berger We"* received a loan of 30,000 Marks to build a new spinning room. Although we lack evidence from a Prussian savings bank, it is most likely that Proettel's (2013) findings can be generalised to Prussian savings banks. At least, they demonstrate that there is a misunderstanding and therefore underestimation of the mortgage loans when it comes to financing industrialisation. It is almost certain that they were not solely used to finance private housing.

Altogether, savings banks were one of the largest banking groups in the early 19th Century compared to other financial intermediaries. According to anecdotal evidence and previous historical research, they provided capital for smaller and medium-sized firms in their region and invested in infrastructure projects. According to Thomes (1985, p. 11), their main achievement was the mobilisation of smaller sums of capital and investing it back into the economy (see also Schulte-Rentrop 1937, p. 57). They are therefore most likely to have had a positive causal impact on regional development. The positive effect on the regions may further increase over time with the accumulation of capital.

2.3 The Decree of 1854 – Supporting the Spread of Public Banks

As mentioned in the introduction, we face endogeneity concerns because of the reverse causality issue. Cities that experienced a period with high growth rates and where authorities expected the growth trend to stay positive or become positive, had a higher incentive to found a savings bank. Thus, the timing of the foundation, i.e. the treatment effect is likely to be endogenous.

To address this issue and establish a causal impact, we make use of the fact that saving banks foundation took place in waves, triggered by changes in regulations. The first large wave of foundations started after the general regulation of Prussian savings banks in 1838 (see Figure 3). This was a general legal framework covering organisation, business practices and public control. While in 1837 we observe just 136 savings banks, this number had nearly trebled (to 376) by 1849. During the 1850s, the state authorities continued to point to the economic importance and necessity of savings banks. In July 1854, the minister for trade and commerce, together with the minister of internal affairs, issued a decree that demanded the foundation of at least one savings bank per county in the years to come. The intention of the decree was to raise capital to support regional development (v. Knebel-Doveritz 1907). Most importantly, this decree encouraged poorer communities to found savings banks by promising financial support for communities that struggled to bear the costs and risks of founding a savings bank (Thomes 1885).[9] This decree triggered a second wave of foundations. In the period between 1854 and 1865 another 345 savings banks were founded and by 1864, we observe 794 savings banks in Prussia. In our sample of cities, we observe 176 cities that founded the first savings bank in this period. After this boom, the number of foundations per year decreased again.[10]

The 1854 decree enhanced the equal distribution of savings banks by requiring the foundation of at least one savings bank per county, and by encouraging poorer local authorities by offering financial support. Figure 4 illustrates this quite nicely. One can see that the foundation of the first savings banks mainly took place in already industrialised areas, such as the Rhineland and Silesia (see Figure 4). This changes after 1854, when the distribution became much wider and the willingness to create good coverage of savings banks throughout Prussia is obvious. If we consider the counties within the 1849 borders, only about 56 percent of the counties had a savings bank by 1854. After the boom, in 1865 over 90 percent had at least one savings bank (see Figure 5). Furthermore, Figure 4 shows that after 1850 the average city that founded a

[9] The original wording was as follows: "*Dabei sind dieselben (Ländräte) namentlich darauf aufmerksam zu machen, dass die Gelder der Sparkassen sicher und nutzbringend bei den Provinzial-hülf-kassen untergebracht werden können, so wie dass den Sparern aus dem Stande der kleinen Leute nicht bloss die Sparkassen-Zinsen, sondern auch die von den Hülfs-kassen zu vertheilenden Prämien zu Gute kommen. Ist eine Sparkasse gerändet, so erhält sie sich, da sie bei irgend umsichtiger Verwaltung nicht füglich Verlust haben kann, von selbst und an den übrigens an sich geringfügigen Mitteln zur Gründung derselben wird es den Kreisständen fehlen. Sollte dies dennoch nicht der Fall sein, so bin ich, der mitunterzeichnende Minister des Inneren bereit, mit mässigen Summen hinzuzutreten, Ich bemerke aber jetzt schon, dass sie nur ausnahmsweise wird geschehen können, theils weil der zu diesem Behulfe zu Gebote stehende Fonds an sich nicht bedeutend ist, theils weil besondere Umstände, welche dann näher zu motivieren sein werden, vorahnden sein müssten, wenn der Kreis nicht im Stande sein sollte, sie nicht erheblichen Einrichtungs-Kassen aufzubringen*."

[10] In the years between 1864 and 1875, on average about 19 new savings banks were founded per year.

savings bank was much smaller than in the earlier years. We use the decree of 1854 to instrument the saving banks foundations, because we believe that those savings banks that were founded because of the decree were not founded because the city already experienced an industrial take-off. Thus, the instrumental variable is equal to one for the years after the savings bank was founded, for cities, which founded a savings bank shortly after the decree (1854 to 1865) and that where located in counties in which by 1854 there was not already a savings bank.

3. Empirical Analysis

3.1 Data and Empirical Approach

In this section, we test empirically whether we can generalize the anecdotal evidence and the foundation of savings banks had a positive and significant impact on economic development in Prussia. Thus, we compare the growth paths of cities that founded a savings bank and their growth experience before and after the foundation of the savings bank with the growth patterns of cities that never founded a savings bank.

The main variable of interest is the foundation date of savings banks. We take this information from the *Zeitschrift des Königlich Preußischen Statistischen Bureaus* for the year 1876. This volume contains founding dates for all savings banks until 1875 (after which only a few new savings banks were founded). [11] About half the cities (459) in this data set founded at least one savings bank by 1875. The first Prussian savings bank was established in Berlin in 1818 and by 1913, there were 1765 savings banks in Prussia and 3,133 in the whole German Empire (Ashauer, 1998).

Measuring economic development for the 19th century on city level is challenging. We use population growth as a proxy variable, because we assume that economic development increased migration to urban centres, while fertility remained unchanged. Generalising from urban population growth to economic growth has shown to be an acceptable approximation where no data on income is available (Acemoglu, Johnson, and Robinson 2002). Moreover, this data is available for a number of years, which allows us to measure economic development over time. City population figures originate from Hornung (2015). The data set covers all 978 cities that held city rights in 1849 in Prussia, within its 1849 borders. It also contains population

[11] Please note that there might be a selection bias, because we only observe savings banks that still existed in 1875. However, given the large number of new banks founded in this period, this bias seems negligible.

figures for every third year between 1837 and 1871, resulting in 12 years with data and 11,736 city-year pair. [12] We also use the number of steam engines per factory as an alternative outcome variable to measure the effect on industrialisation more directly. Data on the number of factories and steam engines (steam engines and steam boilers) in a city for the years 1855 and 1858 we take from the official statistical publication *"Tabellen und amtliche Nachrichten über den Preußischen Staat" (Königlich Preußisches Statistisches Bureau 1858,1860).*

In a first step, we regress population growth on a set of variables representing the savings banks treatment. We use two different treatment variables to capture the structural changes that emerge due to the foundation of the savings bank: $postSB_{it}$ is equal to one for all years after the foundation of a savings bank. Since only 38 of 978 cities had savings banks during the observation period, we do not account for other savings banks that were founded after the first one. $time\_since\_SB_{it}$ measures the years since the foundation of the first savings bank, for each year t and each city i in the data set. Hence, this variable allows us to analyse whether it takes time for the effect of a newly founded savings bank to emerge.

We also include a number of controls: First, we include the natural logarithm of a city's population in period t ($\ln(Pop)_{it}$) to account for the fact that larger cities grow systematically slower than smaller ones, because of convergence in growth levels. To control for the potential impact of credit cooperatives, we conduct a robustness check using the data from Wolf and Süsse (2019).[13] The main data source for their sample is the "Address Book of Purchasing and Economic Cooperatives in the German Empire" as produced by the central Prussian cooperative Bank (Preussische-Genossenschafts-Kasse, 1915). Their sample covers the 236 counties that made up the six eastern provinces of the Kingdom of Prussia in the half-century before World War I (Brandenburg, Pomerania, West Prussia, East Prussia, Posen and Silesia), which is only a sub-sample of the data and reduces our overall number of cities from 978 to 612. However, the six provinces witnessed an unprecedented boom in the foundation of credit cooperatives in the early 19th century (Wolf and Süsse 2019, 12). In the appendix we show regressions were we control for the degree of industrialisation by controlling for the mining industry boom, which took place in the Ruhr and Upper Silesia coal industries. If savings banks were founded (and founded earlier) in regions with an economic upswing caused by the growth of the mining

[12] A similar analysis based on county level was not possible. To get a sufficient number of observations we would need to aggregate the data based on the county borders of 1849. This leaves us with 335 counties and population figures for the years 1849, 1861, 1864, 1867, 1871 and 1875. By 1861, however, 91 per cent of these counties already had at least one savings bank. Thus, the variation in the data is insufficient for this type of analysis.

[13] We thank Wolf and Süsse (2019) for kindly sharing the data.

industry, this could bias our results. Data on the share of mining workers in a county in 1882 we take from the iPEHD. Furthermore, to control for time-invariant unobserved heterogeneity and temporal shocks affecting all cities equally, we include city and year fixed effects. Table 2 provides a descriptive overview of the data set.

Thus, we estimate the following baseline regression equation using the fixed effects (FE) ´panel data estimator:

$$\frac{(Pop_{i,t+1}-Pop_{i,t})}{Pop_{i,t}} = +\alpha_1 \ln(Pop)_{it} + \alpha_2 SB_{it} + \pi_t + \delta_i + \epsilon_{it} \quad (1)$$

With $\frac{(Pop_{i,t+1}-Pop_{i,t})}{Pop_{i,t}}$ being the growth of population in city i between period $t+1$ and t, π_t are year fixed effects and δ_i are city fixed effects. Standard errors are clustered on city level. SB_{it} represents one of the two treatment variables, namely, the "Post-Savings Bank" dummy or the "Time Since First Savings Bank" measure. Moreover, we run instrumental variables (IV) regressions to address the potential endogeneity issue. The applied instrument, as outlined above, is equal to one for cities in which savings banks foundation was most likely triggered by the degree, i.e. that were founded in the period between 1854 and 1865 and in a county where we do not observe any savings bank by 1854.

Formally, we estimate 2SLS regressions of these equations:

$$SB_{it} = +\alpha_1 \ln(Pop)_{it} + \alpha_2 DecreeSB_{it} + \pi_t + \delta_i + \epsilon_{it} \quad (2a)$$

$$\frac{(Pop_{i,t+1}-Pop_{i,t})}{Pop_{i,t}} = +\alpha_3 \ln(Pop)_{it} + \alpha_4 \widehat{SB}_{it} + \pi_t + \delta_i + \varepsilon_{it} \quad (2b)$$

Where equation (2a) is the first stage and equation (2b) is the second stage. SB_{it} is an indicator for either one of the endogenous treatment indicators $postSB_{it}$ or $time\_since\_SB_{it}$. $DecreeSB_{it}$ is the instrumental variable derived from the logic of the 1854 decree. To exploit further the fact that the decree has triggered a wave of plausibly exogenous savings banks foundations, in some regressions we will limit ourselves to two different sub-sample. First, by excluding savings banks founded before 1838, when the first regulatory framework for the savings banks was implemented. Second, by excluding savings banks that where founded before the issue of the decree in 1854 and more than ten years after it (1865). In this sample, the control group consists of cities in which the first savings bank was founded after the end of our observation period in 1871.

3.2 Results on Savings Banks and City Growth

Table 3 presents the results of estimating standard panel FE regressions (as in equation (2)) in Panel A, Panel B and C report the results from the first and second stage of the 2SLS estimation (equations 2a and 2b). Columns 1 and 4 show the results for FE and IV regressions on the whole sample, while the other columns show the results for different sub-samples discussed above which should allow us to focus on savings banks foundations more exogenous than those of the first wave. The first three columns show the coefficients of the "Post-Savings Banks" dummy and columns 3 to 6 that of the "Time Since First Savings Bank" variable for the different estimation samples.

Looking at the fixed effects estimations in Panel A, it becomes apparent, that the effect of savings banks is both statistically and economically significant for both treatment variables and throughout all the samples. With the introduction of a savings bank, the growth rate increased by about 2 to 3 percent. We also find that the effect becomes larger the longer the saving banks existed in the city.[14] These results provide first, but because of the possible endogeneity of the timing of savings banks foundations, only suggestive evidence for a positive effect of the savings banks on local levels of industrialisation.

Thus, the results of the 2SLS regressions presented in Panels B and C are more trustworthy. Reassuringly, Panel B shows that the instrumental variable is strong, both according to the F-value of the excluded instrument and because it shows a large, highly statistically significant and positive coefficient on the first stage. This implies that the decree has worked as intended by the Prussian government and lead to the foundation of savings banks in counties in which this was not the case before.

The second stage results for the Post-Savings banks variable (Panel C, columns 1-3) show a significant and positive effect of savings banks on city growth, which is about the same size or slightly smaller than the OLS estimates, at least in the case of the samples excluding cities with early savings banks. In case of the "Time Since First Savings Bank" variable, it is quite the same, the instrumented variables show economically and statistically significant coefficients for the sub-samples excluding cities with early savings banks. However, here, the coefficients are larger than in the OLS case. Every additional 3-years with a savings bank increases city

[14] We also test whether the impact of treatment duration is non-linear by including the squared number of years since the first savings bank and found it not to be significant. We do not report the results, but are available from the authors upon request.

growth by 0.45%. Overall, the IV results suggest that the significant effects from the fixed effects estimations in Panel A are not resulting from a large upwards bias caused by unobserved heterogeneity. At least, if one limits the empirical analysis to sub-samples excluding the very likely endogenous first wave of savings banks foundations.

Next, we attempt to learn more about the cities that benefitted most. Thus, we spilt the sample into three according to the average size of the city. The first third contains the 326 smallest cities, with the smallest city having just 271 inhabitants, and an average city size of 1380 inhabitants. Most cities (82 percent in this sub-sample and 94 percent overall) had over 1000 inhabitants. The smallest city with a savings bank was Wirsitz with about 930 inhabitants. The second third contains the middle size cities in the sample. Here, the average city had about 2700 inhabitants. The last sample contains the larger cities. Cities in this sample had an average of 11 320 inhabitants.

If we run the baseline fixed effects regressions from Table 3, Panel A for the "Post-Savings Bank" dummy and for the sub-samples (Table 4), it becomes clear that large cities do not cause the effect, but the middle-sized ones. Moreover, if we only consider the sample of the foundation wave after 1854, the effects seems driven by the smallest cities. This suggest that savings banks that were founded after the decree 1854 were particularly useful in the smallest cities and more rural areas, in which capital was scarce.

Next, we make sure that the presence of credit cooperatives in the regions around a city does not bias our results. We thus re-run the fixed effects regressions from Table 4, Panel A, but include the number of cooperative banks in the county in which a city is located as additional control. As indicated before, we only have data on the cooperative banks for Eastern Prussia, which reduces the number of observations from 987 to 612. Table 5 shows the results of these estimations. The cooperative banks are insignificant all the time and the coefficient of the savings bank variables remain qualitatively the same and statistically significant. Clearly, as expected the presence of cooperative banks does not affect the impact of savings banks.

In a robustness check in the appendix, we further account for the possibility that the estimated effects are because of a mining industry boom, caused by increasing industrialisation especially in the Ruhr and Upper Silesia coal industries. A bias could arise from savings banks foundations in regions with an economic upswing caused by the growth of the mining industry. Therefore, in Table A.1 in the appendix, we re-estimate the fixed effects estimations of Table 3, Panel A,

columns 1, 3, 4 and 6 but further exclude first the five percent of cities with the highest share of mining workers (in columns 1-4) and the second, those in the 4th quantile of the mining worker share distribution. Results show that the coefficients of the savings bank variables remain virtually identical. Hence, the fast growing regions in which coal industry was spurring does not drive our results.

Moreover, it is possible that the foundation of a savings bank in a city has spillover effects on cities nearby. This is particularly important if both cities were in the same county, and a savings bank was intended to be accessible to people in neighbouring cities within this county. Such a bank could also have financed public investments and regional business in any city in the county. On the other hand, it is also possible that towns that founded a savings bank experienced substantial increases in population, though such growth mainly reflected a relocation of economic activity to the disadvantage of neighbouring cities. Something similar was induces by railways in 19th century Sweden (Berger and Enflo 2017). To study the effect of banks in the neighbourhood of a city, we constructed two variables, namely the number of savings banks in each year within 10km and within 20km of a city. We then re-run fixed effects regressions with the "Post-Savings Bank" dummy as treatment variable and for all cities and the sub-sample excluding cities founded before 1854 and between 1865 and 1871, this time including one of the two neighbour variables. Alternatively, we also include separate dummy variables for one, two, three and four or over four savings banks within 10km to allow for a non-linear effect of the number of neighbour savings banks. The results are reported in the appendix (Table A.2). They suggest that including the establishment of savings banks in neighbouring cities leaves the effect of savings banks for city growth virtually unchanged. The effect of savings banks in the 10km neighbourhood seems to be larger than the effect of a savings bank in a city. This is, however, driven by the fact that a notable number of cities had two or more neighbouring savings banks, so that the effect of two, three or four savings banks in the neighbourhood is larger than that of a single savings bank in a city.

3.3 Alternative Outcomes

Population growth is a rather wage proxy for economic development. Thus, we try to measure industrialisation more directly. Since the adaption of steam engines in producing industries is a typical characteristic for 19th century industrialisation (see Alan 2009), we use the number of steam engines per factory as a measure for the degree of industrialisation. Those machines were

necessary for the production in almost every important industry, yet they were also costly and firms needed credits from banks to finance them.

Since we only have these two periods of data, a fixed effects estimation is not suitable. Thus, we estimate pooled OLS regressions with the two savings bank treatment variables and include county fixed effects and latitudinal and longitudinal coordinates of cities to the regressions. We again cluster the standard errors on city level. Similar to the previous regressions, we consider all cities and the sub-sample of cities with savings banks founded between 1854 and 1865. We also estimate 2SLS regressions to ensure that endogeneity is not biasing our results. Table 6 reports the results of the POLS (Panel A) and 2SLS regressions (Panel B). Both the POLS and the IV regressions yield significantly and positive regressions of the treatment variables, with the coefficients of the 2SLS second stage turning out to be slightly larger in most of the cases. They imply that the firms in a city with a savings bank use around 10% more steam engines per factory than firms in cities without a savings bank. Another 3-years with a savings bank increases the number of steam engines per factory by around 9%. In sum, the results support our claim that savings banks financed regional business in 19th-century Prussia, and contributed significantly to local industrialisation.

4. Conclusion

There are numerous examples of savings banks funding communal public infrastructure projects and providing credits to small and medium-sized local tradesmen and early industries. Moreover, by 1913, they held the largest market share in total assets and constituted the most important pillar of the German banking industry (Burhop 2011, 184). Nevertheless, their contribution to industrial growth has not been studied very intensively. Previous research has either studied the impact of savings banks on a highly aggregate level (Burhop 2006) or qualitatively with case studies (Proettel 2013, Thomes 1985). This study is the first that studies the impact of savings bank quantitatively on local level for the early 19th century. The evidence strongly suggests that savings banks played a pivotal role in Germany's 19th century economic success. This is even more plausible, considering that the German industrialisation was not only based on larger, multinational firms and coal resources, but rather on good public infrastructure, a competitive schooling system and in particular on small and medium-sized firms as the backbone of German industry. The resulting, peculiar economic structure of an economy based on various, highly specialised, internationally active, yet regionally centred medium-sized firms

has persisted until today, where these firms are still an integral part of the German economic model.

Moreover, the bank-growth nexus was not limited to the large universal banks. Indeed, savings banks clearly were important for Germany's industrial take-off in earlier years, especially in regions in which the economy was dominated by craftsmen, sole-trader business and small firms as one can find it in small rural cities. Thus, this study contributes to our understanding of why Germany industrialised and reveals more about the relationship between banks and growth. We provide evidence that small public and regionally operating financial intermediaries can be equally important for the transition to modern economic growth as large universal banks and stock markets, at least at the beginning of an economic take-off when capital requirements are manageable. Thus, the rise of savings banks in 19th century Prussia has shown that public financial institutions can be instrumental for achieving developmental goals. Our results are still relevant for today's policy makers in developing countries plagued by too high levels of spatial inequalities in economic development since the history of saving banks in Prussia can be seen as a success story of early economic policy.

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Tables and Figures

Figure 1:Total number of savings banks and credit cooperatives in East Prussia

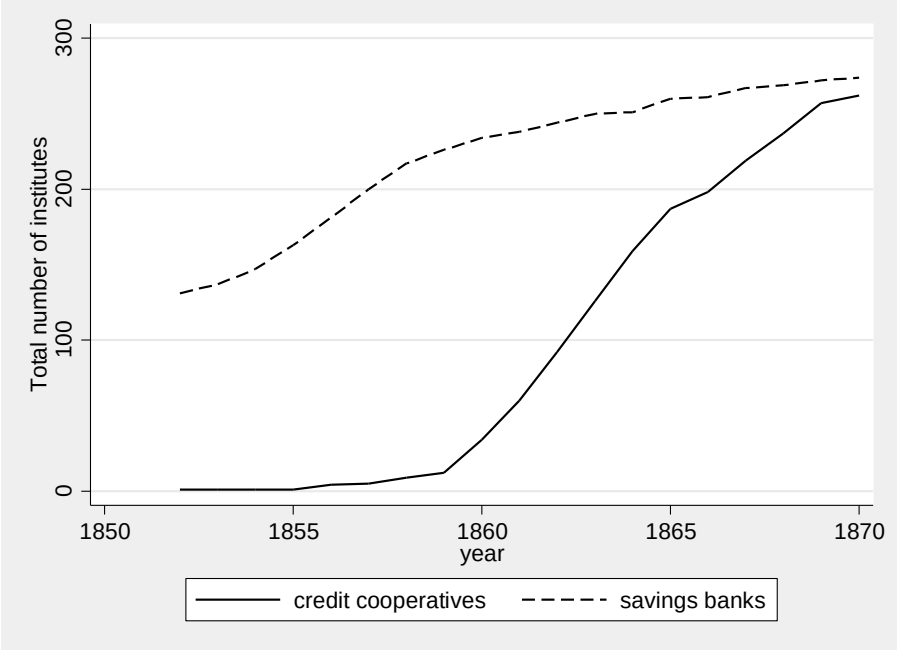
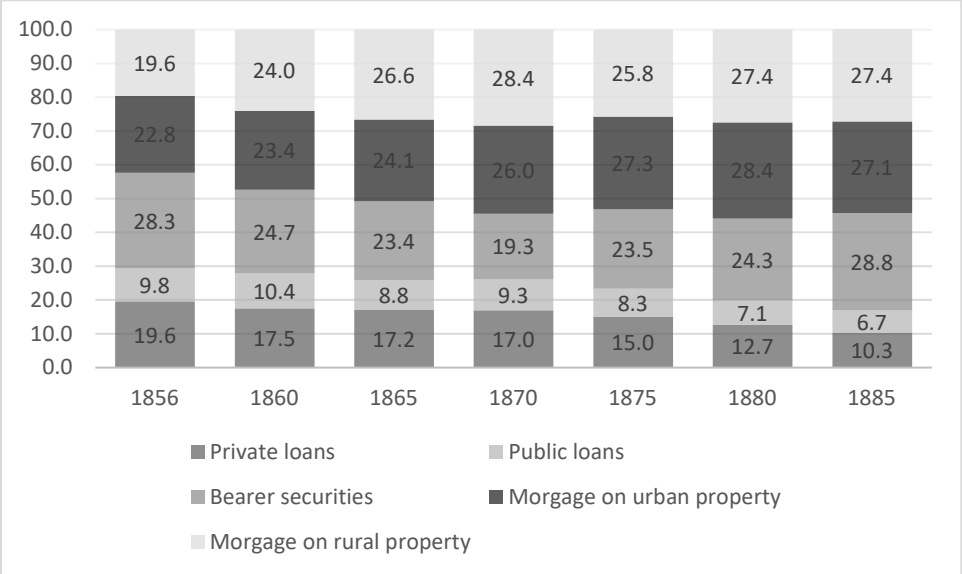


Figure 2: Financial assets of Prussian savings banks in per cent



Source: Ashauer (1998, 77)

Figure 3: Newly founded savings banks

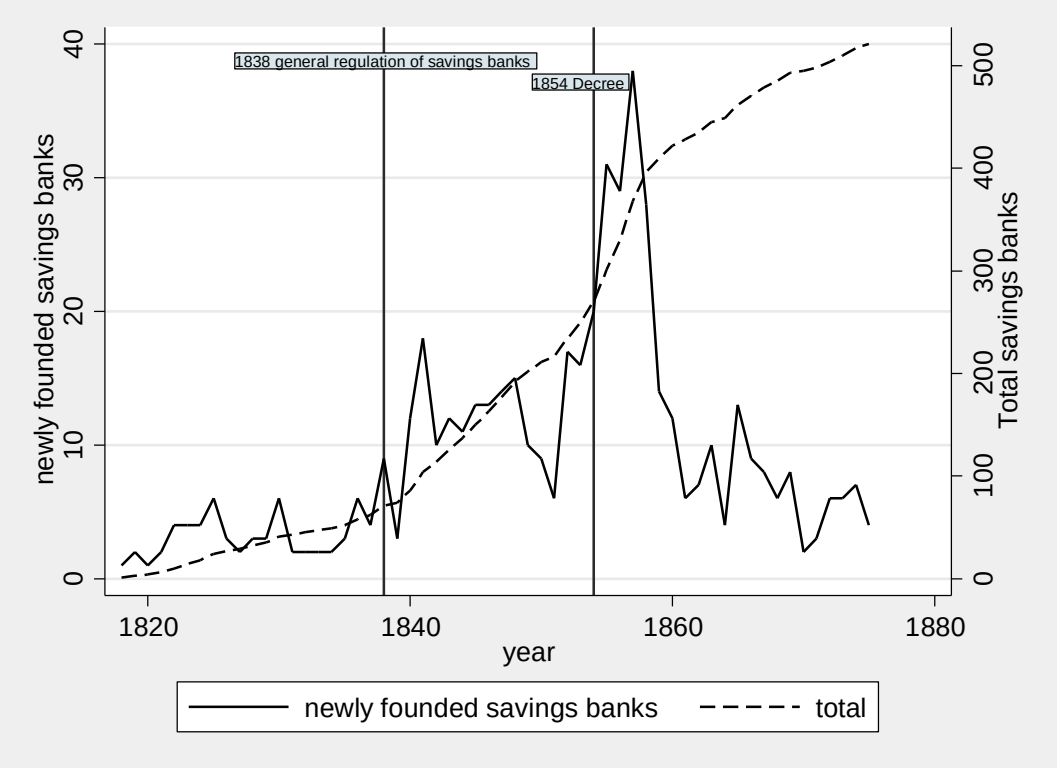
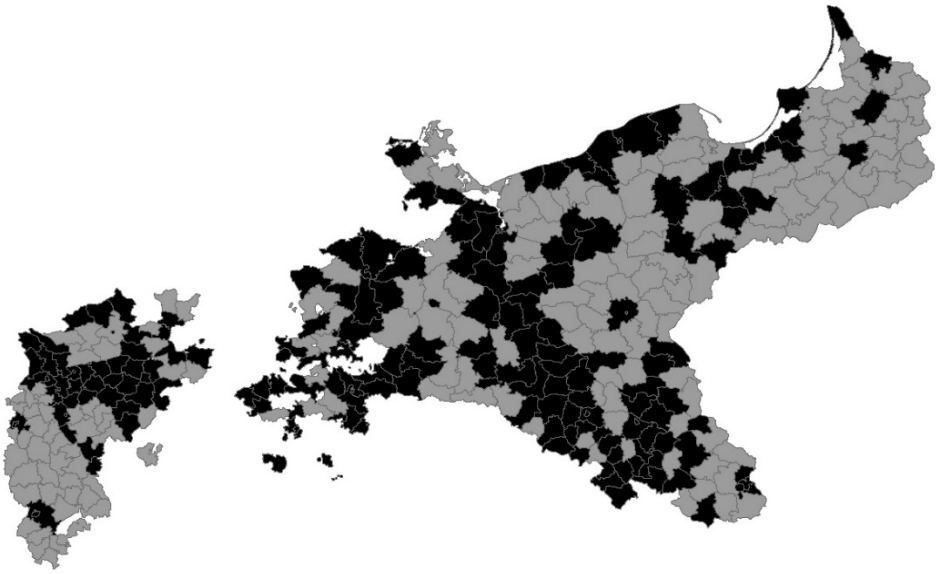


Figure 4: The diffusion of savings banks

Counties with at least one savings bank in 1849 (borders of 1849)



Counties with at least one savings bank in 1864 (borders of 1849)

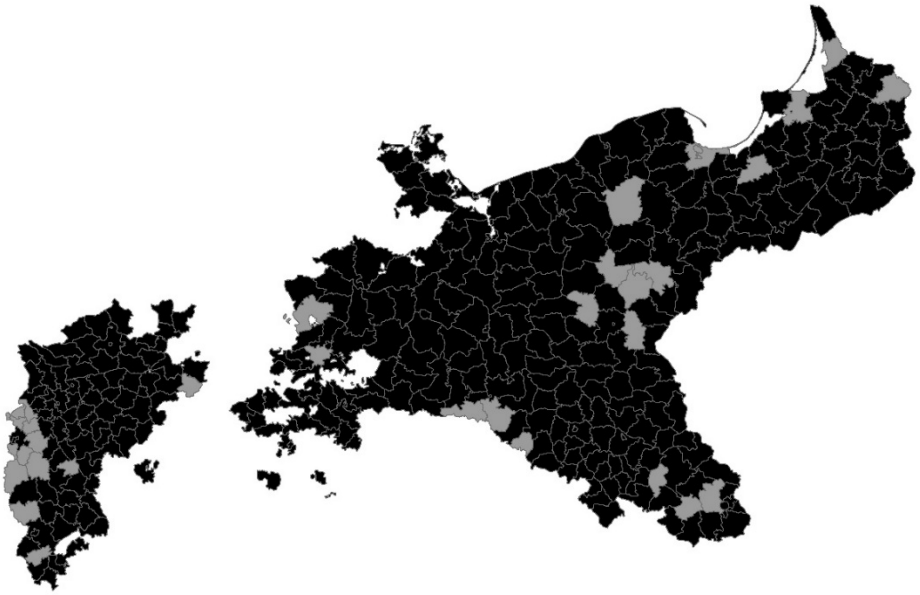


Figure 5: Average population size of cities in the year of foundation

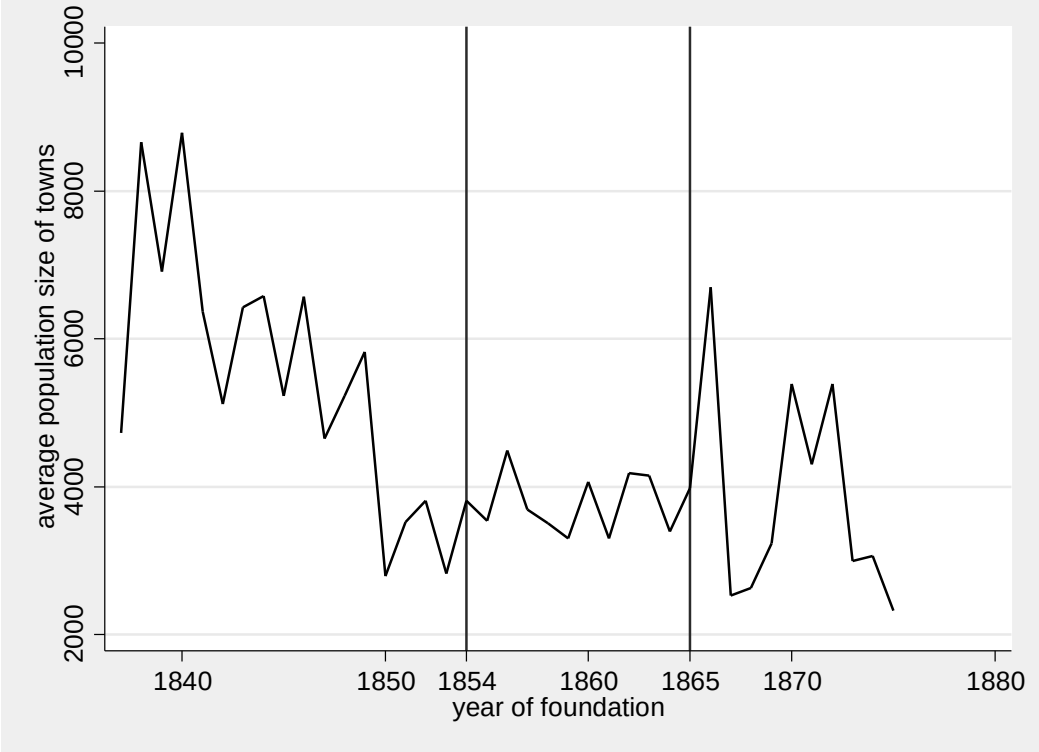


Table 1: Share of different financial institutions in total assets of financial Institutions

	1860	**1880**	**1900**	**1913**
Saving banks (Sparkassen)	12,0	20,6	23,3	24,8
Cooperatives (Genossenschaften)	0.2	4,4	4,1	6,8
Central banks	22,4	11,6	6,3	4,4
Joint stock banks	9,2	10	17,2	24,2
Private banks	35,3	18,5	8,6	4,4
Mortgage banks	16,9	26,7	28,5	22,8
Others	4,0	8,2	12	12,6
Assets in percent of GDP	40	77	125	169

Source: Burhop (2011), 168; Guinanne 2002, 81; Fohlin 1999, 328.

Table 2: Descriptive Overview of the Data Sets

Variable	Obs	Mean	Std. Dev.	Min	Max
City Growth	11,701	0.046	0.164	-0.743	7.808
Cooperative Banks	4,326	0.494	0.823	0.000	5.000
Decree Targeted Savings Bank	11,764	0.046	0.209	0.000	1.000
ln(City Population)	11,716	7.979	0.856	5.525	13.625
ln(Steam Engines per Factory)	1,964	0.113	0.340	0.000	2.773
No. of Savings banks within 10km	11,764	0.270	0.833	0.000	9.000
No. of Savings banks within 20km	11,764	1.567	2.793	0.000	25.000
Post-Savings Bank	11,764	0.279	0.449	0.000	1.000
Time since first savings bank	11,764	3.961	8.544	0.000	53.00

Table 3: Savings Banks and City Growth-OLS and IV Regressions

	(1)	(2)	(3)	(4)	(5)	(6)
Sample	All cities	Excluding town in which saving banks were founded before 1838	Excluding town in which saving banks were founded before 1854 or later than 1865	All cities	Excluding town in which saving banks were founded before 1838	Excluding town in which saving banks were founded before 1854 or later than 1865
Panel A: OLS (Dependent Variable: City Growth)						
Post - Savings Bank	0.0240***	0.0283***	0.0317***			
	(0.0079)	(0.0081)	(0.0107)			
Time Since First Savings Bank				0.00248***	0.00289***	0.00283***
				(0.0004)	(0.0005)	(0.0008)
R^2	0.059	0.058	0.075	0.062	0.060	0.075
Panel B: IV first stage						
Dependent Variable		Post – Savings Banks			Time Since First Savings Bank	
Decree Targeted Savings Bank	0.8267***	0.8127***	0.8931***	1.27***	2.389***	5.753***
	(0.035)	(0.011)	(0.012)	(0.28)	(0.263)	(0.16)
F-value of excluded IV	6651.84	5621.08	5600.3	20.58	82.44	1288.18
Centered- R^2	0.471	0.484	0.648	0.393	0.367	0.451
Panel C: IV second stage (Dependent Variable: City Growth)						
Post - Savings Bank	0.0103	0.0145*	0.0290***			
	(0.00721)	(0.00755)	(0.00796)			
Time Since First				0.00671	0.00494*	0.00450***
Savings Bank				(0.00497)	(0.00264)	(0.00124)
Centered-R^2	0.059	0.058	0.075	0.051	0.058	0.074
Observations	11,701	10,842	8,090	11,701	10,842	8,090
Number of Clusters (Towns)	978	907	678	978	907	678

Standard errors clustered on city level in parentheses. Coefficient statistically different from zero at the *** 1%, ** 5% and* 10 % level. All regressions include a constant not reported. All regressions include the natural logarithm of city population in t, year and city fixed effects as control variables.

Table 4: The Effect of Savings Banks in Small versus Large Cities

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent Variable	City Growth					
Excluded cities	Saving banks were founded before 1854 or after 1865					
Sample of	smallest cities (average population below 1951)	middle sizes cities (average population between 1951 and 3655)	larger cities (average population above 3655)	smallest cities (average population below 1951)	middle sizes cities (average population between 1951 and 3655)	larger cities (average population above 3655)
Post - Savings Bank	0.0281	0.0267*	-0.000124	0.0230**	0.0197	0.0187
	(0.0204)	(0.0144)	(0.0148)	(0.0110)	(0.0127)	(0.0323)
Observations	3,852	3,909	3,940	3,519	3,057	1,514
R^2	0.079	0.068	0.074	0.132	0.096	0.092
Number of Clusters (Towns)	326	326	326	298	255	125

Standard errors clustered on city level in parentheses. Coefficient statistically different from zero at the *** 1%, ** 5% and* 10 % level. All regressions include a constant not reported. All regressions include the natural logarithm of city population in t, year and city fixed effects as control variables.

Table 5: Savings Banks and City Growth---IV Regression Controlling for the Presence of Cooperative Banks

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent Variable				City Growth		
Sample	All cities	Excluding town in which saving banks were founded before 1838	Excluding town in which saving banks were founded before 1854 or later than 1865	All cities	Excluding town in which saving banks were founded before 1838	Excluding town in which saving banks were founded before 1854 or later than 1865
Post - Savings Bank	0.0115*	0.0139**	0.0199***			
	(0.00636)	(0.00633)	(0.00669)			
Time Since First				0.00427*	0.00416**	0.00342***
Savings Bank				(0.00237)	(0.00190)	(0.00116)
Cooperative Banks	-0.00177	-0.00210	-0.00418	-0.00247	-0.00264	-0.00425
	(0.00252)	(0.00258)	(0.00267)	(0.00256)	(0.00260)	(0.00271)
F-value of excluded IV	19641.16	16588.99	10432.86	83.23	131.97	743.04
Observations	4,286	3,999	3,152	4,286	3,999	3,152
Centered-R^2	0.163	0.155	0.150	0.175	0.161	0.151
Number of Clusters (Towns)	612	572	452	612	572	452

Standard errors clustered on city level in parentheses. Coefficient statistically different from zero at the *** 1%, ** 5% and* 10 % level. All regressions include a constant not reported. All regressions include the natural logarithm of city population in t, year and city fixed effects as control variables.

Table 6: Savings Banks and the Financing of Regional Business 1855 and 1858---IV Regressions

	(1)	(2)	(3)	(4)
Dependent Variable	ln(Steam Engines per Factory)			
Sample	All cities		Excluding saving banks founded before 1854 or later than 1858	
	Panel A: OLS			
Post-Savings Bank	0.120***		0.0833**	
	(0.0219)		(0.0328)	
Time Since First Savings Bank		0.00764***		0.0646***
		(0.00179)		(0.0205)
R^2	0.389	0.388	0.353	0.364
	Panel B: IV second stage			
Post-Savings Bank	0.104***		0.102**	
	(0.0400)		(0.0404)	
Time Since First Savings Bank		0.0887***		0.0875**
		(0.0344)		(0.0348)
F-value of excluded IV	3.0e+05	237.42	9.9e+05	231.81
Observations	1,964	1,964	1,360	1,360
Centered-R^2	0.028	-2.944	0.011	0.026
Number of Clusters (Towns)	978	978	678	678

Standard errors clustered on city level in parentheses. Coefficient statistically different from zero at the *** 1%, ** 5% and* 10 % level. All regressions include a constant not reported. All regressions include county fixed effects and latitude and longitude as control variables.

Table A.1: Savings Banks and City Growth Excluding Mining Intensive Districts

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dependent Variable	City Growth							
Observations excluded	excluding the 5% most coal intensive cities (more than 4.5 percent of the working population in 1882)				excluding the 25% most coal intensive cities (more than 0.4 percent of the working population in 1882)			
Sample	All cities	Excluding town in which saving banks were founded before 1854 or later than 1865	All cities	Excluding town in which saving banks were founded before 1854 or later than 1865	All cities	Excluding town in which saving banks were founded before 1854 or later than 1865	All cities	Excluding town in which saving banks were founded before 1854 or later than 1865
Post - Savings Bank	0.0251***	0.0336***			0.0280***	0.0353**		
	(0.0084)	(0.0114)			(0.0106)	(0.0140)		
Time Since First Savings Bank			0.00227***	0.00281***			0.00203***	0.00269***
			(0.0004)	(0.0008)			(0.0004)	(0.0009)
Observations	11,081	7,688	11,081	7,688	8,782	6,226	8,782	6,226
R^2	0.065	0.077	0.066	0.076	0.069	0.079	0.070	0.078
Number of Clusters (Towns)	928	645	928	645	736	523	736	523

Standard errors clustered on city level in parentheses. Coefficient statistically different from zero at the *** 1%, ** 5% and *10 % level. All regressions include a constant not reported. All regressions include the natural logarithm of city population in t, year and city fixed effects as control variables.

Table A.2: Savings Banks and City Growth--Spillovers from Foundations in the Neighborhood

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent Variable	City Growth					
Sample	All Cities			Savings Banks founded between 1854 and 1865		
Post - Savings Bank	0.0224***	0.0208***	0.0219***	0.0333***	0.0313***	0.0313***
	(0.00752)	(0.00747)	(0.00720)	(0.0105)	(0.0104)	(0.00938)
No. of Savings banks within 10km	0.0430***			0.0526***		
	(0.0107)			(0.0177)		
No. of Savings banks within 20km		0.0133***			0.0124**	
		(0.00287)			(0.00499)	
One Savings Bank within 10km			0.0128			0.0136
			(0.00855)			(0.0102)
Two Savings Banks within 10km			0.0676**			0.0492**
			(0.0300)			(0.0231)
Three Savings Banks within 10km			0.226***			0.349**
			(0.0751)			(0.140)
More than four Savings Banks within 10km			0.270***			0.328***
			(0.0650)			(0.121)
Observations	11,673	11,673	11,673	8,076	8,076	8,076
R^2	0.073	0.071	0.083	0.089	0.082	0.106
Number of Clusters (Towns)	978	978	978	678	678	678

Standard errors clustered on city level in parentheses. Coefficient statistically different from zero at the *** 1%, ** 5% and* 10 % level. All regressions include city and year fixed effects and interactions of latitude and longitude with year dummies as well as a constant not reported. All regressions include the natural logarithm of city population in t, year and city fixed effects as control variables.