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The German bank–growth nexus revisited: savings banks and economic growth in Prussia†

By SIBYLLE LEHMANN-HASEMEYER and FABIAN WAHL*

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

The German banking system is often considered a key factor in Germany's industrialization. According to Gerschenkron's seminal work, Germany's experience can serve as a role model for other moderately backward economies: governments could trigger economic development, for example, by supporting the establishment of modern financial institutions such as universal banks, which were typical for the German banking system.[1] Banks and other financial intermediaries can mobilize savings, reduce risks for investors, and improve the allocation of resources. As a result, these activities ease the trading of goods and services and foster technological innovation.[2] In the economic literature, we find many cross-country studies that support this hypothesis.[3]

However, most scholarly discussions on the bank–growth nexus in Germany have focused on universal banks without giving significant attention to other forms of banking.[4] Only Fohlin, Guinnane, Burhop, and Proettel have acknowledged the role of different bank types.[5] Universal banks offered a more comprehensive range of services than the American or British ones, so it is therefore easy to believe

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[1] Gerschenkron, *Economic backwardness*. Da Rin and Hellmann, 'Banks', for instance, have formalized this idea. 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 push towards industrialization.

[2] King and Levine, 'Entrepreneurship'.

[3] See, for instance, King and Levine, 'Finance and growth'; Rajan and Zingales, 'Financial dependence'; Levine and Zervos, 'Stock markets'. Other works point to potential endogeneity and suggest that the development of the banking sectors can be a consequence as well as a cause of economic success. See, for instance, Greenwood and Jovanovic, 'Financial development'; Pagano, 'Financial markets'.

[4] Fohlin, 'Universal banking', p. 311.

[5] Ibid.; idem, *Finance capitalism*; Guinnane, 'Regional organizations'; idem, *Financial intermediation*; idem, 'Delegated monitors'; Burhop, 'Banks'; Proettel, 'Die Darlehensvergabe'; idem, *Die Stellung der Sparkassen*.

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that universal banks supported German firms during their whole life cycle, thereby fostering macroeconomic growth.[6] Still, it is surprising that earlier research has given savings banks only a limited role in this process, since by 1913 they held 24.8 per cent of the total assets of all German financial institutions and ranked at the top of all bank types in terms of net investments.[7] Moreover, savings banks had the advantage of being public institutions, an advantage that Hakenes and Schnabel describe theoretically.[8] They argue that public banks focus on long-term projects with high social returns because they are not profit-driven. Hakenes et al. establish theoretically and confirm empirically (using data on contemporary savings banks in Germany) that small regional banks such as savings banks or cooperative banks enhance local economic development more efficiently than larger private banks do.[9] They also find that this is especially important for the economic growth of poor, peripheral regions with low initial capital endowments and credit rationing.

Burhop provides the most recent and, thus far, only quantitative investigation of the German bank–growth nexus for the early years of industrialization.[10] In particular, the total assets of joint-stock credit banks positively influenced capital formation in the industrial sector between 1851 and 1882. On the other hand, using economy-wide data for financial depth, national income, capital stock, and productivity, he detects no leading role in the financial sector from 1860 to 1913. Most crucially, however, he finds that during the later stages of industrialization (1883–1913), savings banks had a greater causal force for capital formation than did credit banks. While Burhop does not find a significant impact of savings banks before the 1880s, he uses a time series based on yearly data for the entire German Empire. As such, the positive impact of savings banks on the development of small and medium-sized cities for earlier periods is not likely to show at this level of aggregation.[11]

The present study revisits the bank–growth nexus with a focus on savings banks. Using a sample of 978 Prussian cities, we find a positive and significant relationship between the establishment of savings banks and city growth and the number of steam engines per factory in the nineteenth century (1854–75).

To address potential endogeneity, we refer to a decree issued in 1854 by the Minister for Trade and Commerce. The decree enhanced the equal distribution of savings banks because it demanded the founding 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.[12] Following this decree, we observe a wave of savings banks being established on a much wider geographical distribution than before. In 1849, savings banks were present in about half of the counties; this had risen to nearly 95 per cent by 1864. We also observe a significant pre-growth trend in earlier periods before the founding of a savings bank in a city. There is no such trend, however, after 1854. The savings banks that were founded during this

[6] Guinanne, 'Delegated monitors', p. 81.
[7] Wysocki, *Wirtschafts- und Sozialgeschichte der deutschen Sparkassen*, p. 119.
[8] Hakenes and Schnabel, 'Capital drain'.
[9] Hakenes, Iftekhar, Molyneux, and Xie, 'Small banks'.
[10] Burhop, 'Banks'.
[11] Ibid.
[12] See von Knebel-Doveritz, *Das Sparkassenwesen in Preussen*, p. 6.

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Table 1. *Share of different financial institutions in total assets of financial institutions*

	1860	*1880*	*1900*	*1913*
Savings 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	10.0	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	12.0	12.6
Assets in % of GDP	40	77	125	169

Sources: Burhop, *Wirtschaftsgeschichte des Kaiserreichs*, p. 168; Guinanne, 'Delegated monitors', p. 81; Fohlin, 'Universal banking', p. 328.

wave were often established in smaller cities that might not have been able to afford them without this support.

Thus, the decree can be seen as a public policy to promote the establishment of public financial infrastructure in remote regions. This evidence suggests that these small public regional financial intermediaries most likely mattered for the transition to modern economic growth in Prussia.[13] Hence, it seems worthwhile to extend the German bank–growth nexus to other bank types beyond universal joint-stock banks to further our knowledge about their business strategies in the nineteenth century.

Moreover, since savings banks were public, the experience of nineteenth-century Prussia shows that state intervention in the financial sector can be successful in promoting regional economic development. This seems particularly true at the beginning of an industrial take-off when capital requirements were manageable, and access to international capital markets was limited.

The rest of the article is organized as follows. Section I provides an overview of the history and characteristics of Prussian savings banks in the nineteenth century and also discusses their business model in comparison to other types of banks that existed in Germany at this time. Section II discusses the decree of 1854 and its consequences for the establishment of savings banks. Section III introduces our dataset and empirical methodology. Section IV presents the results of the empirical analysis using city population growth as the dependent variable, while section V discusses the results using steam engines per factory as an alternative industrialization measure. Section VI concludes our study.

I. Savings banks and the bank–growth nexus

Table 1 shows the shares of *different bank group*s in the financial system for the late nineteenth century. Burhop showed that by 1913, savings banks were the most important pillar of the German banking industry because they provided the largest

[13] These results are in line with recent research on the role of private local banks and financial systems in growth and development during the industrial revolution in Britain and the US. For Britain, see Heblich and Trew, 'Banking and industrialization'; for the US, see Bodenhorn and Cuberes, 'Finance and urbanization'. It also fits in with the literature on the importance of local banks for development in modern periods. Guiso, Sapienza, and Zingales, 'Local financial development', for instance, have shown that differences in local financial development are important determinants of economic success in modern Italy. Coccorese and Shaffer, 'Cooperative banks', show that cooperative banks played an important role in the economic performance of Italian regions in the years 2001–11.

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share of overall financing.[14] Moreover, these banks significantly expanded in the mid-nineteenth century. Their market share rose from about 12 per cent in 1860 to 24.8 per cent in 1913.

The first German *savings banks* were founded in the late eighteenth century in the northern parts of the country.[15] The Prussian directions for municipal self-administration (*Preussische Städteverordnung*) in 1808 gave municipalities autonomy in financial administration, including whether or not to found a savings bank. Local authorities had several motives for doing so: the primary purpose was to allow poorer people to save and thereby gain financial autonomy and independence.[16] This social goal was shared among most of the early savings banks.[17] These banks accepted relatively small interest-bearing deposits compared with the daily wage of a labourer,[18] and by 1900, there were 8.7 million savers in Prussia. Indeed, for many inhabitants, savings banks were the first and often only contact they had with a financial intermediary.[19] Thus, savings banks created opportunities to take personal precautionary measures by accumulating private savings, reducing the burden on local funds for poor relief.[20]

Furthermore, because of the local authorities' close relationship with 'their' savings banks, they had easy access to capital, since savings banks generally existed as dependent departments of the local government up until the 1930s.[21] The strong ties between savings banks and communities were also manifested in their guarantor liabilities. The regional authority, which could be the community, the town, or the county, was liable for the debt notes of the savings banks. Moreover, savings banks applied the so-called '*Regionalprinzip*'.[22] According to this principle, a savings bank's business area was generally restricted to the area of its municipal authority. As a result, it was often not possible to open an account if one did not live in that region. More importantly, however, the savings bank's investments were also supposed to be regional. This was to ensure that only those who were liable if the bank failed would benefit from successful investments.[23] This strong local character is particularly useful for our study. In most countries, the banking systems are either entirely nation-wide or else they lend through networks that make it hard to ascertain where loans end up geographically.

Savings banks are not just a German phenomenon. In the nineteenth century, a wave of savings banks appeared all over Europe.[24] However, while these institutions became essential pillars of the banking industry in countries such as Germany, Austria, and Scandinavia, their importance remained limited in others. In Great Britain, for example, the savings bank system almost disappeared entirely after a short-lived heyday.[25] Indeed, the main difference between countries can be

[14] Burhop, *Wirtschaftsgeschichte*, p. 184.
[15] Wysocki, *Wirtschafts- und Sozialgeschichte der deutschen Sparkassen*, p. 24.
[16] Schulz, 'Sparkassen und Kommunen', pp. 27–8.
[17] Wysocki, *Wirtschafts- und Sozialgeschichte der deutschen Sparkassen*, p. 18; Trende, *Geschichte der deutschen Sparkassen*.
[18] Schmidt, Seibel, and Thomes, *Microfinance*, p. 57.
[19] Burhop, *Wirtschaftsgeschichte*, p. 184; Ashauer, *Ersparungscasse*, p. 63.
[20] See also Lehmann-Hasemeyer and Streb, 'Social security'.
[21] Schulz, 'Sparkassen und Kommunen', p. 22.
[22] Mura, *Entwicklungslinien*, p. 27; Ashauer, *Ersparungscasse*, p. 177.
[23] Schulz, 'Sparkassen und Kommunen', p. 24.
[24] For an overview of the history of European savings banks, see Horne, *History*; Proettel, 'Path dependencies'.
[25] Proettel, 'Path dependencies', p. 178.

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observed in these banks' investment strategies. While the German savings banks invested locally, others, like those in Britain and France, decided centrally about investments. Thus, they withdrew liquid funds from the country and transferred them almost exclusively to the central government. In contrast, in countries with decentralized capital investments such as Germany, the capital could be reintroduced into the economic system at the same point where it was saved.[26]

The literature on the actual business strategies of savings banks in Germany is limited, however, to a handful of case studies, making it difficult to obtain a reliable picture of the savings banks' activities in general. Nevertheless, the literature shows numerous potential channels through which the banks could have positively influenced growth. For example, savings banks were involved in financing infrastructure projects, lending to local firms as well as financing projects that required the services of local firms.[27] Moreover, it is possible that they made urban real estate loans and that those loans freed up capital for other purposes. This capital could be put towards industrial investment, for example, an area for which banks may also have provided loans directly.[28] One might argue that the overall capital of any individual savings bank would have been too low to have an impact on city development. However, if we limit our scrutiny to the savings banks established after 1854, this is not the case. In 1875, the average savings bank had assets of about 40,000 Marks. On average, this is about 184 Marks per capita if we count all citizens in a town (median 68 Marks per capita) across all cities and assume approximately 440 Marks per capita for the smallest decile of cities.[29]

To summarize: compared with other financial intermediaries, savings banks were one of the largest banking groups in early nineteenth-century Germany. Previous research provides several examples of potential channels through which they influenced growth. Their main achievement seems to have been the mobilization of smaller sums of capital and investing them back into the local economy.[30] They are, therefore, likely to have had an impact on regional development. The positive effect on the regions probably increased over time with the accumulation of capital.

One might argue that it is not possible to isolate the impact of the establishment of savings banks on industrial development from the influences of other banks. However, as Guinnane has asserted, the different kinds of German banks were not competing so much as complementing each other.[31]

Mortgage banks focused on mortgage bonds and had a relatively large market share of total assets, with about 27 per cent around 1880. Overall, this large market share was held by a small number of banks. After the foundation of the first mortgage bank in the 1860s, only 20 more were founded until 1871. These institutions mainly served large landowners and took land as collateral for

[26] Proettel, 'Path dependencies'.

[27] For some examples, see Guinanne, 'Delegated monitors'; Proettel, *Die Stellung der Sparkassen*; Thomes, *Die Kreissparkasse Saarbrücken*.

[28] See Proettel, *Die Stellung der Sparkassen*.

[29] See Königlich Preußisches Statistisches Bureau, ed., *Zeitschrift*. The purchasing power of 100 Marks in 1875 is equal to 670 euros in 2019; Bundesbank, 'Kaufkraftäquivalente historischer Beträge in deutschen Währungen', https://www.bundesbank.de/resource/blob/615162/3334800ed9b5dcc976da0e65034c4666/mL/kaufkraftaequivalente-historischer-betraege-in-deutschen-waehrungen-data.pdf (accessed on 7 April 2020).

[30] See, for instance, Schulte-Rentrop, *Die Anlagepolitik*, p. 57; Thomes, *Die Kreissparkasse Saarbrücken*, p. 11.

[31] Guinnane, 'Delegated monitor'. For an overview of Germany's banking sector, see also Burhop, *Wirtschaftsgeschichte*, pp. 167–90.

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a mortgage. They were also engaged in financing private housing construction in major cities.[32] These banks cannot influence our results because they focused on large projects and did not provide loans or mortgages to small and medium-sized firms or artisans. Moreover, the first Prussian mortgage bank was founded in Berlin in 1864; that is, after the majority of the Prussian savings banks had already been established.[33]

The *universal joint-stock banks* are central to early and more contemporary research, especially the four D-Banks (Deutsche Bank, Dresdner Bank, Discontogesellschaft, and Darmstädter Bank für Handel und Industrie). Their impact on industrial growth has already been discussed extensively by scholars.[34] In contrast to the other types of banks, joint-stock banks were particularly large. In 1871, eight of the 30 largest banks were stock-market-listed universal banks, and within 20 years, this number had risen to 17.[35] Cost advantages of large banks can emerge due to their better screening and monitoring process, given that they have more customers and credit applications.

Moreover, joint-stock banks have more power in exerting corporate control since their loans are vital for firms. In addition, risk diversification becomes easier when using a broad portfolio.[36] Previous research has supported this view. Kindleberger, for instance, states that 'the great banks constituted less than a tenth of the total assets of financial institutions of the country but were found at the critical margin affecting economic growth'.[37] Additionally, Tilly argues that banks promoted growth through portfolio diversification and the expansion of risk capital that emerged as a result.[38] This is further supported by Fohlin, who presents evidence for a modest impact of joint-stock credit banks in Germany on capital formation, capital allocation, and economic growth.[39] However, the causal impact of joint-stock banks on growth has also been disputed.

Neuburger and Stokes, for instance, show empirically that the industrial financing of these banks displayed inefficiencies severe enough to have hampered the growth of non-agricultural output.[40] Edwards and Ogilvie, meanwhile, outline that in comparison to the national product, joint-stock credit banks were too small to influence the economic development of Germany in a significant way.[41] As mentioned previously in the introduction, Burhop provides the most recent contribution to this debate.[42] He analyses the influence of financial sector development on economic performance using time series data at the country level. He finds a significant and causal impact of joint-stock banks on industrial production for the period 1851–82. Despite this evidence, it is unlikely that large universal banks have biased our results. First, large universal joint-stock banking only developed after the first wave of industrialization. With a share of about 9 per

[32] See, for instance, Redenius, *Strukturwandel*, p. 77.
[33] Jessen, *Kreditwesen*, p. 16.
[34] See Jeidels, *Das Verhältnis*; Riesser, *German great banks*; Hilferding, *Das Finanzkapital.*
[35] Burhop, *Wirtschaftsgeschichte*, p. 170.
[36] Burhop, 'Banks', p. 40.
[37] Kindleberger, *Financial history*, p. 130.
[38] Tilly, 'German banking'.
[39] Fohlin, 'Universal banking'.
[40] Neuburger and Stokes, 'German banks and German growth'.
[41] Edwards and Ogilvie, 'Universal banks'.
[42] Burhop, 'Banks'.

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cent of the total assets in 1860, it can only have played a marginal role for the mid-nineteenth-century take-off. Second, universal joint-stock banks had a somewhat different target clientele compared with savings banks. They mainly provided loans to large-scale enterprises, whereas small and medium-sized firms were reliant on savings banks and credit cooperatives instead.[43]

Most universal joint-stock banks were founded by a group of *private banks* that aimed to become large enough to fulfil the capital needs of their target group. Among the founders of Deutsche Bank, Germany's largest universal joint-stock bank, for instance, were the private bankers Adelbert Delbrück, Heinrich Hardt, and Victor Freiherr von Magnus.[44] We can thus see private banks as the forerunners of joint-stock banks. They emerged in the late eighteenth century in various parts of Germany and were formed by either individuals or family groups or else by small partnerships.[45] While savings banks experienced an extraordinary expansion during our observation period, private banks continuously lost ground. Their market share fell from 35.5 to about 4 per cent from 1860 to 1913.[46] We cannot control quantitatively for the impact of private banks: any estimates of the number and size in different German regions would be imprecise because private banks were rarely incorporated.[47] However, as Fohlin points out, the availability of secure government business—with some exceptions—made the conservative banking elite reluctant to finance riskier business.[48] Moreover, private banks usually originated as adjuncts to trading houses and were therefore mostly present in important trading cities such as Cologne and Frankfurt.[49] Since we are particularly interested in the impact of the foundation of savings banks in small, remote cities, the probability that we have mistakenly estimated the impact of private banks and not savings banks is therefore low.

Credit cooperatives, the fourth type of bank, were collectively a much smaller part of the banking system than savings banks, with a market share of about 4 per cent in 1900. They were local, private organizations controlled by their members.[50] Like savings banks, they were mainly founded in rural areas and small cities. Most of them, however, concentrated on individual small-scale farmers. Moreover, since savings banks often supplied credit to cooperatives, they often acted as complementary institutions.[51] Wolf and Süsse have studied the determinants of the foundation of credit cooperatives in East Prussia.[52] If we compare the number of newly founded savings banks with the number of newly founded credit cooperatives over time, we see that credit cooperatives also experienced a wave of establishment in the second half of the nineteenth century (figure 1). However, the most significant wave for founding credit cooperatives came about 10 years later than the boom for savings banks.

[43] Burhop, *Wirtschaftsgeschichte*, p. 171; Tilly, 'German banking'.
[44] Gall, Feldman, James, Holtfrerich, and Buschgen, *Die Deutsche Bank*, p. 11.
[45] Guinnane, 'Delegated monitors', p. 96.
[46] Burhop, *Wirtschaftsgeschichte*, pp. 168–9.
[47] Guinnane, 'Delegated monitors', p. 96.
[48] Fohlin, *Finance capitalism*, p. 18.
[49] Tilly, *Financial institutions*.
[50] Guinnane, 'Delegated monitors', p. 89.
[51] Burhop, *Wirtschaftsgeschichte*; Wolf and Süsse,'Rural transformation'.
[52] Wolf and Süsse, 'Rural transformation'. We thank the authors for kindly sharing their data.

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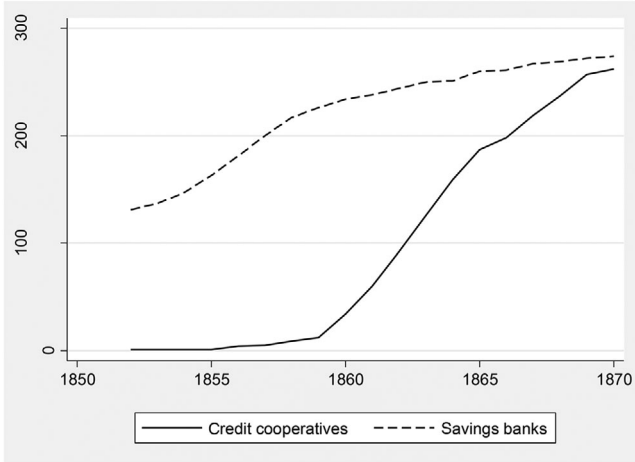

Figure 1. *Total number of savings banks and credit cooperatives in East Prussia*

Sources: Founding dates of savings banks were taken from Königlich Preußisches Statistisches Bureau, ed., *Zeitschrift*, pp. 313–36. Founding dates for the credit cooperatives were taken from Wolf and Süsse, 'Rural transformation'. We thank the authors for kindly sharing their data.

II. 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, for example, 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—that is, the treatment effect—is likely to be endogenous.

To mitigate this issue, we make use of the fact that the founding of savings banks was triggered by changes in regulations and occurred in waves. The first large wave of founding began after the general regulation of Prussian savings banks in 1838 (see figure 2). This was a broad legal framework covering organization, business practices, and public control. While we observe just 136 savings banks in 1837, this number had nearly tripled (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 founding of at least one savings bank per county in the years to come. The decree was intended to raise capital to support regional development.[53] Most importantly, this decree encouraged poorer communities that struggled to bear the costs and risks of founding a savings bank by promising financial support.[54] This triggered a second wave of these banks being established. In the period between 1854 and 1865, another 345 savings banks were founded, and by 1864, there were 794 savings banks in Prussia. In our sample of cities, we observe 176 cities that founded the first savings banks in this period. After this boom, the number of savings banks being established per year decreased again.[55]

[53] von Knebel-Doveritz, *Das Sparkassenwesen in Preussen.*
[54] Thomes, *Die Kreissparkasse Saarbrücken.*
[55] In the years between 1864 and 1875, on average about 19 new savings banks were founded per year.

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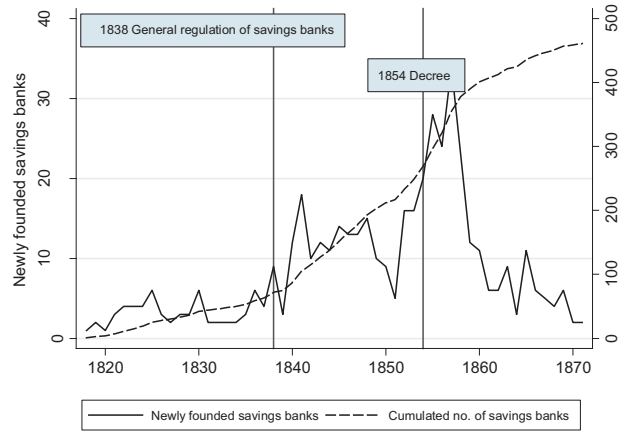

Figure 2. *Newly founded savings banks*
[Colour figure can be viewed at wileyonlinelibrary.com]
Source: Königlich Preußisches Statistisches Bureau, ed., *Zeitschrift*, pp. 313–36.

As previously stated, the 1854 decree enhanced the equal distribution of savings banks by requiring the founding of at least one savings bank per county, and by encouraging poorer local authorities to do so by offering financial support. Figure 3 effectively illustrates this distribution. One can see that the founding of the first savings banks mainly took place in areas that were already industrialized, such as the Rhineland and Silesia. This changed after 1854 when the distribution became much wider, and the willingness to create extensive coverage of savings banks throughout Prussia was much more apparent. If we consider the counties within the 1849 borders, only about 56 per cent of counties had a savings bank by 1854. In 1865, after the boom, over 90 per cent had at least one.

Furthermore, figure 4 shows that after 1850, the average city that founded a savings bank was much smaller than in the earlier years. This impression is confirmed by probit regressions, reported in online appendix table S1, where we predict the founding of savings banks between 1838 and 1854 and between 1854 and 1865. Savings banks that were established in this later period—unlike those founded between 1838 and 1853—cannot be predicted by structural factors such as the share of Protestants or city growth in the six years before the founding of the first savings bank in the county. This supports the idea that the establishment of savings banks during this period was rather exogenous and was not driven by, for example, political decision-makers' expectations about the future growth prospects of the city. Thus, in our analysis, we look at the savings banks that were founded in this wave in particular because we expect a higher degree of exogeneity.

III. Data and empirical approach

In this section, we test empirically whether the founding of savings banks had a positive and significant impact on economic development in Prussia. To achieve this, we compare the growth paths of cities that founded a savings bank before and after the bank was founded against the growth patterns of cities that never founded

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Figure 3. *Diffusion of savings banks: counties with at least one savings bank in 1849 (1849 borders)*

Source: As for fig. 2.

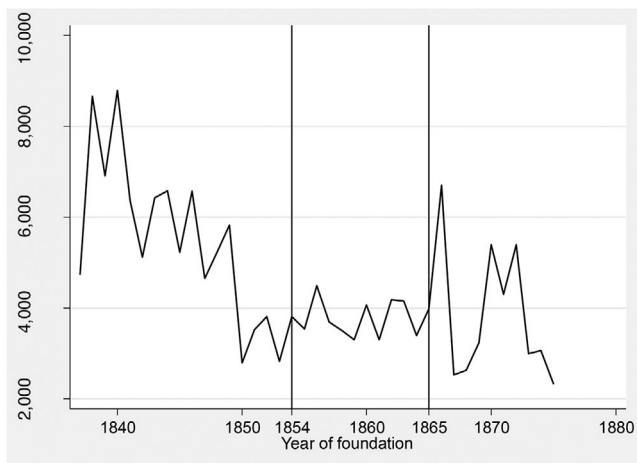

Figure 4. *Average population size of cities in the year of foundation*

Source: City population figures are taken from Hornung, 'Railroads'. Founding dates from Königlich Preußisches Statistisches Bureau, ed., *Zeitschrift*, pp. 313–36.

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one at all. Following the source of the city-level data, we consider a place to be a city if it had the legal status of one in 1849.[56]

The primary variable of interest is the founding date of savings banks. We obtained 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).[57] About half of the cities (459) in this dataset had founded at least one savings bank by 1875. The first Prussian savings bank was established in Berlin in 1818, and by 1913 there were 1,765 savings banks throughout Prussia and 3,133 in the entire German Empire.[58]

Measuring economic development for the nineteenth century at the 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. Generalizing from urban population growth to economic growth is an acceptable approximation when no data on income are available.[59] Indeed, several papers have used city population or growth figures as a proxy for the economic development of a city.[60] These data are available for several years, which allows us to measure economic development over time. City population figures originate from Hornung's study on the effects of the introduction of the railway in Prussia.[61] The dataset covers all 978 cities that held city rights in Prussia in 1849, within its 1849 borders. It also contains population figures for every third year between 1837 and 1871, resulting in 12 years with data and 11,736 city–year pairs.[62] We also use the number of steam engines per factory as an alternative outcome variable measuring the effect on industrialization more directly in section

[56] See Hornung, 'Railroads', online app. D, for more details on this aspect of the data. Having city rights does not imply that a city was not under the authority of the county government. Actually, there were only a few such 'district free cities' or 'city counties' in Prussia, such as Gdansk. We have included those too, but most of the other cities were under the authority of the county government. Cities that lost or gained city rights before or after 1849 are excluded from the analysis. This restriction is further prompted by the census of 1849 (Statistisches Bureau zu Berlin, 1851–5), which is unique in providing a wealth of information at the city level. We thus analyse the 1849 cross-section in depth. Using this legally defined threshold results in the omission of a couple of city-like locations. When examining the Prussian census data, we found 39 towns entering the census during the period 1849–85 and thus gaining legal city rights. These cities had on average 4,915 inhabitants. Historically, city rights were granted to settlements because of their economic or political importance relative to the surrounding area and their size, but also because of political bargaining processes. Thus, there is no single criterion that was responsible for a place being a city.

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

[58] Ashauer, *Ersparungscasse*.

[59] Acemoglu, Johnson, and Robinson, 'Reversal of fortune'.

[60] See, for instance, Börner and Severgnini, 'Time for growth'; Cantoni, 'Protestant Reformation'; DeLong and Shleifer, 'Princes and merchants'; Dittmar, 'Information technology'; Hornung, 'Railroads'. Using Prussian census data from 1821, Cantoni, 'Protestant Reformation', shows that there is a close and statistically significant relationship between city size and economic outcomes such as teacher–student ratios, fire insurance values p.c., business tax returns, and the quality of housing in the city. Henderson, 'Urbanization', establishes a theoretical relationship between technological innovations and city growth. Bodenhorn and Cuberes, 'Finance and urbanization', show a positive impact of the diffusion of local commercial banks on urbanization in the US. Finally, Jedwab and Vollrath, 'Urbanization without growth', have shown that until the mid-twentieth century, there was a significant and positive relationship between economic development levels and urbanization. They also show that the strength of the relationship varied between the centuries, but was particularly strong during the second half of the nineteenth century.

[61] See Hornung, 'Railroads'.

[62] A similar analysis at the county level was not possible. To get a sufficient number of observations, we would need to aggregate the data on the basis of the county borders in 1849. This leaves us with 335 counties and population

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V. Data on the number of factories and steam engines (steam engines and steam boilers) in a city between the years 1855 and 1858 are taken from the official statistical publication *Tabellen und amtliche Nachrichten über den Preußischen Staat*.[63]

As 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 emerged due to the founding of the savings bank: $Savings\ Bank_{it}$ is a dummy variable that is equal to one for all years after the founding of a savings bank. Since only 34 of the 978 cities had more than one savings bank during the observation period, we do not include a treatment variable counting the number of savings banks in a city. $Time\ since\ first\ savings\ bank_{it}$ measures the years since the foundation of the first savings bank, for each year t and each city i in the dataset. 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, as is usually done in the literature, we include the natural logarithm of a city's population in period t ($\ln(Pop)_{it}$).[64] Therefore, we assume population growth from period t to $t+1$ to be a function of population size in t. This is done to account for convergence in city size over time, meaning that it is assumed that all cities converge to a similar size, and hence, large cities grow more slowly than smaller cities. This follows the reasoning of a 'Solow-type growth regression' in the spirit of Mankiw et al., and the generalization of their cross-sectional regressions to panel data by Islam.[65] In online appendix S1, we show regressions in which we control for the degree of industrialization 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 industry, this could bias our results. Data on the share of mining workers in a county in 1882 are taken from the iPEHD (ifo Prussia Economic History Database).[66] 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 dataset.

Thus, we estimate the following baseline regression equation using the fixed effects panel data estimator and pooled ordinary least squares (OLS):

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

with $\ln(\frac{Pop_{i,t+1}}{Pop_{i,t}})$ being the natural logarithm (ln) of population growth in city i between period $t+1$ and t, π_t are year fixed effects and δ_i are city fixed effects included for the fixed effects panel data estimations. Standard errors are clustered at the city level. $\ln(Pop)_{it}$ is the natural logarithm of a city's population in period t,

figures for the years 1849, 1861, 1864, 1867, 1871, and 1875. By 1861, however, 91% of these counties already had at least one savings bank. Thus, the variation in the data is insufficient for this type of analysis.

[63] Königlich Preußisches Statistisches Bureau, ed., *Tabellen* (1858, 1860).

[64] See, for example, Börner and Severgnini, 'Time for growth'; Dittmar, 'Information technology'.

[65] Mankiw, Romer, and Weil, 'Empirics of economic growth'; Islam, 'Growth empirics'. The results do not qualitatively depend on the inclusion of lagged population growth. Results are not shown, but are available from the authors upon request.

[66] Becker, Cinnirella, Hornung, and Wößmann, 'iPEHD'.

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Table 2. *Descriptive overview of the datasets*

Variable	*Obs.*	*Mean*	*Std. dev.*	*Min.*	*Max.*
ln(city growth)	11,701	0.04	0.091	–1.358	2.176
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
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

Sources: Population figures are taken from Hornung, 'Railroads'. Founding dates for calculating time since first saving bank and the savings bank dummy are taken from Königlich Preußisches Statistisches Bureau, ed., *Zeitschrift*, pp. 313–36. Data on the no. of factories and steam engines (steam engines and steam boilers) in a city between the years 1855 and 1858 are taken from the official statistical publication Königlich Preußisches Statistisches Bureau, ed., *Tabellen* (1858, 1860).

as discussed above. SB_{it} represents one of the two treatment variables, namely, the 'Savings bank' dummy or the 'Time since first savings bank' measure.

To exploit the fact that the 1854 decree triggered a wave of savings banks being established that were less endogenous than the ones founded in earlier years, we estimate the regression for two sub-samples. First, we exclude savings banks founded before 1838, when the first regulatory framework for the savings banks was implemented. Second, we exclude savings banks that were founded before the decree was issued and for more than 10 years after it (1865).

IV. Empirical results

Table 3 presents the results of estimating standard pooled OLS regressions in panel A, and panel fixed effects regressions (equation 2) in panel B. Columns 1 and 4 show the results for pooled OLS and fixed effects 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 the founding of savings banks that were more exogenous than those of the first wave. The first three columns show the coefficients of the 'Savings banks' dummy and columns 3 to 6 show those of the 'Time since first savings bank' variable for the different estimation samples.

Looking at the pooled OLS 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 log growth rate increased by about 0.64 to 1 per cent. We also find that the effect becomes larger, the longer the savings banks existed in the city.[67] These results provide suggestive evidence for a positive effect of savings banks on local levels of industrialization.

We further estimate a model that includes city fixed effects. Such a regression can account for time-invariant unobserved heterogeneity (such as favourable geography and natural conditions, but also persistent differences in culture and social norms). In comparison to pooled OLS, the results (panel B of table 3) suggest a larger effect of around 1.5 per cent for the founding of savings banks on city growth.

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

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Table 3. *Savings banks and city growth: OLS and fixed effects regressions*

	(1)	(2)	(3)	(4)	(5)	(6)
Sample	All cities	Excluding towns in which saving banks were founded before 1838	Excluding towns in which saving banks were founded before 1854 or later than 1865	All cities	Excluding towns in which saving banks were founded before 1838	Excluding towns in which saving banks were founded before 1854 or later than 1865
Panel A: Pooled OLS (dependent variable: ln(city growth))						
Savings bank	0.0100***	0.0094***	0.0064***			
	(0.0016)	(0.0021)	(0.0023)			
Time since first savings bank				0.0007***	0.0013***	0.0016***
				(0.0002)	(0.0003)	(0.0005)
R^2	0.080	0.070	0.065	0.081	0.071	0.071
Panel B: fixed effects (dependent variable: ln(city growth))						
Savings bank	0.0149***	0.0181***	0.0226**			
	(0.0042)	(0.0043)	(0.0058)			
Time since first savings bank				0.0018***	0.002***	0.0022***
				(0.0003)	(0.0003)	(0.0006)
Within-R^2	0.105	0.102	0.123	0.110	0.106	0.123
Observations	11,701	10,842	8,090	11,701	10,842	8,090
No. of clusters (towns)	978	907	678	978	907	678

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

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Interestingly, the effect increases to around 2.2 per cent when one considers the sub-samples of savings banks founded after 1838 and between 1854 and 1865. For the 'Time since first savings bank' variable (columns 4–6), the same holds true. The fixed effects coefficients are notably larger than the pooled OLS ones, suggesting that an additional three years of a savings bank's existence in a city increased city growth by around 0.2 per cent.

Next, we attempt to learn more about the cities that benefited most from having a savings bank. To do this, we split the reduced sample into three according to the average size of the city. The first third contained the 225 smallest cities, with the smallest having just 271 inhabitants, and the average city having 1,221 inhabitants. Most cities (75 per cent in this sub-sample and 94 per cent overall) had over 1,000 inhabitants. The smallest city with a savings bank was Wirsitz, which had about 930 inhabitants. The second third included the 226 medium-sized cities in the sample. Here, the average city had about 2,176 inhabitants. The last sample, finally, contained the 226 largest cities. These cities had an average of 4,844 inhabitants. Already, these numbers show that the whole sample consisted of predominantly small and medium-sized cities. If we run the regressions from table 3, for the 'Savings bank' dummy (online appendix table S3), the effect of the savings banks does not differ much between the three categories. The coefficient is insignificant for the smallest third; however, its size is similar to the marginally significant one for medium-sized cities. The coefficient is larger, yet still only marginally significant for the largest third of cities.

Next, we further account for the possibility that the estimated effects could be attributed to the mining industry boom caused by increasing industrialization, especially in the Ruhr and Upper Silesia coal industries. A bias could arise from savings banks founded in regions with an economic upswing caused by the growth of the mining industry. Therefore, in online appendix table S4, we estimate the fixed effects estimations of table 3, excluding the cities in which the coal sector was most dominant. Results showed that the coefficients of the savings bank variables are qualitatively identical or even larger than the baseline regressions. Hence, the fast-growing regions, spurred by the coal industry, did not drive our results.

Moreover, the establishment of a savings bank in a city may potentially have spillover effects on nearby cities. This is particularly important if both cities were in the same county, and if the savings bank was intended to be accessible to people in neighbouring cities as well. Such a bank could also have financed public investments and regional business in any city in the county. It is also possible that towns that founded a savings bank experienced substantial increases in population. However, such growth mainly reflected a relocation of economic activity, to the disadvantage of neighbouring cities. Something similar was induced by railways in nineteenth-century Sweden.[68] To study the effect of banks in the neighbourhood of a city, we construct two further control variables, namely the number of savings banks in each year within 10km and 20km of a city. Alternatively, we also include separate dummy variables for one, two, three, and four or more savings banks within 10km, to allow for a non-linear effect of the number of neighbouring savings banks.

The results are reported in online appendix table S5. They suggest that including the establishment of savings banks in neighbouring cities leaves the effect of savings

[68] Berger and Enflo, 'Locomotives of local growth'.

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Table 4. *Savings banks and the financing of regional business, 1855 and 1858*

	(1)	(2)	(3)	(4)
Dependent variable	*ln(steam engines per factory)*			
Sample	All cities		Excluding cities in which saving banks founded before 1854 or later than 1865	
	Panel A: pooled OLS			
Savings banks	0.119***		0.0828***	
	(0.022)		(0.033)	
Time since first savings bank		0.008***		0.0644***
		(0.002)		(0.021)
R^2	0.389	0.388	0.351	0.363
	Panel B: fixed effects			
Savings bank	0.0685*		0.0685*	
	(0.0349)		(0.0349)	
Time since first savings bank		0.0273***		0.0618***
		(0.008)		(0.0211)
Within-R^2	0.003	0.016	0.004	0.027
Observations	1,964	1,964	1,360	1,360
No. of clusters (towns)	978	978	678	678

Notes: Standard errors clustered at city level in parentheses. Coefficient statistically different from zero at the ***1%, **5%, and *10% level. The regressions in panel A include a constant not reported. The regressions in panel A include county and those in panel B city fixed effects.

banks for city growth virtually unchanged. The effect of savings banks in the 10km neighbourhood seems to be larger or similar to the effect of a savings bank in a city (columns 1 and 4). Savings banks in the 20km neighbourhood, meanwhile, still have a significant positive effect, although the estimated semi-elasticity is much smaller (around 0.07 per cent). However, this is 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 (see columns 3 and 6). Based on the fixed effects regressions, we cannot claim that our results are causal, since we cannot perfectly solve the endogeneity issue. However, in summary, the results clearly support our hypothesis that savings banks financed regional business in nineteenth-century Prussia and contributed significantly to local industrialization.

V. Alternative outcomes

Population growth may not be the ideal proxy for an industrial take-off.[69] Thus, we try to measure industrialization more directly. The adoption of steam engines in producing industries is a typical characteristic of nineteenth-century industrialization. Accordingly, we use the number of steam engines per factory as a measure for the degree of industrialization.[70] These machines were necessary

[69] See n. 65.
[70] See, for instance, Allen, *British industrial revolution*.

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for almost every important industry, yet they were also expensive, and firms often needed loans from banks to finance them.

Similar to the previous regression, we first estimate pooled OLS regressions with the two savings banks treatment variables and included county fixed effects (panel A). In the second step, we also include city fixed effects (panel B). Both regressions are estimated for all cities (columns 1 and 2) and for the sub-sample of cities with savings banks founded between 1854 and 1865 (columns 3 and 4). Again we cluster the standard errors at the city level. Table 4 reports the results. Both treatment variables yield a significant and positive impact. They imply that the firms in a city with a savings bank used around 10 per cent more steam engines per factory than firms in cities without a savings bank. Another three years with a savings bank further increased the number of steam engines per factory by around 9 per cent. The coefficients from the fixed effect regressions were slightly lower, and the savings banks dummy was less significant.

VI. Conclusion

By 1913, savings banks held the largest market share in total assets and therefore constituted the most important pillar of the German banking industry.[71] Previous research has either studied the impact of savings banks at a highly aggregated level, or qualitatively using case studies.[72] This study is the first to consider the impact of savings banks quantitatively at a local level for the early nineteenth century.

Although we cannot address the endogeneity issue perfectly, the regression results, including city fixed effects, suggest that savings banks promoted city growth. This is even more plausible considering that Germany's industrialization was not only based on larger, multinational firms and coal resources, but also on good public infrastructure, a competitive schooling system, and, in particular, small and medium-sized firms, which were the backbone of German industry. The resulting peculiar economic landscape, based on various highly specialized, internationally active, yet still regionally-centred medium-sized firms, has persisted until today; these firms are still an integral part of the German economic model.

Thus, this study contributes to our understanding of why Germany industrialized and reveals more about the relationship between banks and growth. Earlier research has focused on the impact of large universal banks and stock markets at the end of the nineteenth century, largely overlooking the impact of savings banks and the potential benefit of a decentralized financial system. The evidence that we provide clearly shows that there is a considerable gap in the literature on savings banks and what they actually contributed to economic growth. To improve our knowledge of the ways that savings banks contributed to growth, we need more research like Proettel's recent careful analysis of loans granted by several savings banks in the south of Germany in the nineteenth and early twentieth century.[73]

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[71] Burhop, *Wirtschaftsgeschichte*, p. 184.
[72] Burhop,'Banks'; Proettel, *Die Stellung der Sparkassen*; idem, 'Die Darlehensvergabe'; Thomes, *Die Kreissparkasse Saarbrücken.*
[73] Proettel, *Die Stellung der Sparkassen.*

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Supporting information

Additional supporting information may be found online in the Supporting Information section at the end of the article.

S1. Explaining the foundation of new savings banks

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