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Centre for Economic Policy Research
33 Great Sutton Street, London EC1V 0DX, UK
Tel: +44 (0)20 7183 8801
www.cepr.org

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Abstract

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JEL Classification: I18, L33, L53

Keywords: State ownership

Clarissa Mang - clarissa.mang@econ.lmu.de
Ludwig-Maximilians University of Munich (LMU)

Klaus Schmidt - klaus.schmidt@lmu.de
Ludwig-Maximilians University of Munich (LMU) and CEPR

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Does State Ownership Bias Government Support? Evidence from the Financial Crisis[†]

Clarissa Mang[*]
University of Munich

Klaus M. Schmidt[**]
University of Munich, CESifo and CEPR

February 21, 2023

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Keywords: State ownership; industrial policy; soft budget constraint; privatization.

[†]We would like to thank Lukas Buchheim, Stefano DellaVigna, Sarah Eichmeyer, Alfons Labisch, Arthur Seibold, Reinhard Spree, Peter Schwardmann, Fabian Waldinger, Martin Watzinger, Joachim Winter and many seminar participants for comments and suggestions. We are particularly grateful to Lukas Buchheim and Martin Watzinger for sharing their data on the German stimulus package of 2009 with us. Katja Michlbauer, Filip Milojevic, Paul Rosmer, Jacob Schaal and Jakob Weber provided excellent research assistance. Financial support by Deutsche Forschungsgemeinschaft through CRC-TRR 190 (project number 280092119) is gratefully acknowledged.

[*]Department of Economics, University of Munich, Kaulbachstr. 45, D-80539 München, Germany, email: clarissa.mang@econ.lmu.de.

[**]Department of Economics, University of Munich, Ludwigstr. 28, D-80539 München, Germany, email: klaus.schmidt@lmu.de (corresponding author).

1 Introduction

Industrial policy is on the rise. Many governments sponsor new technologies (hydrogen, electric cars, digitization), secure supply chains for vaccines and other "vital" inputs, promote national champions, and engage in massive rescue packages to prevent firm closures and job losses during crises, such as the Covid-19 pandemic or the financial crisis.[1] If governments engage in these activities, they can intervene at arms' length, using various forms of subsidies and regulation, or they can acquire ownership by injecting equity into existing companies, founding new state-owned firms or even nationalizing industries. For example, both the US and Europe are heavily engaged in promoting their aircraft industries. The US government has no equity stake in Boeing, while 26 percent of the shares of Airbus are owned by the governments of Germany, France and Spain.[2] This raises the question whether choosing one or the other affects how the government will treat the firm in the future.

A large body of economic literature has examined and compared the relative performance of private and state-owned firms and the debate about the advantages and disadvantages of state ownership has been ongoing for decades (Shirley and Walsh, 2001). Some common concerns about extensive state ownership have been, first, that this could distort competition by granting an advantage to state-owned firms over their privately-owned competitors (Sappington and Sidak, 2003; Bauer, 2005; Edwards and Waverman, 2006). Second, the government might accept lower profits than a private owner and would be in a position to bail out some unprofitable firms while private firms in the same situation would go bankrupt (Chari and Kehoe, 2016; Glowicka, 2006). Finally, the prospect of a soft budget constraint could reduce the management's incentive to reduce costs and to innovate or allow excessive risk-taking, making state-owned firms less efficient (Bertero and Rondi, 2000; Bartel and Harrison, 2005; Bianchi, 2016; Pint, 1991). While there is ambiguity about the costs and benefits of state ownership in the theoretical literature, with some models even finding more efficient outcomes

[1] The case for state activism is prominently made by Mazzucato (2018, 2020) who offers many examples of recent government interventions.

[2] Other prominent examples include the US government that acquired ownership stakes in GM and Chrysler as part of a bailout in the financial crisis. These shares were sold again (at a loss) several years later. In Germany, the vaccine producers BioNTech and CureVac both received generous government support during the Covid-19 pandemic. The German government owns about 20 percent of CureVac while it has no ownership stake in BioNTech.

for state ownership (De Fraja, 1993), the empirical evidence largely supports the claim that state-owned firms are less efficient and less profitable than private firms (Ehrlich et al., 1994; Shleifer, 1998; Dewenter and Malatesta, 2001; Megginson and Netter, 2001; Wei, Xie, and Zhang, 2017; Shirley and Walsh, 2001). One explanation could be if governments support firms that they own more generously than otherwise identical firms that they do not own, i.e. if ownership *causes* governments to be more generous towards a firm. In this paper, we seek to determine if there is a causal effect of ownership on government support.

Providing such causal evidence seems almost impossible for three reasons. First, state-ownership is not randomly assigned. Governments tend to own firms and industries that are particularly important for the economy as a whole, e.g. because they generate large external effects. For these firms more generous government support may be justified. Second, government support comes in many guises that are often difficult to observe and to measure. The government could offer more generous subsidies, provide credit at preferential terms, sell land or other assets at below market prices, accept lower profits than a private owner, ease regulation, or use other discretionary decisions to support a firm that it owns. Third, in most industrialized countries there are explicit legal provisions that forbid unequal treatment of state-owned and privately owned firms. If a government wants to favor a state-owned firm nevertheless, it would have to try to hide the preferential treatment.

In this paper we show that it is possible to deal with these identification problems by exploiting a unique data set of project-level stimulus money distributed in 2009 at the local level to more than 1600 German hospitals that are owned by local governments, private not-for-profit organizations, and private for-profit companies. We restrict attention to general hospitals that provide the same level and quality of health care in all parts of the country and are very similar in structure.[3] Given that all hospitals, regardless of their ownership structure, have the same obligation to the provision of public health care, this setting allows us to rule out a crucial reason for a justified favoritism for state firms: public hospitals do not provide any additional positive external effects compared to private hospitals. Moreover, the

[3]These are so called "plan hospitals" that are listed in the hospital plans of the federal states. Each state has to provide a hospital plan to guarantee the equal and sufficient provision of hospital services in all parts of the country. The hospital financing act (Krankenhausfinanzierungsgesetz) requires the health insurance system and the federal states to fund all of these hospitals independently of their ownership status. See Section 2 for more details.

stimulus money could be used only for new investment projects, mainly for the construction and renovation of buildings. It was explicitly aimed at stimulating the local construction and infrastructure industry. We argue that the economic benefits of these investments are independent of ownership. All else equal, stimulus money paid to a publicly owned hospital generates the same social benefits as when paid to a privately owned hospital. In fact, this assumption was shared by the federal government which required by law that the funds should be allocated "trägerneutral", i.e. independently of ownership.

This setting has the following advantages that allow us to address all three identification problems mentioned above and to disentangle the causal effect of ownership on government support.

First, the ownership structure of the hospitals in our data set was largely determined when they were founded, mostly in the 19^{th} or early 20^{th} century, by factors that are independent of the current socio-economic conditions of their catchment areas. In Section 5, we show that ownership is as good as randomly assigned and a causal determinant of government support: First, we describe the historical context of hospital ownership and show that the large majority of hospitals was founded before 1950 and has not changed ownership since their foundation. Second, we use ownership type at foundation as an instrument for ownership type in 2009 to rule out concerns about endogeneity of ownership type. Third, we use district fixed effects to show that different historical backgrounds of different regions do not affect our results. Finally, we look at recently privatized hospitals separately and show that they have been treated like "always private" hospitals and not like "always public hospitals", showing that it is the current ownership type that determines how much stimulus money hospitals received.

Second, there is a very simple and accurate metric to measure government support: the amount of stimulus money received. For each hospital we know the exact amount that they received. More specifically, we measure three outcome variables: the amount of funding each hospital received, the probability of receiving funds at all, and the size of each funded project.

Third, the money had to be allocated by the local governments very quickly, within a few months, to projects that were proposed by state-owned hospitals, private hospitals, schools and other local institutions. Because of the decentralized decision making within a very short period of time, the usual controls that ensure ownership neutrality were less stringent, allowing

us to identify government favoritism in this setting more easily.

Our main finding is that publicly owned hospitals received, on average, about € 350k to € 400k more than private hospitals, after controlling for observable hospital characteristics, financial performance, regional and political factors and some further robustness checks. Given that the average amount of funding per hospital was € 900k, this is a large effect. For private for-profit hospitals, this difference is driven by a lower probability of receiving funding at all, with the funding probability being 19.5 percent (or 8.6ppt) lower for private for-profit hospitals compared to public hospitals. Conditional on being funded, the amount received per project is similar. In contrast, private not-for-profit hospitals are funded at the same rate as public hospitals, but receive around € 380k to € 480k less in funding per funded project.

These findings are important for at least two reasons. First, they provide a foundation for some of the concerns about the costs of state ownership mentioned above. In Section 6 we develop a simple theoretical model showing that if the government treats a company it owns more generously, this gives rise to a soft-budget constraint which can explain why state-owned firms are often less efficient than comparable private firms. Second, our results show that the legal provisions in many industrialized countries to prevent preferential treatment of state-owned companies are warranted and should be strictly enforced.

There are several mechanisms that could give rise to the preferential treatment of state-owned hospitals. For example, a local government may be held responsible by the public for the performance of a hospital it owns, but less so for the performance of a private hospital. It could be the case that stakeholders of a public hospital (managers or employee representatives) have better access to the local government, for example because representatives of the local government are members of the board. There could be ideological reasons to favor public hospitals. Left-wing politicians might be convinced that hospitals should be publicly owned and therefore give more subsidies to them. The financing of public hospitals could thus follow the agenda of local politicians, similar to the lending behavior of government-controlled banks, which has been shown to follow the electoral cycle (Englmaier and Stowasser, 2017). Or ownership could have a direct effect on preferences. There is ample psychological evidence that people care more about things they own than things they do not own (Marzilli Ericson and Fuster, 2014). Our data indicate that some of these mechanisms are at work, and our

exploratory analysis suggests that ideological reasons of left-leaning politicians and voters holding the government accountable for the performance of public but not private hospitals are possible explanations. Our main interest in this paper, however, is to show that there is a causal effect of ownership on government support. The precise identification of the mechanisms through which it works has to be left to future research.

Our paper is related to three strands of literature. First, there is a theoretical literature on the pros and cons of privatization and state ownership. Many of the papers focus on the efficient provision of public goods under different ownership regimes (Hoppe and Schmitz, 2010; Schmitz, 2015, 2021). Kornai (1980, 1986) argues that nationalized firms face a soft budget constraint which may explain the poor performance of state-owned firms in socialist countries, but also in market economies in which some industries are nationalized. However, he does not explain why there is a soft-budget constraint only for state-owned firms. After all, governments can and do also support privately-owned firms (Heim et al., 2017; Bernini and Pellegrini, 2011; Groenewegen, Hardeman, and Stam, 2021; Dong, Raghunandan, and Rajgopal, 2022). Schmidt (1996) and Hart, Shleifer, and Vishny (1997) offer explanations for a differential treatment of state-owned and privately-owned firms based on the theory of incomplete contracts.[4] In this paper we point to a different explanation: Ownership changes the "preferences" of the government and thereby induces a different treatment.

Second, there is a large empirical literature on the performance of state-owned versus private firms. Shleifer (1998), Dewenter and Malatesta (2001), Megginson and Netter (2001), Wei, Xie, and Zhang (2017) show that private companies tend to be more efficient and more profitable than state-owned firms. Harrison et al. (2019) look at a large data set of Chinese companies and show that state-owned firms receive substantially more subsidies than formerly state-owned firms that have been privatized, which in turn receive more subsidies than privately-founded firms. Shen et al. (2007) conduct a meta analysis of several quantitative and qualitative studies on the determinants of the financial performance of US hospitals. They find that state-owned hospitals are on average associated with weaker financial performance

[4]In Schmidt (1996) ownership changes access to information. The government is reluctant to bail out a private firm because it does not know whether the firm really needs the subsidy or whether it only claims to be in trouble, while it is less reluctant to do so for a public firm where it observes the cost structure. Hart, Shleifer, and Vishny (1997) assume that quality is not contractible. A private owner will provide worse quality than the government, but he has a stronger incentive to contain costs.

as measured by costs, revenues, profits and efficiency. However, all of this literature provides correlational evidence only. We identify a causal effect of state-ownership.

Finally, there is an experimental literature on the psychological effects of ownership. It has revealed the well-documented endowment effect, i.e. the effect that individuals care more about an object if they own it (Marzilli Ericson and Fuster, 2014). In addition, even in the absence of legal ownership, Dawkins et al. (2017), van Dyne and Pierce (2004), and Pierce, Kostova, and Dirks (2001, 2003) show that a feeling of "psychological ownership" can be sufficient to bring about the same behavioral, emotional, and psychological consequences. This can explain the psychological effect of individual politicians feeling more personally responsible for a public firm, even without a formal individual claim to ownership. In fact, in the English language "taking ownership" is associated with "feeling responsible" and "getting engaged".

The remainder of this paper is structured as follows: In Section 2, we provide institutional background information on our setting and discuss the identification strategy. Section 3 describes the data set. In Section 4, we present the OLS regression results and test their robustness. In Section 5, we provide several robustness checks, including additional evidence for the validity of our identifying assumption and the use of an instrumental variable (IV) approach to confirm our findings. Section 6 highlights the implications of our result. We develop a simple theoretical model showing that the main stylized facts about the performance of private versus public ownership can be explained if the government cares more about a firm that it owns than a privately owned firm. Finally, Section 7 concludes. All proofs are relegated to Appendix A. Appendix B offers some additional (regression) tables.

2 Setting and Identification Strategy

In March 2009, at the peak of the financial crisis, the Federal Government of Germany launched an economic stimulus package (Konjunkturpaket II). Part of this package was an "investment program for the future" (Zukunftsinvestitionsgesetz, ZuInvG) to stimulate infrastructure investments. The program had a volume of € 15.8 billion (0.68 percent of GDP). The explicit aim of the program was to foster investments into local infrastructure, thereby generating a

multiplier effect on the rest of the economy. At least 65 percent of the funds had to be invested into buildings and physical equipment of schools, universities and day care centers. The remaining 35 percent could be spent on hospitals, urban and rural development, and other local infrastructure (§3 ZuInvG). Most of the funds were invested into the construction and renovation of buildings. The funds were provided as matching grants. The federal government allocated € 10 billion to the federal states in proportion to their population under the condition that the states and the municipalities match these funds with at least € 3.3 billion. Most states contributed substantially more (€ 5.8 billion in total). At least 70 percent of the funds had to be spent at the local level by counties and municipalities. The actual fraction was larger than 75 percent in almost all states. To be eligible, a project had to be started before the end of 2010 and to be completed by the end of 2011.[5]

We focus on the funds received by hospitals. In Germany, hospitals are either owned by the municipalities/counties, by private not-for-profit organizations (e.g. the catholic or protestant church, the German Red Cross, and others charitable organizations), or by private for-profit companies. We restrict attention to so called "plan hospitals". These are general hospitals for the primary health care of the population. Each state is required to provide a list of plan hospitals that guarantees that each county is equipped with a sufficient number of hospital beds (determined by a Hill-Burton formula) and the major hospital departments (internal medicine, surgery, gynecology, orthopedics, etc.) that satisfy legally determined standards of quality. All hospitals on this list, no matter whether they are publicly or privately owned, are funded in the same way, which is governed by the Hospital Financing Act (Krankenhausfinanzierungsgesetz, KHG).[6] The allocation of funds should not be affected by ownership status (KHG §1.2). Running expenses are covered by the health insurance system through "diagnosis related groups" (DRGs, "Fallpauschalen") that are fixed amounts for each diagnosis and treatment. Investment costs are funded by the federal states (KHG §6). This "dual financing system" applies to all plan hospitals in the same way. Thus, plan hospitals are very similar in structure

[5]See Slansky (2010) and Bundesministerium der Finanzen (2013) for detailed descriptions of this program. By the German constitution (Grundgesetz, § 104b) the federal government is allowed to finance investments of the federal states only in exceptional circumstances. Three conditions have to be satisfied: (i) The funding has to be temporary, (ii) the types of investment have to be specified by law, and (iii) the federal government can only provide transfers, so that the decision on which projects will be funded remains with the states.

[6]The purpose of the KHG is to "safeguard the economic viability of hospitals in order to ensure high-quality care for the population that is tailored to patients and needs with efficient, high-quality hospitals that operate on their own responsibility" (KHG §1.1).

independently of their ownership type.[7]

Plan hospitals are also similar in terms of the quality of care they provide. One could worry that there might be systematic differences in quality, if for example private hospitals shade on quality in order to maximize profits (Hart, Shleifer, and Vishny (1997)). However, Augurzky et al. (2010, p. 118) and Augurzky, Beivers, and Gülker (2012, p.32-34) report that the number of complaints in the regular, official quality assessments is similar across hospital types. If anything, there are less complaints about private hospitals. Furthermore, Wübker and Wuckel (2019) do not find a significant difference in the mortality rates for heart attack treatment of private for-profit hospitals as compared to public hospitals. For pneumonia patients they find a slightly lower 30-day-mortality rate in private for-profit hospitals. Moreover, they do not find any hints for quality changes after hospital privatization. Another possibility to measure perceived hospital quality is to look at patient satisfaction. Augurzky, Beivers, and Gülker (2012, p. 32-34) report that there is no significant difference in patient satisfaction across hospital types, Zich and Tisch (2018, p. 11) and Kraska, Weigand, and Geraedts (2017, p. 597) report that patient satisfaction is slightly higher in public and private not-for-profit hospitals than in private for-profit hospitals, while Augurzky et al. (2010, p. 118) report that private for-profit and not-for-profit hospitals have a slightly higher patient satisfaction than public ones. Thus, systematic quality differences do not seem to be an issue.

Because there is no systematic difference in quality of care, there is no reason for patient selection into hospitals. One could have worried that, for example, rich patients self-select into private hospitals and poor patients into public hospitals, and governments wanting to subsidize poor patients would therefore favor public hospitals. However, Wübker and Wuckel (2019) show that distance from hospital is the major factor determining hospital choice and that there is no systematic selection bias. Wübker and Wuckel (2019, p. 383) conclude: " ... within the German hospital system it is difficult for patients to systematically rank hospitals in terms of quality. There are only few tools at hand to learn about the quality of hospitals. In addition, quality does not necessarily correlate between departments. Hence, a significant patient selection bias is unlikely." This is confirmed by Zich and Tisch (2018, p. 43): "It is hardly plausible that differences in hospital ownership affect patient satisfaction"

[7] A more detailed description of the German hospital system is provided by Quentin et al. (2010) and Deutsche Krankenhaus Gesellschaft (2018).

(own translation).

The stimulus package (Zukunftsinvestitionsgesetz) was passed by the Bundestag on March 5, 2009, and received a lot of public attention. Funds were allocated to counties roughly in proportion to their population. States either delegated the funding decisions to the counties or had some joint selection process.[8] All plan hospitals were encouraged to apply for funds independently of whether they were public or private. There is no information available on the projects that were not funded. Thus, a possible concern could be that public and private hospitals had different application rates. However, the Zukunftsinvestitionsgesetz required explicitly that funds should be provided independent of ownership status (ZuInvG § 3.1, "Trägerneutralität"), and we could not find any public complaints about discriminating application procedures. If anything, we would expect more applications by private for-profit hospitals, because they tend to be managed somewhat more efficiently (see Section 4.2 below). In this case, we would underestimate the extent to which the government favored public hospitals. In any case, the available funds were spent quickly and completely, and the program was widely considered a success.[9] The federal states contributed significantly more than they were required to. A total of 43,000 projects were financed by the program with an average size of € 367,442 per project. Buchheim and Watzinger (2023) show that the program was indeed effective in stimulating the economy. However, because the money had to be spent quickly, the usual rules and regulations to allocate funds and to award contracts were suspended (Bundesrechnungshof, 2012). This gave more discretion to the counties and municipalities who decided on the final selection of investment projects.

A crucial feature of the funds provided by the investment program of 2009 is that they were supposed to be add-ons to generate positive spillover effects. Existing projects could not be (co-)financed. The projects had to be new and additional to regular investments (§ 3.3 and § 4.1. ZuInVG). Moreover, they were intended to stimulate the local economy, preserve historical buildings, or benefit the climate through improved energy efficiency. These positive spillover effects are independent of whether a hospital is publicly or privately owned. The federal government required the funds to be allocated independent of ownership. Thus, after

[8] See Slansky (2010).

[9] See Bundesministerium der Finanzen (2013, p. 51). 12.5 percent of the funds were spent in 2009 already, 41.3 percent in 2010, and 46.1 percent in 2011.

controlling for possible structural differences, public and private hospitals should be equally successful in acquiring stimulus money. If the federal states and the counties give more funds to public hospitals, they are biased towards the hospitals they own.

3 Data and Descriptive Statistics

Our data set includes the 1681 plan hospitals that existed in 2009. Of these, 583 are publicly owned by municipalities and counties, 702 are private not-for-profit (NFP, "frei-gemeinnützig") owned by religious and charitable organizations, and 362 are owned by private for-profit (FP) companies. 34 of the plan hospitals are university hospitals that are not only treating patients but are also engaged in medical research and in teaching students. 31 of them are owned by the federal states while three are private for-profit.[10] However, since university hospitals are much larger than regular hospitals, differ substantially in structure, and could apply for stimulus money that was reserved for the education sector (schools, daycare centers and universities), we exclude them from our sample for the main analysis. Thus, the data set (for the main analysis) consists of 1647 plan hospitals.

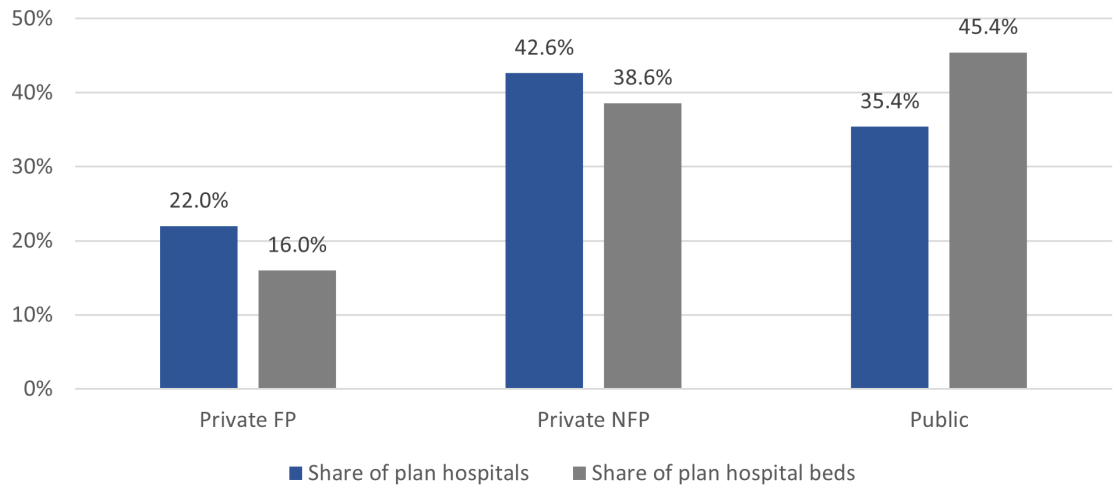
Figure 1 shows the distribution of the 1647 plan hospitals and the distribution of plan hospital beds. While 35 percent of all hospitals are publicly owned, public hospitals account for 45 percent of all hospital beds. Thus, they tend to be somewhat larger than their private counterparts.[11]

About half (45.6%) of all plan hospitals received funds from the stimulus package. Table 1 shows how these funds were allocated across hospitals. While 44.1% of all public hospitals successfully acquired funds, only 25.4% of all private FP and 57.1% of all private NFP hospitals did so. Public hospitals acquired on average two to three times as much as private hospitals (€ 0.97 M per hospital as compared to € 0.44 M and € 0.36 M for private NFP and private FP hospitals, respectively). This is partly because public hospitals tend to be somewhat larger (as measured by hospital beds). Still, they received 40 to 60 percent more per hospital bed

[10] Two of the private university hospitals belong to the University Hospital Gießen-Marburg and one is the heart surgery clinic of the University Hospital Hamburg-Eppendorf

[11] The average number of beds is 195 for private for-profit hospitals, 243 for private not-for-profit hospitals and 344 for public hospitals.

Figure 1: Plan hospitals and plan hospital beds by ownership type



Notes: Share of private for-profit (private FP), private not-for-profit (private NFP), and public hospitals of all plan hospitals in 2009 as well as the share of hospital beds by ownership type. The total number of plan hospitals is 1,647, the total number of hospital beds is 441,588.

than their private counterparts. Thus, public hospitals received substantially more generous funding than private NFP and private FP hospitals.

Table 1: Allocation of stimulus money to plan hospitals

	(1) Number of hospitals	(2) Hospitals receiving funds	(3) Share of hospitals receiving funds	(4) Sum of funds received *(in M €)*	(5) Funds received per hospital *(in M €)*	(6) Funds received per hospital bed *(in k €)*
Private FP	362	92	25.4%	130.19	0.36	1.63
Private NFP	702	402	57.3%	311.34	0.44	1.86
Public	583	257	44.1%	566.62	0.97	2.61
Total	1647	751	45.6%	1008.14	0.61	2.28

Notes: Descriptive statistics showing the allocation of available funds to the hospitals based on ownership type, private for-profit (private FP), private not-for-profit (private NFP), and public hospitals. Values in column (3) result from dividing column (2) by column (1). Values in column (5) result from dividing column (4) by column (1).

Our main data source is a complete hand-collected list of all stimulus-funded projects approved for hospitals.[12] We combine this list with the hospital register of the German Statistical

[12]We are very grateful to Martin Watzinger and Lukas Buchheim for sharing their data with us and to the federal states that helped us to update these lists.

Office from 2009.[13] The hospital register comprises detailed information about the structural characteristics of German hospitals, including the number of beds, types of wards, number of beds per ward and information on ownership.[14] Financial data on a subset of hospitals is provided by the Orbis dataset of Bureau Van Dijk.[15] However, Orbis provides the financial controls for only about 15 percent of all hospitals in our data set (239 out of 1647). Regional socio-economic data are provided by the statistical offices of the federal states and the Federal Office for Building and Regional Planning.[16] We manually collected data on the political affiliation of the prime ministers of the federal states and of the mayors and district administrators of the municipalities and counties in 2009, as well as data on when the next elections were held after 2009 on the state and county level. Finally, we manually collected information about the founding dates and ownership types at founding from the hospital websites. Where this information was not publicly available, we contacted the hospitals by email. We obtained the information on founding dates for 1459 hospitals in our sample (89 percent) and on both founding dates and ownership type at founding for 1400 hospitals in our sample (85 percent). Descriptive statistics for the full list of controls used in this paper split by ownership type are provided in Table B1 in the Appendix.

4 Regression Analysis

4.1 Main Results

Table 2 shows that there is a highly significant and large effect of ownership on the average total funding received by each hospital. Column (1) shows that public hospitals receive on average € 0.97 M. This is reduced by € 0.53 M for private NFP and by € 0.61 M for private FP hospitals.

[13] The hospital register is published annually, see Statistischen Bundesamt, Grunddaten der Krankenhäuser, Fachserie 12, Reihe 6.1.1, `www.statistischebibliothek.de/mir/servlets/MCRFileNodeServlet/DEHeft_derivate_00010402/2120611107004.pdf;jsessionid=E38CF46ED91921B5772B18F04208973D`.

[14] See Augurzky, Beivers, and Gülker (2012), Herr, Schmitz, and Augurzky (2011) and Pilny (2017) for empirical analyses of the German hospital sector that is partly based on this data.

[15] `www.bvdinfo.com/de-de/unsere-losungen/daten/international/orbis`.

[16] The data is provided at `www.inkar.de`. In Mecklenburg Western Pomerania, the definition of some counties was changed between 2009 and when the regional data was accessed in 2021. Several counties were merged together. Regional data from 2009 was only available on the level of the new, merged counties. We therefore took the regional controls of the new, merged counties to apply equally to each of the smaller counties making up the merged one. This applies to 19 counties from 2009 that were merged into 6 larger counties by 2021.

Thus, public hospitals receive on average more than twice as much in subsidies compared to non-public ones. Column (2) controls for the number of beds, the number of departments[17], and several regional controls at the municipal and county level (population density, urban vs. rural, share of the population 65 years and older, GDP per head, unemployment rate, share of public hospitals, total number of hospitals beds in the county, and communal debt). Because public hospitals tend to be larger, controlling for the number of beds reduces the effect, but it remains large. We add fixed effects for the federal states in column (3) in order to account for systematic differences between the states (such as political and economic differences, as well as differences in the process of paying out the stimulus money). Finally, we add fixed effects for the quarter century in which a hospital was founded to control for any systematic differences resulting from how old a hospital is.[18] Although this slightly reduces the sample size to 1459 hospitals, column (4) is our preferred specification. With this specification, we find that private hospitals receive on average around € 350k to € 400k less than public hospitals.[19]

Do public hospitals receive more funding on average because they are more likely to receive funding, or do they receive larger amounts per funded project than non-public hospitals? This question is addressed in Tables 3 and 4.

Table 3 reports results from a linear probability model of being funded. Column (1) shows that without any controls, private FP hospitals are significantly less likely to be funded, while private NFP hospitals are significantly more likely to be funded than public hospitals. The effects are similar, but slightly smaller if we control for number of beds, number of departments, and regional controls in column (2). Including state fixed effects in column (3) absorbs a large part of the effect, especially for private NFP hospitals, reducing the coefficient to a tightly estimated zero.[20] In column (4), we add fixed effects for the quarter century in which the

[17]We include the number of departments in the regression, because a hospital with more departments may have more buildings that need renovation. The type of departments could also be important, if certain departments are in greater need of investments than others. We repeat our main regressions with department fixed effects in Table B3 in the appendix. This does not change our results.

[18]This could, for example, include the quality of buildings erected in different periods or other structural differences between hospitals founded in different periods. All hospitals founded before 1750 are grouped into the same category.

[19]We use robust standard errors throughout our analysis. Following Abadie et al. (2022), we do not use clustered standard errors, since we observe the full population of interest (all plan hospitals in Germany) and do not rely on a randomly selected sample for our analysis.

[20]The surprising result that private NFPs are more likely to get funding turns out to be largely driven by just one state, North Rhine-Westphalia (NRW). NRW is the largest state in Germany with the highest number

Table 2: Funding per hospital by hospital type

	(1)	(2)	(3)	(4)
	Average total funding (in Mio EUR)			
Private FP	-0.612***	-0.276	-0.292*	-0.410**
	(0.16)	(0.18)	(0.16)	(0.19)
Private NFP	-0.528***	-0.331**	-0.319**	-0.359**
	(0.12)	(0.16)	(0.15)	(0.17)
Beds in thsd		2.969***	3.039***	2.848***
		(0.72)	(0.68)	(0.75)
Number of departments		-0.004	-0.010	-0.008
		(0.04)	(0.04)	(0.04)
Constant	0.972***	1.150***	0.579	0.292
	(0.12)	(0.41)	(0.56)	(0.57)
Regional Controls	No	Yes	Yes	Yes
State FE	No	No	Yes	Yes
Founding period FE	No	No	No	Yes
Adj. R^2	0.016	0.136	0.153	0.171
Observations	1647	1647	1647	1459

Notes: OLS regression of the average total amount of funding across all hospitals in Mio EUR. Robust standard errors shown in parentheses. Column (1) shows OLS estimates without controls, column (2) adds number of beds, number of departments and regional controls on the county level (share of public hospitals, unemployment rate, share of inhabitants aged 65+, number of hospital beds per 1000 inhabitants, urban dummy, population density, GDP per capita). Column (3) adds state fixed effects. Column (4) adds fixed effects for the quarter century in which the hospital was founded. Column (4) includes 314 private FP, 653 private NFP and 492 public hospitals. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

hospital was founded, which slightly increases the magnitude and level of significance for private FP hospitals (and has no effect on the private NFP coefficient). Again, this is our preferred specification. The resulting coefficient for private NFPs is insignificant and very close to zero, while the coefficient for private FPs is negative and significant. The difference in average funding for private NFP hospitals compared to public hospitals is thus apparently not driven by a lower likelihood of being funded. Private for-profit hospitals, on the other hand, are 19.5% (or 8.6ppt) less likely to be funded compared to public hospitals.

Next we turn to the average amount of funding per approved project. Table 4 considers

of hospitals (385 in total). Plan hospitals in NRW are predominantly private NFP (272 private NFP, 79 public and 28 private FP). Because the probability of being funded is much higher for all plan hospitals in NRW than in all other states (more than 80% of all plan hospitals in NRW received funding, compared to 46% in Germany as a whole), this drives up the relative probability of NFP hospitals being funded compared to the national average. This is corrected for by including state fixed effects.

Table 3: Probability of being funded by ownership type

	(1)	(2)	(3)	(4)
	Linear probability of funding			
Private FP	-0.187***	-0.170***	-0.060*	-0.086**
	(0.03)	(0.04)	(0.03)	(0.03)
Private NFP	0.132***	0.082**	0.003	-0.020
	(0.03)	(0.04)	(0.03)	(0.03)
Beds in thsd		0.086	0.069	0.039
		(0.07)	(0.07)	(0.07)
Number of departments		0.026***	0.024***	0.026***
		(0.01)	(0.01)	(0.01)
Constant	0.441***	0.544***	0.422***	0.580***
	(0.02)	(0.15)	(0.15)	(0.19)
Regional Controls	No	Yes	Yes	Yes
State FE	No	No	Yes	Yes
Founding period FE	No	No	No	Yes
Adj. R^2	0.059	0.136	0.423	0.442
Observations	1647	1647	1647	1459

Notes: Linear probability model with the dependent variable being a dummy variable equal to 1 if funding was received by a hospital and 0 otherwise. Robust standard errors shown in parentheses. Column (1) shows OLS estimates without controls, column (2) adds number of beds, number of departments and regional controls on the county level (share of public hospitals, unemployment rate, share of inhabitants aged 65+, number of hospital beds per 1000 inhabitants, urban dummy, population density, GDP per capita). Column (3) adds state fixed effects. Column (4) adds fixed effects for the quarter century in which the hospital was founded. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

the size of the funded projects. Funded projects in a public hospital tend to be much larger than in a hospital that is not publicly owned. Without any controls in column (1), a project in a public hospital receives € 1.22 M on average, while a project in a private FP hospital receives € 0.82 M and a project in a private NFP hospital receives only € 0.42 M. Controlling for the number of beds and departments and for regional controls in column (2) confirms these results, though the magnitude of the difference decreases. The same holds if state fixed effects are added in column (3). Adding fixed effects for the quarter century in which the hospitals were founded in column (4) increases the magnitude and level of significance of the observed effect for both private FP and private NFP hospitals. Overall, public hospitals receive € 380k to € 480k less per approved project than hospitals that are not publicly owned.

Thus, we find that private NFP hospitals are not in general less likely to be funded, but conditional on being funded they receive significantly less money. Private FP hospitals, on

Table 4: Funding per project by ownership type

	(1)	(2)	(3)	(4)
	Funding per project (in Mio EUR)			
Private FP	-0.405	-0.216	-0.253	-0.389*
	(0.27)	(0.28)	(0.20)	(0.22)
Private NFP	-0.804***	-0.561***	-0.376**	-0.476***
	(0.14)	(0.18)	(0.16)	(0.18)
Beds in thsd		0.980***	1.017***	0.892**
		(0.37)	(0.36)	(0.36)
Number of departments		0.037	0.009	0.025
		(0.04)	(0.03)	(0.03)
Constant	1.224***	1.826***	0.236	-1.702
	(0.14)	(0.53)	(0.60)	(1.22)
Regional Controls	No	Yes	Yes	Yes
State FE	No	No	Yes	Yes
Founding period FE	No	No	No	Yes
Adj. R^2	0.030	0.070	0.415	0.400
Observations	1363	1363	1363	1237

Notes: OLS regression of the amount of funding received per project (some hospitals received funding for more than one project). Column (1) shows OLS estimates without controls, column (2) adds number of beds, number of departments and regional controls on the county level (share of public hospitals, unemployment rate, share of inhabitants aged 65+, number of hospital beds per 1000 inhabitants, urban dummy, population density, GDP per capita). Column (3) adds state fixed effects. Column (4) adds fixed effects for the quarter century in which the hospital was founded. Robust standard errors shown in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

the other hand, are significantly less likely to be funded and receive slightly less money per project. A possible explanation could be that the federal government required the stimulus money to be distributed independently of ownership ("trägerneutral"). Because it is easy to observe who gets funded, private NFP hospitals, which are more similar to public hospitals in size, might have complained if their applications had been accepted less frequently. It is more difficult to observe whether the size of the projects is comparable across ownership types. On the other hand, private FP hospitals are fewer in number and smaller, so it is more difficult to recognize a difference in the probability of being funded.

One concern could be that funding for public and private hospitals differs, because they were using the funds in systematically different ways and were applying for different kinds of projects. In Appendix B.4 we show that this is not the case. There are some small differences in the types of projects that are being procured. However, the funding received by public

hospitals is larger for all project types. Thus, differences in the costs of different project types cannot explain why public hospitals were treated more generously.

4.2 Financial Controls

So far, we controlled for the number of beds and departments, but not for other hospital characteristics such as financial performance. Public hospitals might receive more funds because they are in more urgent need of subsidies, for example, if they are underfunded or operate less efficiently compared to private NFP and private FP hospitals. Indeed, there is some empirical evidence that public hospitals are less efficient and less profitable than private NFP and FP hospitals (Pilny, 2017). Note, however, that this is an endogenous effect of ownership. Thus, if we are interested in the total effect of ownership on receiving funds, these financial variables are "bad controls" (Angrist and Pischke, 2009) that should not be included in the regression.

Including financial controls in the regression answers a different question: What is the short-run effect of ownership status, given the (endogenously determined) financial situation of hospitals? This is reported in Table 5. We include controls for fixed assets per bed, long-term debt per bed, operating revenue per bed and the ratio of earnings before interest, taxes, depreciation and amortization to operating revenue (EBITDA margin). To avoid our results being driven by outliers in financial performance in any given year (e.g. affected by the financial crisis), we use the average of each measure across the four years from 2006-2009. Unfortunately, we could match the information on all of these financial controls for all four years for only a subset of 239 hospitals.[21]

The first three regressions in Table 5 report effects on total average funding in column (1), probability of funding in column (2), and funding per project in column (3). They are identical to the regressions in columns (4) of Tables 2, 3, and 4, but restricted to the 239 hospitals for which we have financial controls. Comparing the coefficients in the restricted sample to the unrestricted sample shows that the restricted sample is not representative of the entire population. However, all coefficients go in the same direction as in the full sample. Adding financial controls in columns (4), (5), and (6) hardly affects the magnitude or level of

[21]Including 90 public hospitals (37.7%), 111 private NFP hospitals (46.4%), and 38 private FP hospitals (15.9%).

Table 5: Financial controls

	(1) Total average funding	(2) Linear Probability of funding	(3) Per project funding	(4) Total average funding	(5) Linear Probability of funding	(6) Per project funding
Private FP	-0.855*	-0.256***	-0.074	-0.767	-0.213***	-0.140
	(0.47)	(0.08)	(0.50)	(0.47)	(0.08)	(0.49)
Private NFP	-0.921*	-0.116	-0.127	-0.922*	-0.117*	-0.098
	(0.49)	(0.07)	(0.27)	(0.49)	(0.07)	(0.33)
Beds in thsd	1.777	0.040	-0.244	1.781	0.026	-0.329
	(1.09)	(0.17)	(0.51)	(1.13)	(0.16)	(0.55)
Number of departments	0.082	0.011	0.126**	0.078	0.008	0.140**
	(0.07)	(0.01)	(0.06)	(0.07)	(0.01)	(0.06)
EBITDA margin (4yr average)				-1.522	-1.430**	0.688
				(3.63)	(0.66)	(5.52)
Operating revenue in mio per bed (4yr average)				0.615	0.441	-2.178
				(1.91)	(0.50)	(5.37)
Fixed assets in mio per bed (4yr average)				2.459	0.246	0.673
				(3.13)	(0.35)	(2.89)
Long term debt in mio per bed (4yr average)				-7.384	-1.040	4.049
				(7.48)	(0.90)	(6.98)
Number of employees per bed (4yr average)				-0.138	-0.050	0.107
				(0.13)	(0.03)	(0.29)
Constant	1.220	0.298	-0.339	1.829	0.651*	-0.745
	(1.35)	(0.32)	(1.55)	(1.51)	(0.36)	(1.66)
Regional Controls	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes
Founding period FE	Yes	Yes	Yes	Yes	Yes	Yes
Adj. R^2	0.319	0.539	0.588	0.310	0.548	0.580
Observations	239	239	245	239	239	245

Notes: OLS regression (total average funding, probability of funding and funding per project) for only the subsample of hospitals for which all financial controls are available. Financial controls consist of the averages of the controls across the years 2006-2009. Standard regression (with regional controls, state fixed effects and fixed effects for the quarter century in which the hospital was founded) in columns 1-3, including financial controls in columns 4-6. Sample not representative of full sample. Robust standard errors reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

significance of the coefficients on ownership status for all three outcomes. Moreover, almost all of the financial controls have insignificant effects. An exception is that a higher EBITDA margin reduces the probability of funding. Private FP hospitals tend to be somewhat more profitable.[22] Nevertheless, the negative effect of "Private FP" on the probability of being funded remains large and significant even after controlling for the EBITDA margin. Overall, this result suggest that it is not differences in the financial performance of the hospitals (in the four years prior to the stimulus packages) or greater investment needs resulting from lower profit margins that drive our main results.[23]

[22]See Augurzky, Beivers, and Gülker (2012) and Pilny (2017).

[23]To ensure these results are not driven by our definition of financial controls, we re-run the same regression using three different definitions of financial controls: only using data from 2007, using the 3-year average from 2007-2009, and using the 5-year average from 2005-2009. Results are found in the appendix in Tables B4, B5, and B6. The order of magnitude, direction and level of significance of the coefficients do not differ greatly,

4.3 Mechanisms

We have seen that public hospitals receive on average more subsidies than non-public hospitals. We have presented evidence that this is not driven by differences in regional conditions, financial performance, or greater investment needs, but rather by ownership status itself. By what mechanism could ownership causally affect the subsidy payments? Our data does not allow us to give a full answer to this question, but it provides a few insights about what mechanisms could be at work. One possible mechanism is ideology. Some politicians could believe that hospitals should be owned by the government and that publicly-owned hospitals should get preferential treatment as compared to their private competitors. In this case, left-wing politicians would probably favor public hospitals more than right-wing politicians. We test this hypothesis in Table 6, by adding several political controls, in particular whether the prime minister of the state and the mayor or district administrator (DA) of the municipality or county is left-wing, i.e. a member of the social democrats (SPD) or the left party (DIE LINKE). We interact these variables with being a non-public (either PFP or PNFP) hospital. If ideology was a relevant mechanism, the interaction terms should be negative.

With a left-wing prime minister[24], hospitals receive significantly more money than with a conservative prime minister. Public hospitals receive on average € 1.5 Mio more, while this effect is significantly reduced (by more than half) if the hospital is non-public. Furthermore, under a left-wing prime minister the probability that hospitals are funded increases significantly. These results support the hypothesis that left-wing governments are more inclined to finance hospitals more generously, with public hospitals receiving significantly more of those additional funds. The political affiliation of the mayor or district administrator of the municipality or county does not have an additional significant impact.

Another possible mechanism is that voters hold local and state governments accountable for the quality of public hospitals, but less so for private FP and NFP hospitals. To test this hypothesis, we include a dummy variable that equals 1 if there are upcoming statewide or local elections in 2010. Again we interact this variable with being a non-public

leaving the interpretation of our findings unchanged.

[24]Here left wing means a member of the SPD. In 2009 there was no prime minister who was a member of DIE LINKE.

Table 6: Political controls

	(1) Total average funding	(2) Linear Probability of funding	(3) Per project funding
Private FP	-0.350*	-0.236***	0.1340
	(0.19)	(0.06)	(0.21)
Private NFP	-0.302	-0.044	-0.262
	(0.23)	(0.06)	(0.34)
Beds in thsd	2.734***	0.113	0.754**
	(0.72)	(0.09)	(0.38)
Number of departments	-0.005	0.020***	0.065*
	(0.04)	(0.01)	(0.04)
Left-wing MP	1.237***	0.277***	-0.170
	(0.46)	(0.07)	(0.45)
Non-public × left-wing MP	-0.882*	-0.027	0.428
	(0.52)	(0.09)	(0.49)
Left-wing mayor/DA	-0.214	-0.027	-0.245
	(0.27)	(0.05)	(0.32)
Non-public × left-wing mayor/DA	0.229	-0.048	0.275
	(0.28)	(0.06)	(0.35)
Election year	0.169	-0.331***	1.611***
	(0.23)	(0.05)	(0.40)
Non-public × election year	-0.247	0.148**	-1.031**
	(0.26)	(0.06)	(0.44)
Eastern State	-0.733***	-0.685***	1.199***
	(0.27)	(0.07)	(0.36)
Non-public × Eastern State	0.533	-0.036	2.295
	(0.37)	(0.06)	(1.85)
Constant	0.454	0.434**	1.368**
	(0.48)	(0.20)	(0.70)
Regional Controls	Yes	Yes	Yes
Founding period FE	Yes	Yes	Yes
Adj. R^2	0.161	0.244	0.148
Observations	1445	1445	1237

Notes: OLS regression (total average funding, probability of funding and funding per project) including political controls. Includes regional controls and fixed effects for the quarter century in which the hospital was founded. Robust standard errors reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

hospital. If accountability was a relevant mechanism, this interaction term should also be negative. This is indeed the case for the total amount of funding (although this effect is not significant) and the funding per project, which is significantly lower for private hospitals compared to public hospitals when elections are near. In general, we observe that there is a highly significant negative effect of upcoming elections on the probability of funding, but a positive effect on the size of individual projects. This could suggest that upcoming elections caused the government to be more inclined to fund particularly large, visible and prestigious

projects in public hospitals, but had to cut back on the number of projects to make up for this larger spending. This could indicate that politicians are indeed held more accountable for public hospitals and focus on larger and more prestigious projects in public hospitals in an election year.

Lastly, eastern (former GDR) states may have treated their hospital differently than western states, because hospitals in eastern states benefited from large investments after reunification in the 1990s and early 2000s and were less in need for additional projects. A dummy variable for eastern states is indeed highly significant. However, there is no significant difference between public and non-public hospitals in the east.

There are several other plausible mechanisms that may explain the more favorable treatment of public hospitals. For example, public hospitals may have easier and more frequent access to local politicians, if local politicians are members of the board or are engaged in some other fashion in the oversight of a public hospital. Another possible explanation is that there are psychological effects of ownership. If the local government owns a hospital it may feel more responsible (and accountable) for its success and therefore more inclined to favor it. Disentangling these effects is not feasible with our data set and goes beyond the current study, but it would be a very interesting project for future research.

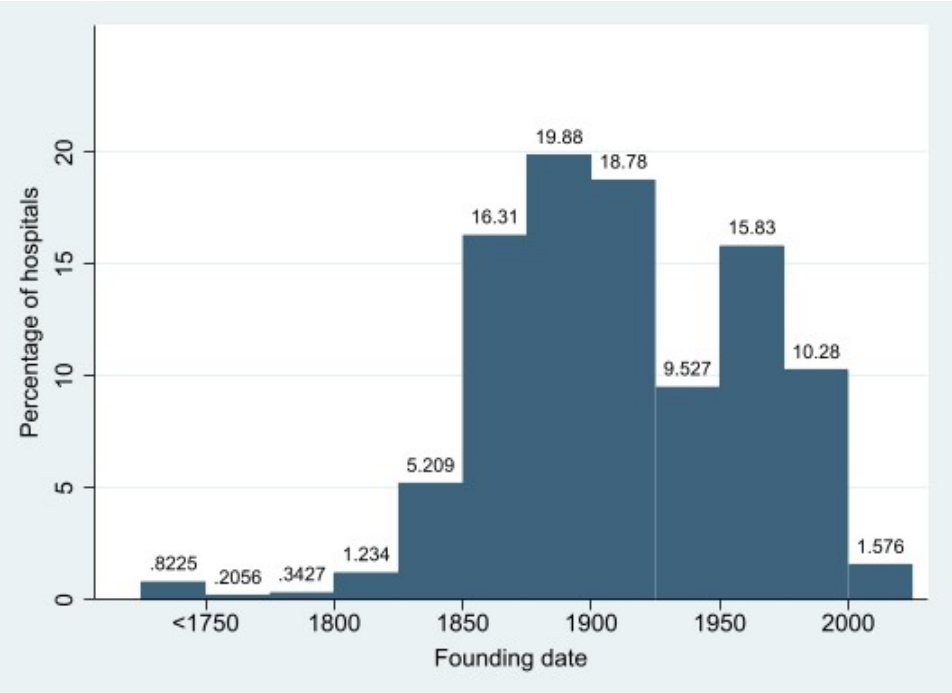
5 Causal Evidence

5.1 Is Hospital Ownership as Good as Randomly Assigned?

To establish a causal impact of ownership on the amount of subsidies received from the stimulus money requires the identifying assumption that the error terms in our main regressions (described in Tables 2, 3 and 4) are uncorrelated with ownership status. In other words, ownership status has to be as good as randomly assigned. Looking at the historical context in which German hospitals were founded, this seems highly plausible. Most German hospitals were founded in the 19^{th} and early 20^{th} century and kept their ownership structure since then. Figure 2 shows the share of hospitals founded in each quarter century since 1750. Almost half (44%) were founded in the 19th century and another 28% between 1900 and 1950. While the

foundation dates are similarly distributed for public and private NFP hospitals, private FP hospitals have been founded somewhat more recently (see Figure C1 in the appendix). Of all hospitals, around 79% did not change ownership between being founded and 2009. Figure 3 plots the relationship between ownership type at foundation and in 2009, when the government subsidies were received. The raw correlation coefficient between the two variables is 0.55.

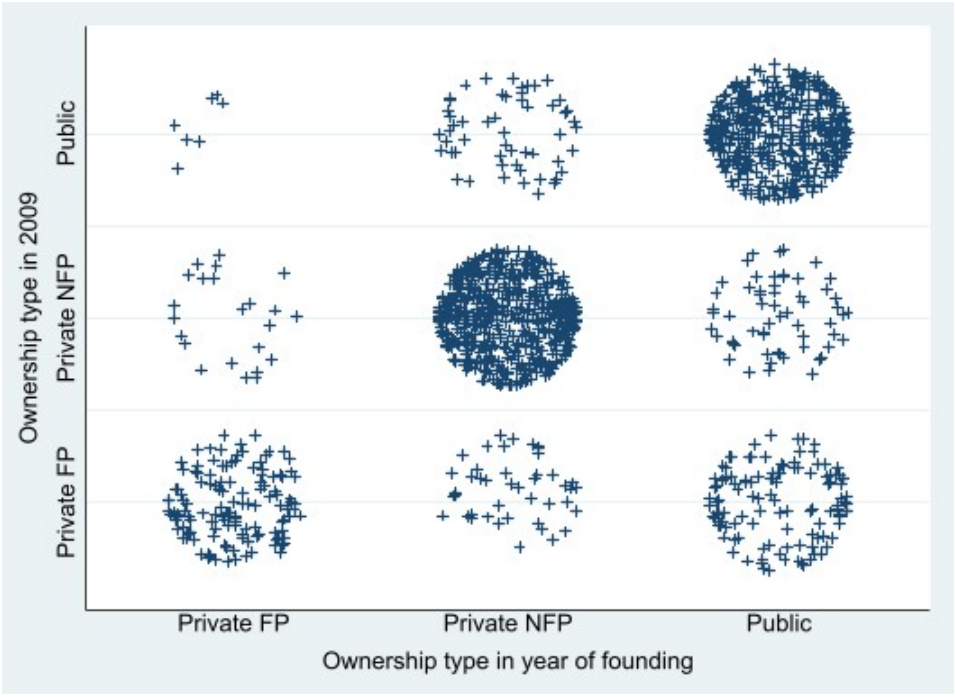
Figure 2: Founding dates of hospitals



Notes: Percentage of hospitals founded in each quarter of a century. Leftmost bar aggregates all hospitals founded prior to 1750.

What determined by whom a hospital was founded? Before the 19th century there existed only hospices run by churches or by religious orders. Old and sick people who did not have relatives to look after them and who could no longer support themselves would go there to be cared for and die. These hospices did not have the facilities to cure diseases. In the 19th century the first modern hospitals were founded with the explicit objective to cure people. However, the probability to catch an infection or a disease in a hospital was high, and everybody who could afford it and who could rely on the care of relatives would not go to a hospital but stay at home and perhaps pay a doctor for a visit. Hospitals were founded for the poor without family support, in particular for the many factory workers, craftsmen, maids and other service

Figure 3: Relationship of ownership at foundation and in 2009



Notes: Hospital ownership types in the founding year plotted against ownership type in 2009, when they received the aid payments. Circular dispersion of data points serves only to visualize the number of observations and has no independent interpretation.

staff moving to the cities who could not rely on a network of relatives and who could not afford medical care.[25]

The ownership structure of these hospitals depended on idiosyncratic local conditions. Sometimes a hospital grew out of a local hospice and was owned by the church or a religious order. Sometimes the municipality founded a hospital for its growing number of inhabitants. In some cases there was a donation of the local bishop or a local secular ruler on which a hospital was founded. After the Franco-German war (1870-71) organizations like the German Red Cross founded NFP hospitals to care for the wounded and for disabled persons. In industrialized regions (e.g. the Ruhr area) trade unions and labor organizations ("Arbeiterwohlfahrt") founded NFP hospitals to care for workers and their families.[26]

[25]See Spree (1999).

[26]The papers collected in Labisch and Spree (2001) offer fascinating spotlights on the development of hospitals in Germany in the 19th century. See also Figures C1 and C2 and Table **??** in the Appendix.

5.2 Using an Instrumental Variable Approach

We exploit the historical context to use ownership at foundation as an instrument for ownership in 2009. We argue that this instrument is relevant and exogenous.

For the instrument to be *relevant*, ownership at foundation has to be a good predictor of ownership in 2009. Figure 3 suggests that there is a strong relationship. This is confirmed by the first stage of the two stage least squares regression where we regress ownership type in 2009 on ownership type when the hospital was founded (and all other exogenous variables). We do this by running three separate first stage regressions, as shown in Table 7. Column (1) shows the first stage regression of the linear probability model that a hospital is private FP in 2009, given ownership type at founding. Columns (2) and (3) show the same for hospitals that are private NFP and public in 2009, respectively. This regression model does not have a constant to allow for all three dummies on ownership types to be included as regressors. As can be seen in Table 7, ownership type at foundation is highly predictive of ownership type in 2009. To test for underidentification and weak instruments formally, we report the Kleibergen-Paap rk LM statistic and the Kleibergen-Paap rk Wald F statistic in Table 8. The large test statistics in each case allow us to reject the null hypotheses that our model is underidentified or that our instruments are weak.

For the instrument to be *exogenous*, there must be no relationship between ownership at foundation and stimulus money received in 2009 after controlling for all observable exogenous variables. This is plausible because ownership at foundation was largely driven by historical factors long before stimulus money was paid out in 2009, as argued above. Reverse causality can be ruled out, and our main variables on the amount of funding received in 2009 are precisely measured, so measurement error is not an issue. Furthermore, it is difficult to come up with omitted variables that affected both the ownership structure at founding and the need for subsidies in 2009 after controlling for all the economic, social and demographic observables that we have. We present further evidence against an omitted variable in section 5.3 below.

Using ownership at foundation as a relevant and exogenous instrument for the ownership status in 2009, we run a two-stage least squares regression. Table 8 shows the results of the second stage. Columns (1), (2) and (3) of Table 8 show the results from the standard

Table 7: First-stage regressions

	(1) PNFP in 2009	(2) PFP in 2009	(3) Public in 2009
PNFP when founded	0.716***	0.139	0.145
	(0.19)	(0.14)	(0.17)
PFP when founded	0.084	0.846***	0.070
	(0.19)	(0.13)	(0.17)
Public when founded	0.090	0.317**	0.593***
	(0.19)	(0.14)	(0.17)
Beds in thsd	-0.120***	-0.089*	0.210***
	(0.04)	(0.05)	(0.06)
Number of departments	-0.001	-0.000	0.001
	(0.00)	(0.00)	(0.00)
Regional Controls	Yes	Yes	Yes
State FE	Yes	Yes	Yes
Founding period FE	Yes	Yes	Yes
Adj. R^2	0.785	0.530	0.743
Observations	1400	1400	1400

Notes: First stage regressions of the linear probability of the ownership type of a hospital in 2009 being PFP in Column (1), PNFP in column (2) or public in column (3) based on the instruments (ownership type when founded) and all exogenous regressors. Does not include a constant. Robust standard errors are reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

OLS regression on the subset of 1400 hospitals for which data on the founding date and ownership type at founding was available. The coefficients are very similar to those from our main regressions, suggesting that the restricted sample is not subject to any selection bias. Columns (4), (5) and (6) show the results of the IV regression. The effects are very similar in terms of sign and statistical significance to our main results, but most of the coefficients are somewhat larger.

According to the IV estimates, the probability of a private FP hospital to get funded at all is about 15ppt lower than for public hospitals, while private NFP hospitals receive funding at the same rate as public hospitals. However, private NFP hospitals receive almost € 700k less per project, which translates into around € 530k less in total average funds. Our IV estimates therefore support the conclusions drawn above and suggest that, if anything, the OLS analysis provides an underestimation of the true effect of ownership on subsidies received.

Table 8: IV Regression with 2SLS

	(1)	(2)	(3)	(4)	(5)	(6)
	OLS			IV		
	Total average funding	Linear Probability of funding	Per project funding	Total average funding	Linear Probability of funding	Per project funding
Private FP	-0.417**	-0.082**	-0.383*	-0.392	-0.153**	-0.394
	(0.19)	(0.03)	(0.22)	(0.31)	(0.07)	(0.34)
Private NFP	-0.358**	-0.007	-0.489***	-0.534*	-0.024	-0.701**
	(0.17)	(0.03)	(0.18)	(0.29)	(0.05)	(0.28)
Beds in thsd	2.873***	0.048	0.856**	2.802***	0.037	0.803**
	(0.75)	(0.07)	(0.36)	(0.79)	(0.07)	(0.37)
Number of departments	-0.008	0.025***	0.028	-0.007	0.025***	0.028
	(0.04)	(0.01)	(0.03)	(0.04)	(0.01)	(0.03)
Constant	0.383	0.657***	-1.767	0.493	0.687***	-1.630
	(0.60)	(0.20)	(1.29)	(0.56)	(0.20)	(1.27)
Regional Controls	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes
Founding period FE	Yes	Yes	Yes	Yes	Yes	Yes
Kleibergen-Paap rk LM statistic				149.01	149.01	57.88
Kleibergen-Paap rk Wald F statistic				135.84	135.84	57.64
Observations	1400	1400	1215	1400	1400	1215

Notes: Main OLS regressions vs. 2SLS regressions with ownership at founding as instrument for ownership in 2009 * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

5.3 District Fixed Effects

Despite the long time lags between the founding of most hospitals and the financial criscould be argued that there may be omitted variables affecting both the ownership structure at founding and the need for subsidies in 2009. For example, whether a region was mainly catholic or protestant, whether it was agricultural or industrialized, or whether it belonged to Prussia or to the southern states may have affected both the ownership status when founded, and affluence of the region in 2009, affecting the need of subsidies after the financial crisis. However, these factors should affect all hospitals in a given region equally. To control for this, we add fixed effects for the 33 districts (Regierungsbezirke) in Germany to our main regression.[27]

[27]We use the definitions of districts as they were in 2009. We also run a regression on the even more granular level of the 417 counties and municipalities in Table B7 in the appendix. A district comprises several counties but these counties tend to be similar in economic structure and to have a common historical background. For example, the state of Bavaria comprises catholic and protestant regions as well as regions that are very rich and rather poor. However the districts of, say, "Upper Bavaria" or "Lower Franconia" are much more homogenous. Note that only the states North Rhine Westphalia (5), Bavaria (7), Baden-Wurttemberg (4), Hessia (3) and Saxony (3) are subdivided into districts. The smaller territorial states and the city states do not have this additional layer, so we identify the district with the state.

	(1) Total average funding	(2) Linear Probability of funding	(3) Per project funding	(4) Total average funding	(5) Linear Probability of funding	(6) Per project funding
Private FP	-0.410**	-0.086**	-0.389*	-0.399**	-0.084**	-0.317
	(0.19)	(0.03)	(0.22)	(0.19)	(0.03)	(0.21)
Private NFP	-0.359**	-0.020	-0.476***	-0.362**	-0.025	-0.400**
	(0.17)	(0.03)	(0.18)	(0.17)	(0.03)	(0.18)
Beds in thsd	2.848***	0.039	0.892**	2.855***	0.037	0.901**
	(0.75)	(0.07)	(0.36)	(0.76)	(0.07)	(0.36)
Number of departments	-0.008	0.026***	0.025	-0.009	0.025***	0.024
	(0.04)	(0.01)	(0.03)	(0.04)	(0.01)	(0.03)
Constant	0.292	0.580***	-1.702	0.369	0.611***	-1.299
	(0.57)	(0.19)	(1.22)	(0.64)	(0.20)	(1.03)
Regional Controls	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	No	No	No
Region (Bezirk) FE	No	No	No	Yes	Yes	Yes
Founding period FE	Yes	Yes	Yes	Yes	Yes	Yes
Adj. R^2	0.171	0.442	0.400	0.167	0.452	0.429
Observations	1459	1459	1237	1459	1459	1237

Table 9: District Fixed Effects

Notes: OLS regression (total average funding, probability of funding and funding per project) using different fixed effects: state fixed effects in columns 1-3 (as in the previous analysis) and district fixed effects in columns 4-6. District fixed effects are based on 33 "Regierungsbezirke" (as defined in 2009). Robust standard errors reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

The regression results are reported in Table 9. Columns (1), (2) and (3) show the regression results for total average funding, linear probability and project funding for the full sample again to facilitate the comparison. Columns (4), (5) and (6) repeat the same analyses adding district level fixed effects. This has almost no effect on our results. The level of significance is slightly reduced on the two coefficients for per project funding. Given that controlling for more granular regional differences does not affect our outcomes, we conclude that regional differences are not acting as important omitted variables in our estimations. Based on this and the fact that ownership at foundation was largely driven by historical factors long before stimulus money was paid out in 2009, we conclude that the instrument is plausibly exogenous.

5.4 Recent Privatizations

Lastly, it could be argued that it is not ownership status itself causing the difference in treatment, but secondary effects resulting from ownership, such as poorer management quality driving the need for higher subsidies. In this robustness check, we consider hospitals that

changed their ownership type from public to private in the 5 years prior to the financial crisis, so since 2003. We compare the privatized hospitals (i.e. hospitals that were public in 2003 and private in 2009) to those hospitals that were public throughout this time period ("always public") and hospitals that were private throughout this period ("always private"). If our hypothesis is correct and funding decisions are causally driven by ownership status itself rather than any indirect secondary effects, we should see recently privatized hospitals to be treated exactly the same as hospitals that have always been private and thus receive less funding compared to hospitals that have always been public. If, on the other hand, some other factor were driving funding decisions that correlated with ownership, we would expect the treatment of recently privatized hospitals to be closer to that of "always public" hospitals, because its history of having been public should mean it is more similar to "always public" hospitals than to "always private" hospitals. Table 10 shows that recently privatized hospitals do indeed receive less funding than "always public" hospitals, indicated by the negative coefficients in columns (1) and (3), while there is almost no difference between recently privatized and "always private" hospitals, shown by the coefficients being close to 0 in columns (4), (5) and (6). This confirms our hypothesis.

	(1)	(2)	(3)	(4)	(5)	(6)
	Total average funding	Linear Probability of funding	Per project funding	Total average funding	Linear Probability of funding	Per project funding
was public now private	-0.399	0.032	-0.469*	0.060	0.031	-0.054
	(0.30)	(0.06)	(0.26)	(0.24)	(0.05)	(0.19)
Beds in thsd	2.956***	0.007	0.707	1.091***	0.031	1.143***
	(0.72)	(0.08)	(0.45)	(0.41)	(0.10)	(0.25)
Number of departments	0.025	0.033***	0.034	0.044	0.017**	-0.010
	(0.05)	(0.01)	(0.05)	(0.03)	(0.01)	(0.02)
Constant	1.253	0.415	-0.150	0.349	0.496***	0.235
	(1.42)	(0.28)	(1.38)	(0.62)	(0.16)	(0.74)
Regional Controls	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes
Adj.R^2	0.177	0.259	0.412	0.083	0.532	0.538
N	629	629	511	1064	1064	900
Reference group	*Always public*	*Always public*	*Always public*	*Always private*	*Always private*	*Always private*

Table 10: Recently privatized hospitlas (to private NFP)

Notes: OLS regression (total average funding, probability and funding per project) comparing the subsample of hospitals that were privatized between 2003 and 2009 to those that were always public (columns 1-3) or always private (columns 4-6). Robust standard errors reported in parentheses.

6 Implications: A Simple Model of Private versus Public Ownership

In this section we develop a simple model that highlights the main implications of our empirical result for the performance of publicly owned vs. privately owned firms.

Consider a firm that needs additional funds $I > 0$ in order to continue its operation. The firm generates two types of returns: private returns, x, that accrue to the owner and social returns or positive external effects, y, that accrue to other stakeholders of the firm or the general public. A private owner does not care about these external effects, but the government does. Importantly, based on our empirical results, we assume that if the government owns the firm, these positive external effects weigh more heavily in its objective function, i.e. they are multiplied by $\lambda > 1$.[28] The investment I can result in either success or failure. If the firm succeeds, it generates $x = \overline{x} > I$ and $y = \overline{y} > 0$. If the firm fails, it can either be shut down, in which case $x = y = 0$, or it can be kept in operation in which case $x = \underline{x} < 0$ and $y = \underline{y} > 0$. Failure happens with probability $p \in (0, 1)$. In the simplest version of the model p is exogenous, but it will be endogenized later.

The time structure is as follows. At date 0, the owner, i.e. either a private owner P or the government G, decides on the investment. If there is no investment the game ends and all parties get a payoff that is normalized to 0. If the investment takes place nature determines at date 1 whether the firm succeeds (S) or fails (F), where failure happens with probability p. If the firm fails, the government decides at date 2 whether to rescue the firm by covering losses $\underline{x}$. Note that it can rescue the firm no matter whether it is privately or publicly owned. Finally, at date 3, parties receive their payoffs.

In the following we restrict attention to the most interesting case where $\underline{x} + \underline{y} < 0$ but $\underline{x} + \lambda \underline{y} > 0$. In this case the government does not rescue the firm if the firm is privately owned, but it does rescue the firm if it owns it.

[28] In the hospital example, the positive external effects could be the consumer surplus (the health benefits) of the patients, the rents enjoyed by the employees on their jobs, or the benefits from landmark renovation or climate protection measures.

6.1 Exogenous Probability of Failure

Let us first characterize the welfare maximizing (first-best) allocation. Ex post social welfare is given by $W = x + y - I$. At date 2, the investment I is sunk. Thus, efficiency requires to continue operation if and only if $x + y > 0$, i.e. in case of success. Therefore, at date 0 the investment should be undertaken if and only if[29]

$$(1-p)[\overline{x}+\overline{y}] > I \quad \Leftrightarrow \quad p < \frac{\overline{x}+\overline{y}-I}{\overline{x}+\overline{y}} \equiv p^{FB} \ . \tag{1}$$

If the firm is privately owned, the private-owner does not want to continue operation at date 2 if the firm failed (because $\underline{x} < 0$) and the government does not want to rescue the firm (because $\underline{x} + \underline{y} < 0$), so the firm will be shut down which is efficient. At date 0, the private owner invests if and only if

$$(1-p)\overline{x} > I \quad \Leftrightarrow \quad p < \frac{\overline{x}-I}{\overline{x}} \equiv p^{P}. \tag{2}$$

If the firm is owned by the government, it will continue operation after failure, because the government will bail it out at date 2 ($\underline{x} + \lambda\underline{y} > 0$) which is inefficient. Anticipating this the government will invest if

$$(1-p)[\overline{x}+\lambda\overline{y}] + p[\underline{x}+\lambda\underline{y}] > I \quad \Leftrightarrow \quad p < \frac{\overline{x}+\lambda\overline{y}-I}{(\overline{x}+\lambda\overline{y})-(\underline{x}+\lambda\underline{y})} \equiv p^{G} \tag{3}$$

The first proposition shows that neither private nor government ownership achieves the first best, and that they deviate from the first best in opposite directions.

Proposition 1. *A privately owned firm does not invest often enough while a publicly owned firm invests too often, i.e.*

$$p^{P} < p^{FB} < p^{G} \ . \tag{4}$$

Furthermore, a publicly owned firm is rescued after failure which is inefficient.

The intuition for Proposition 1 is straightforward. With private ownership there is too little investment because the private owner ignores the positive externalities in case of success.

[29] In the following we ignore the non-generic cases where parameters give rise to equalities. In these cases it does not matter what is being done.

With government ownership there is too much investment because the government overweighs the positive externalities and rescues the firm in case of failure. The next proposition shows under which conditions private ownership outperforms public ownership and vice versa.

Proposition 2. *Let* $\hat{p} = \frac{\overline{x}+\overline{y}-I}{(\overline{x}+\overline{y})-(\underline{x}+\underline{y})}$ *where* $\hat{p} < p^{FB}$. *If* $\overline{y} > (I - \overline{x}) \cdot (\underline{x} + \underline{y})$, *then for all* $p \in (p^P, \hat{p})$ *public ownership outperforms private ownership. In all other cases social welfare with private ownership is weakly higher than with public ownership.*

Private ownership is clearly superior if p is small ($p < p^P$). In this case both types of owners invest, but the government rescues the firm in case of failure which is inefficient. Private ownership is also superior if p is large ($p > p^{FB}$). In this case investment is inefficient. The private owner does not invest while the government does (as long as $p < p^G$). The interesting case is when $p \in (p^P, p^{FB})$. In this case the investment is efficient but not profitable for a private investor. The government does invest, but it also rescues the firm in case of failure. Proposition 2 shows that government ownership can be strictly better than private ownership if the positive external effects in case of success ($\overline{y}$) are large as compared to the private losses in case of failure ($-\underline{x}$). Note that if $\overline{y}$ is small so that the condition in Proposition 2 is not satisfied, then $\hat{p} < p^P$ and private ownership is always optimal.

6.2 Endogenous Probability of Failure

We now endogenize the probability of failure. Suppose that the firm is run by a manager who can spend effort e in order to reduce the probability of failure from p to $p - e$ at personal cost $c(e) = \frac{1}{2}ke^2$. The manager's ex post utility is given by

$$U = w - \frac{1}{2}ke^2 \tag{5}$$

The manager receives a fixed wage $\bar{w} > 0$ as long as he is employed. If the firm is shut down he looses his job and receives a wage of 0. We assume that the manager's wage cannot be tied directly to the firm's performance, but only indirectly (if it is closed down). Note that the manager is risk neutral, but protected by limited liability, i.e. $w < 0$ is ruled out. The next proposition summarizes the optimal wages and effort choices under private and pubic ownership.

Proposition 3. *The manager spends more effort to reduce the probability of failure if the firm is privately owned than if it is publicly owned, i.e.*

$$e^P = \frac{\overline{x} - (1-p)k}{2k} > e^G = 0 \ . \tag{6}$$

Furthermore, he will be paid a higher wage by the private owner than by the government, i.e.

$$w^P = \frac{\overline{x} - (1-p)k}{2} > w^G = 0 \ . \tag{7}$$

The intuition is again straightforward. With private ownership the manager is motivated to spend effort in order to avoid that he loses his job in case of failure. With government ownership the manager anticipates that the firm will be bailed out, so there is no need to spend any effort. This is reflected in the wages that are paid.

This very simple model explains several "stylized" facts that have been documented in the empirical literature: Public ownership may be superior to private ownership if there are large positive externalities that cannot be realized under private ownership because the necessary investment are not sufficiently privately profitable. However, public ownership results in a soft-budget constraint: The firm will be bailed out too often if it fails. This in turn weakens the incentives of the management to work hard to reduce the probability of failure. Furthermore, managers of public companies are paid lower wages than managers of private companies.

All of theses predictions are derived from a single assumption, namely that the government cares more about the social benefits generated by a firm that it owns than by a firm that it does not own. This assumption is validated by our empirical analysis.

7 Conclusion

We have shown that public hospitals received much more generous funding from stimulus money than private NFP and FP hospitals that are similar in structure. Private FP hospitals are around 19.5% less likely to receive funding compared to public hospitals, while private NFP hospitals are equally likely to receive funding, but conditional on being funded receive around 38.9% less funding per project. After controlling for all relevant observables, this results in a lower average funding per hospital of around € 350k to € 400k for both private

NFP and private FP hospitals compared to public hospitals. Because the ownership status of the large majority of hospitals was determined by historical factors in the 19th and early 20th century long before the financial crisis, we argue that ownership is predetermined and as good as randomly assigned. An IV analysis using ownership when a hospital was founded as instrument for ownership in 2009 confirms our results and indicates that, if anything, our results underestimate the true causal effect of ownership on subsidy payments.

The result that state ownership biases government support has important and far reaching implications. It suggests that some of the concerns regarding extensive state ownership, such as the distortion of competition or the over-funding of publicly owned and under-funding of privately owned projects with large positive external effects, may be warranted. Furthermore, it can explain why state-owned firms face a soft-budget constraint, as first postulated by Kornai (1980). This can result in the management of a state-owned firm having insufficient incentives to reduce costs and inefficient companies being kept alive for too long. Finally, it shows that the legal provisions that prevent governments in many industrialized countries from giving preferential treatment to state-owned firms are warranted and need to be strictly enforced.However, there are many ways how a government can support a company it owns. Legal safeguards can prevent some but not all forms of preferential treatment. Governments should be aware of their biases and take into account their favoritism towards their own firms, both when granting state aid, but also when deciding to acquire ownership of companies to pursue industrial policy in the first place.

Our data hint at two mechanisms that might be driving the observed state favoritism, ideological reasons of left-leaning politicians as well as increased public scrutiny regarding the performance of public as opposed to private hospitals. A promising avenue for further research is to dig deeper into these mechanisms and shed more light on the reasons for the observed changes in government preference. Moreover, all public hospitals in our data set are fully state-owned. It would be an interesting topic for future research to determine if the intensity of government favoritism varies with the degree of ownership, given that many firms are not fully state-owned, but the state buys a fraction of the shares and thus becomes a partial owner.

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Appendix

A Proofs

Proof of Proposition 1. Note that

$$\frac{d\left(\frac{\overline{x}+\overline{y}-I}{\overline{x}+\overline{y}}\right)}{d\overline{y}} = \frac{(\overline{x}+\overline{y})-(\overline{x}+\overline{y}-I)}{(\overline{x}+\overline{y})^2} = \frac{I}{(\overline{x}+\overline{y})^2} > 0\ . \tag{A1}$$

Thus, because $\overline{y} > 0$, we have $p^P < p^{FB}$. Note further that

$$p^{FB} = \frac{\overline{x}+\overline{y}-I}{\overline{x}+\overline{y}} < \frac{\overline{x}+\lambda\overline{y}-I}{(\overline{x}+\lambda\overline{y})-(\underline{x}+\lambda\underline{y})} = p^G\ . \tag{A2}$$

This must be true because

$$p^{FB} = \frac{\overline{x}+\overline{y}-I}{\overline{x}+\overline{y}} < \frac{\overline{x}+\lambda\overline{y}-I}{\overline{x}+\lambda\overline{y}} \tag{A3}$$

by (A1) and

$$\frac{\overline{x}+\lambda\overline{y}-I}{\overline{x}+\lambda\overline{y}} < \frac{\overline{x}+\lambda\overline{y}-I}{(\overline{x}+\lambda\overline{y})-(\underline{x}+\lambda\underline{y})} = p^G \tag{A4}$$

because $\underline{x}+\lambda\underline{y} > 0$, so the denominator is reduced. □

Proof of Proposition 2. If the probability of failure is small ($p < p^P$), both types of owner invest, but the private owner does not rescue the firm in case of failure while the government does. Therefore, private ownership is strictly better. If the probability of failure is large ($p < p^{FB}$), then the investment is inefficient. The private owner does not invest, while the government does invest if $p \in (p^{FB}, p^G)$ and the government rescues in case of failure, so again private ownership is strictly better. If $p > p^G$ nobody invests and both types of ownership are equally good.

The interesting case is if $p \in (p^P, p^{FB})$, i.e. the private owner does not invest, but investment would be efficient. If the government owns the firm, it does invest, but it will also rescue the firm in case of failure. Government ownership outperforms private ownership in this case iff

$$(1-p)(\overline{x}+\overline{y})+(\underline{x}+\underline{y})-I>0 \quad \Leftrightarrow \quad p<\hat{p}=\frac{\overline{x}+\overline{y}-I}{(\overline{x}+\overline{y})-(\underline{x}+\underline{y})}\ . \tag{A5}$$

Note that

$$\hat{p} = \frac{\overline{x} + \overline{y} - I}{(\overline{x} + \overline{y}) - (\underline{x} + \underline{y})} < \frac{\overline{x} + \overline{y} - I}{\overline{x} + \overline{y}} = p^{FB} \tag{A6}$$

because the numerator is the same while the denominator is larger on the left hand side. Furthermore,

$$p^P = \frac{\overline{x} - I}{\overline{x}} < \frac{\overline{x} + \overline{y} - I}{(\overline{x} + \overline{y}) - (\underline{x} + \underline{y})} = \tilde{p} \tag{A7}$$

if and only if

$$\begin{aligned}
& & (\overline{x} - I)[(\overline{x} + \overline{y}) - (\underline{x} + \underline{y})] &< \overline{x}^2 + \overline{x} \cdot \overline{y} - I \cdot \overline{x} \\
\Leftrightarrow \quad & \overline{x}^2 + \overline{x} \cdot \overline{y} - \overline{x} \cdot \underline{x} - \overline{x} \cdot \underline{y} - I \cdot \overline{x} - I \cdot \overline{y} + I \cdot \underline{x} + I \cdot \underline{y} &< \overline{x}^2 + \overline{x} \cdot \overline{y} - I \cdot \overline{x} \\
& \Leftrightarrow \quad \underbrace{(I - \overline{x})}_{<0} \underbrace{(\underline{x} + \underline{y})}_{<0} &< I \cdot \overline{y} \\
& \Leftrightarrow \quad \frac{(I - \overline{x})(\underline{x} + \underline{y})}{I} &< \overline{y}
\end{aligned} \tag{A8}$$

Thus, if inequality (A8) holds and $p \in (p^P, \hat{p})$, then governemnt ownership strictly outperforms private ownership. If $p > \hat{p}$ or if inequality (A8) does not hold, private ownership is better. □

Proof of Proposition 3. Under private ownership the manager chooses e to maximize

$$U = (1 - p + e)w - \frac{1}{2}ke^2 \tag{A9}$$

The optimal effort level is characterized by the first order condition

$$\frac{\partial U}{\partial e} = w - ke = 0 \quad \Leftrightarrow \quad e^P = w/k \quad \Leftrightarrow \quad w = ke^P \ . \tag{A10}$$

The private owner choose the w in order to maximize his profits

$$\Pi = (1 - p + e)(\overline{x} - w) - I = (1 - p + e)(\overline{x} - ke) - I \tag{A11}$$

Thus, the firm will implement an effort level that is characterized by

$$\frac{\partial \Pi}{\partial e} = \overline{x} - ke - k(1 - p + e) = 0 \quad \Leftrightarrow \quad e^P = \frac{\overline{x} - (1 - p)k}{2k}. \tag{A12}$$

For this it has to pay $w^P = ke^P = \frac{\overline{x} - (1-p)k}{2k}$.

If the government owns the firm, the manager anticipates that the government will rescue the firm in case of failure, so his expected utility is

$$U = (1 - p + e)w + (p - e)w - \frac{1}{2}ke^2 = w - \frac{1}{2}ke^2. \tag{A13}$$

Hence the manager has no incentive to spend effort and chooses $e^G = 0$ for which he gets paid $w^G = 0$. □

B Additional Tables

B.1 Descriptive Statistics: Balance Table

Table B1 shows that there are some differences between hospitals of different ownership types, such as their size (number of beds, departments, employees per bed) and their financial performance (esp. EBITDA margin), as well as between the demographic, regional, and political characteristics of the counties in which they are located. We therefore control for these variables in our regressions.

B.2 Multiple Projects per Hospital

Table B2 shows that there was no difference in the number of projects funded per hospital by ownership type, with all hospitals receiving funding for 1-2 projects on average.

Table B1: Descriptive statistics and full balance table

	(1)	(2)	(3)	(4)	(5)
	Private FP	Private NFP	Public	Diff private FP - public	Diff private NFP - public
Number of beds	194.98	242.71	344.11	-149.13***	-101.40***
	(203.09)	(171.44)	(331.56)	(17.39)	(15.18)
Number of departments	3.36	4.08	5.27	-1.91***	-1.19***
	(3.00)	(2.52)	(3.55)	(0.22)	(0.18)
Fixed assets in mio per bed (4yr mean)	0.15	0.14	0.13	0.02	0.01
	(0.21)	(0.23)	(0.08)	(0.03)	(0.02)
Ebitda margin (4yr mean)	0.09	0.06	0.07	0.03***	-0.00
	(0.06)	(0.03)	(0.04)	(0.01)	(0.00)
Operating revenue in mio per bed (4yr mean)	0.21	0.21	0.16	0.05	0.04
	(0.35)	(0.30)	(0.06)	(0.05)	(0.03)
Long-term debt in mio per bed (4yr mean)	0.02	0.02	0.02	0.01	0.00
	(0.03)	(0.05)	(0.03)	(0.01)	(0.01)
Number of employees per bed (4yr mean)	2.66	2.64	1.90	0.76	0.74**
	(5.37)	(3.72)	(1.00)	(0.81)	(0.36)
Share of public hospitals in county	0.23	0.20	0.62	-0.39***	-0.43***
	(0.23)	(0.20)	(0.28)	(0.02)	(0.01)
Unemployment rate	8.33	8.60	7.26	1.08***	1.35***
	(3.38)	(3.05)	(3.36)	(0.23)	(0.18)
Share of inhabitants 65+	21.12	20.59	20.82	0.30*	-0.23*
	(2.33)	(2.11)	(2.18)	(0.15)	(0.12)
Hospital beds per 1000 inhabitants	6.75	7.25	6.40	0.35	0.86***
	(3.09)	(3.15)	(3.60)	(0.22)	(0.19)
Urban	0.54	0.75	0.54	0.00	0.22***
	(0.50)	(0.43)	(0.50)	(0.03)	(0.03)
Population density	0.81	1.05	0.56	0.26***	0.50***
	(1.17)	(1.13)	(0.78)	(0.07)	(0.05)
GDP per capita	29.87	31.08	29.27	0.59	1.80***
	(13.76)	(12.95)	(12.03)	(0.88)	(0.70)
East	0.23	0.10	0.14	0.08***	-0.04**
	(0.42)	(0.30)	(0.35)	(0.03)	(0.02)
SPD MP	0.14	0.17	0.08	0.06***	0.10***
	(0.35)	(0.38)	(0.26)	(0.02)	(0.02)
SPD or LINKE Mayor or LR	0.35	0.39	0.29	0.07**	0.10***
	(0.48)	(0.49)	(0.45)	(0.03)	(0.03)
Election year	0.61	0.82	0.54	0.07**	0.29***
	(0.49)	(0.38)	(0.50)	(0.03)	(0.03)
Communal debt in EUR per inhabitant	1.48	1.96	1.43	0.04	0.53***
	(1.00)	(1.33)	(1.03)	(0.07)	(0.07)

Notes: This table shows the mean and standard deviation (in parentheses) of each control variable by ownership type in columns (1)-(3). Columns (4) and (5) show the coefficient of a simple regression of each control variable on a dummy indicating ownership (in a restricted sample including only private FP and public hospitals in column (4) and only private NFP and public hospitals in column (5)). Robust standard errors of these regressions are reported in parentheses. Stars indicate statistical significance of the differences. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

B.3 Department Fixed Effects

In the main regressions, we control for the number of departments, but it may also be relevant which kinds of department a hospital has. We control for department fixed effects in Table B3 and show that it makes no difference to the magnitude or the level of significance of the coefficients and does not change the interpretation of our results.

Table B2: Number of funded projects per hospital

	(1)	(2)	(3)	(4)
	Number of projects funded per hospital			
Private FP	-0.073	0.088	-0.123	-0.060
	(0.21)	(0.28)	(0.29)	(0.30)
Private NFP	0.042	0.143	0.061	0.125
	(0.17)	(0.26)	(0.24)	(0.23)
Beds in thsd		0.573**	0.523**	0.544**
		(0.24)	(0.26)	(0.22)
Number of departments		0.048	0.068	0.031
		(0.04)	(0.04)	(0.04)
Constant	1.802***	0.404	2.453	2.631
	(0.13)	(1.01)	(1.65)	(1.74)
Regional Controls	No	Yes	Yes	Yes
State FE	No	No	Yes	Yes
Founding period FE	No	No	No	Yes
Adj. R^2	-0.002	0.023	0.082	0.079
Observations	751	751	751	679

Notes: OLS regression of the number of projects for which each hospital received funds. Column (1) shows OLS estimates without controls, column (2) adds number of beds, number of departments and regional controls on the county level (share of public hospitals, unemployment rate, share of inhabitants aged 65+, number of hospital beds per 1000 inhabitants, urban dummy, population density, GDP per capita). Column (3) adds state fixed effects. Column (4) adds fixed effects for the quarter century in which the hospital was founded. Only includes the subset of hospitals that received any funding at all, consisting of 92 PFP, 402 PNFP and 257 public hospitals in columns (1)-(3) and 80 PFP, 372 PNFP and 227 public hospitals in column (4). Robust standard errors are reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table B3: Department fixed effects

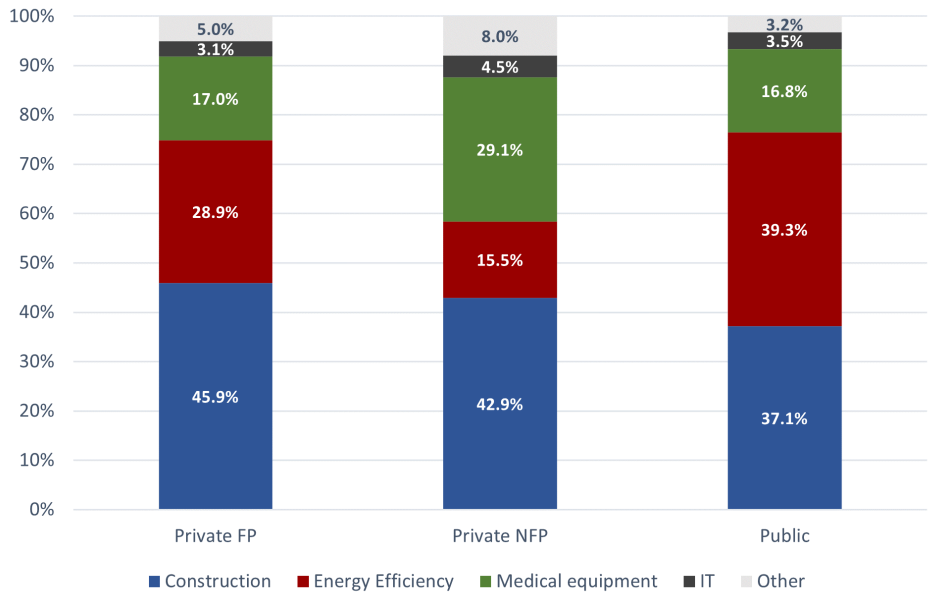
	(1) Total average funding	(2) Linear Probability of funding	(3) Per project funding
Private FP	-0.419**	-0.074**	-0.387*
	(0.19)	(0.03)	(0.23)
Private NFP	-0.393**	-0.023	-0.452***
	(0.17)	(0.03)	(0.17)
Beds in thsd	2.677***	0.099	0.519
	(0.77)	(0.09)	(0.40)
Number of departments	0.081	0.026	-0.077
	(0.17)	(0.03)	(0.14)
Constant	0.275	0.532***	-1.301
	(0.61)	(0.19)	(1.25)
Regional Controls	Yes	Yes	Yes
State FE	Yes	Yes	Yes
Hosp. Dept. fixed effects	Yes	Yes	Yes
Founding period FE	Yes	Yes	Yes
Adj. R^2	0.179	0.445	0.408
Observations	1459	1459	1237

Notes: OLS regression (total average funding, probability and funding per project) including department fixed effects, i.e. a dummy variable for each department a hospital has. 21 different departments are included. Robust standard errors reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

B.4 Categories of Projects

Figure B1 shows the share of approved projects in each category by ownership types. Public hospitals engage more in energy efficiency measures than private hospitals. Private NFP hospitals procure more medical equipment, while both private FP and private NFP hospitals spend more on construction measures than public hospitals. The shares of projects on IT infrastructure or other projects are similar.

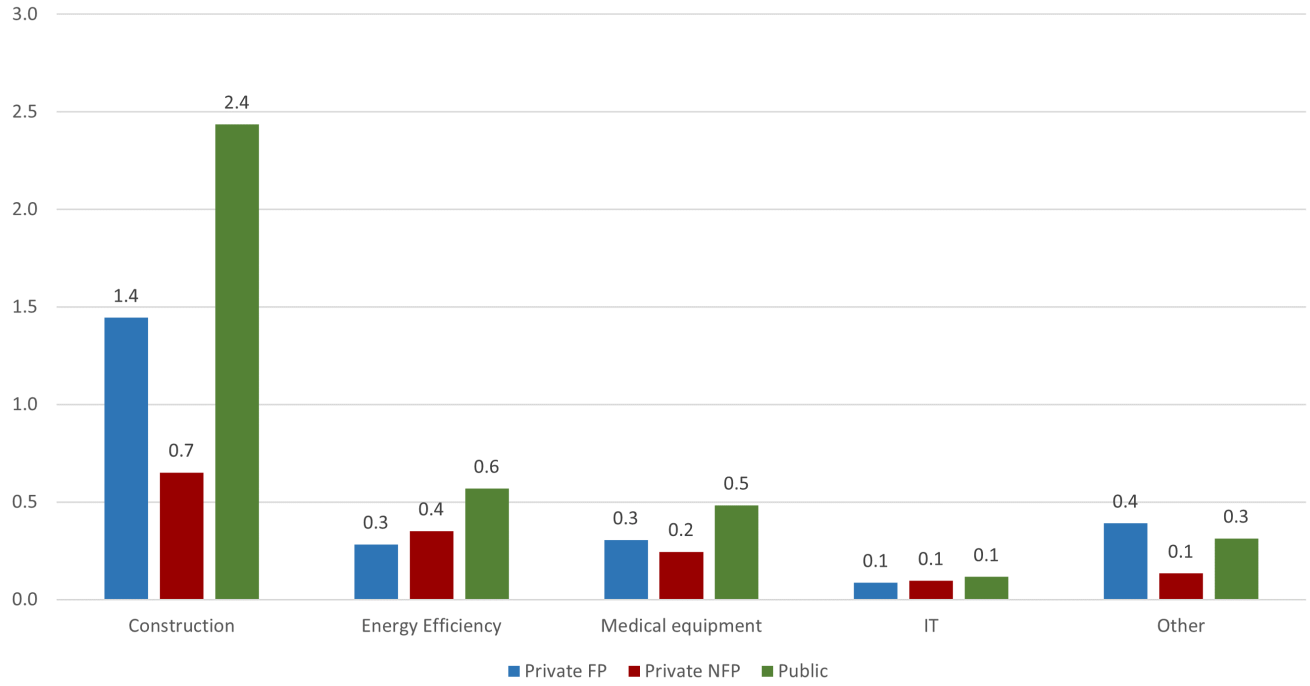
Figure B1: Financed projects by category



Notes: Financed projects by the 5 categories: construction, energy efficiency, medical equipment, IT and other, for each ownership type. Shares in percent of all funded projects per ownership type. Includes 159 projects of private FP, 741 of private NFP and 463 of public hospitals.

If buying medical equipment were significantly cheaper than energy efficiency measures, this could explain why private NFP hospitals received less funding. However, Figure B2 illustrates that this is not the case. Moreover, Figure B2 shows that the average funding received by public hospitals is, in fact, larger for all project categories. Thus, differences in the costs of different project types cannot explain the difference in funding received by public NFP hospitals, as they receive fewer funds across the board (and especially for construction measures, which make up the majority of measures for all ownership types).

Figure B2: Average funding per project by project category



Notes: Average funding received per project in a given category (construction, energy efficiency, medical equiment, IT, other), by ownership type. Figures are in Mio EUR.

B.5 Financial Controls

In the main regressions, we constructed financial controls as the averages across four years from 2006-2009. To ensure that our findings are not dependent on the specific years chosen, we repeat the analysis with three different specifications: using the year 2007 only, using the 3-year average from 2007-2009, and using the 5-year average from 2005-2009. Neither specification changes the interpretation of our results.

Table B4: Using financial controls from 2007 only

	(1)	(2)	(3)	(4)	(5)	(6)
	Main regression *(restricted sample)*			Including Financial Controls		
	Total average funding	Linear Probability of funding	Per project funding	Total average funding	Linear Probability of funding	Per project funding
Private FP	-0.889**	-0.196***	-0.074	-0.788**	-0.196***	0.016
	(0.39)	(0.06)	(0.46)	(0.37)	(0.06)	(0.39)
Private NFP	-0.689*	-0.094	-0.100	-0.673*	-0.099*	-0.041
	(0.37)	(0.06)	(0.24)	(0.37)	(0.06)	(0.25)
Beds in thsd	1.958*	0.003	0.301	2.033*	-0.006	0.238
	(1.08)	(0.14)	(0.34)	(1.12)	(0.14)	(0.36)
Number of departments	0.071	0.018	0.090**	0.064	0.017	0.081*
	(0.06)	(0.01)	(0.04)	(0.06)	(0.01)	(0.04)
Fixed assets in mio per bed (in 2007)				1.381	0.102	-0.589
				(1.76)	(0.29)	(1.30)
EBITDA margin (in 2007)				-0.155	0.004	-0.853
				(0.12)	(0.01)	(0.65)
Operating revenue in mio per bed (in 2007)				-0.681	0.146	1.559
				(1.17)	(0.32)	(3.11)
Long term debt in mio per bed (in 2007)				-3.195	-0.884	4.291
				(3.90)	(0.65)	(4.41)
Number of employees per bed (in 2007)				0.001	-0.021	-0.105
				(0.07)	(0.02)	(0.13)
Constant	1.837*	0.407	0.050	1.947*	0.417	0.503
	(1.10)	(0.25)	(1.13)	(1.09)	(0.26)	(1.14)
Regional Controls	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes
Founding period FE	Yes	Yes	Yes	Yes	Yes	Yes
Adj. R^2	0.273	0.576	0.576	0.268	0.577	0.584
Observations	356	356	378	356	356	378

Notes: OLS regression (total average funding, probability and funding per project) with financial controls, using only the year 2007 as input for the financial controls. Columns (1)-(3) replicate the main regressions in the restricted sub-sample containing only those hospitals for which financial data from 2007 is available, financial controls are added in columns (4)-(6). The sample includes 58 private FP, 172 private NFP and 126 public hospitals. Robust standard errors reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table B5: Using financial controls from 2007-2009 (3-year mean)

	(1)	(2)	(3)	(4)	(5)	(6)
	Main regression *(restricted sample)*			Including Financial Controls		
	Total average funding	Linear Probability of funding	Per project funding	Total average funding	Linear Probability of funding	Per project funding
Private FP	-0.662	-0.207***	-0.047	-0.557	-0.192***	-0.087
	(0.43)	(0.07)	(0.48)	(0.42)	(0.07)	(0.44)
Private NFP	-0.661	-0.096	-0.194	-0.668	-0.109*	-0.198
	(0.42)	(0.06)	(0.28)	(0.42)	(0.06)	(0.31)
Beds in thsd	1.976*	0.012	0.346	2.007*	-0.017	0.379
	(1.10)	(0.15)	(0.36)	(1.19)	(0.15)	(0.37)
Number of departments	0.046	0.017	0.057	0.038	0.014	0.054
	(0.06)	(0.01)	(0.04)	(0.06)	(0.01)	(0.04)
Fixed assets in mio per bed (3yr average)				1.793	-0.149	1.400
				(2.61)	(0.33)	(1.76)
EBITDA margin (3yr average)				-2.790	-0.922***	-1.090
				(2.04)	(0.35)	(1.96)
Operating revenue in mio per bed (3yr average)				0.740	0.652	0.429
				(1.59)	(0.41)	(3.38)
Long term debt in mio per bed (3yr average)				-5.479	-0.573	-0.588
				(5.94)	(0.77)	(5.06)
Number of employees per bed (3yr average)				-0.125	-0.049*	-0.089
				(0.10)	(0.03)	(0.13)
Constant	1.439	0.537**	-0.355	2.064*	0.727**	-0.232
	(1.15)	(0.27)	(1.12)	(1.23)	(0.28)	(1.14)
Regional Controls	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes
Founding period FE	Yes	Yes	Yes	Yes	Yes	Yes
Adj. R^2	0.316	0.579	0.595	0.311	0.589	0.589
Observations	303	303	334	303	303	334

Notes: OLS regression (total average funding, probability and funding per project) with financial controls, using the 3-year average across the years 2007-2009 as input for the financial controls. Columns (1)-(3) replicate the main regressions in the restricted sub-sample containing only those hospitals for which financial data from 2007-2009 is available, financial controls are added in columns (4)-(6). The sample includes 42 private FP, 151 private NFP and 110 public hospitals. Robust standard errors reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table B6: Using financial controls from 2005-2009 (5-year mean)

	(1)	(2)	(3)	(4)	(5)	(6)
	Main regression *(restricted sample)*			Including Financial Controls		
	Total average funding	Linear Probability of funding	Per project funding	Total average funding	Linear Probability of funding	Per project funding
Private FP	-1.802*	-0.325***	-1.416	-1.792*	-0.315**	-0.147
	(0.92)	(0.12)	(1.13)	(0.93)	(0.13)	(0.79)
Private NFP	-1.799**	-0.254***	0.232	-1.788**	-0.257**	0.012
	(0.87)	(0.10)	(0.42)	(0.89)	(0.10)	(0.58)
Beds in thsd	1.395	0.047	-1.662	1.366	0.025	-0.993
	(1.46)	(0.21)	(1.03)	(1.46)	(0.22)	(0.73)
Number of departments	0.178	0.018	0.329**	0.168	0.015	0.291**
	(0.12)	(0.02)	(0.13)	(0.12)	(0.02)	(0.12)
Fixed assets in mio per bed (5yr average)				4.196	0.034	3.964
				(5.08)	(0.67)	(10.22)
EBITDA margin (5yr average)				-1.545	-0.872	-4.114
				(6.80)	(1.03)	(15.15)
Operating revenue in mio per bed (5yr average)				0.105	0.590	-22.320
				(3.47)	(0.79)	(14.55)
Long term debt in mio per bed (5yr average)				-11.371	-1.038	-10.821
				(14.58)	(1.87)	(11.92)
Number of employees per bed (5yr average)				-0.139	-0.045	0.951
				(0.27)	(0.05)	(0.82)
Constant	12.431***	0.136	4.352	13.780***	0.415	5.846
	(2.17)	(0.51)	(5.00)	(2.74)	(0.70)	(5.88)
Regional Controls	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes
Founding period FE	Yes	Yes	Yes	Yes	Yes	Yes
Adj. R^2	0.357	0.527	0.585	0.327	0.512	0.586
Observations	128	128	141	128	128	141

Notes: OLS regression (total average funding, probability and funding per project) with financial controls, using the 5-year average across the years 2005-2009 as input for the financial controls. Columns (1)-(3) replicate the main regressions in the restricted sub-sample containing only those hospitals for which financial data from 2005-2009 is available, financial controls are added in columns (4)-(6). The sample includes 23 private FP, 47 private NFP and 58 public hospitals. Robust standard errors reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

B.6 County fixed effects

Table B7: County fixed effects

	(1) Total average funding	(2) Linear Probability of funding	(3) Per project funding
Private FP	-0.537***	-0.080**	-0.486**
	(0.19)	(0.04)	(0.24)
Private NFP	-0.387**	-0.025	-0.314
	(0.18)	(0.04)	(0.20)
Beds in thsd	2.791***	0.063	1.079***
	(0.63)	(0.08)	(0.41)
Number of departments	-0.028	0.022***	-0.022
	(0.04)	(0.01)	(0.02)
Constant	-1.900**	-0.120	-0.053
	(0.80)	(0.15)	(0.40)
County (Landkreis) FE	Yes	Yes	Yes
Founding period FE	Yes	Yes	Yes
Adj. R^2	0.356	0.481	0.673
Observations	1459	1459	1237

Notes: OLS regression (total average funding, probability and funding per project) using county fixed effects insted of state fixed effects. County fixed effects are based on 417 counties, i.e. "Landkreise" and "kreisfreie Städte" (as defined in 2009). Robust standard errors reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

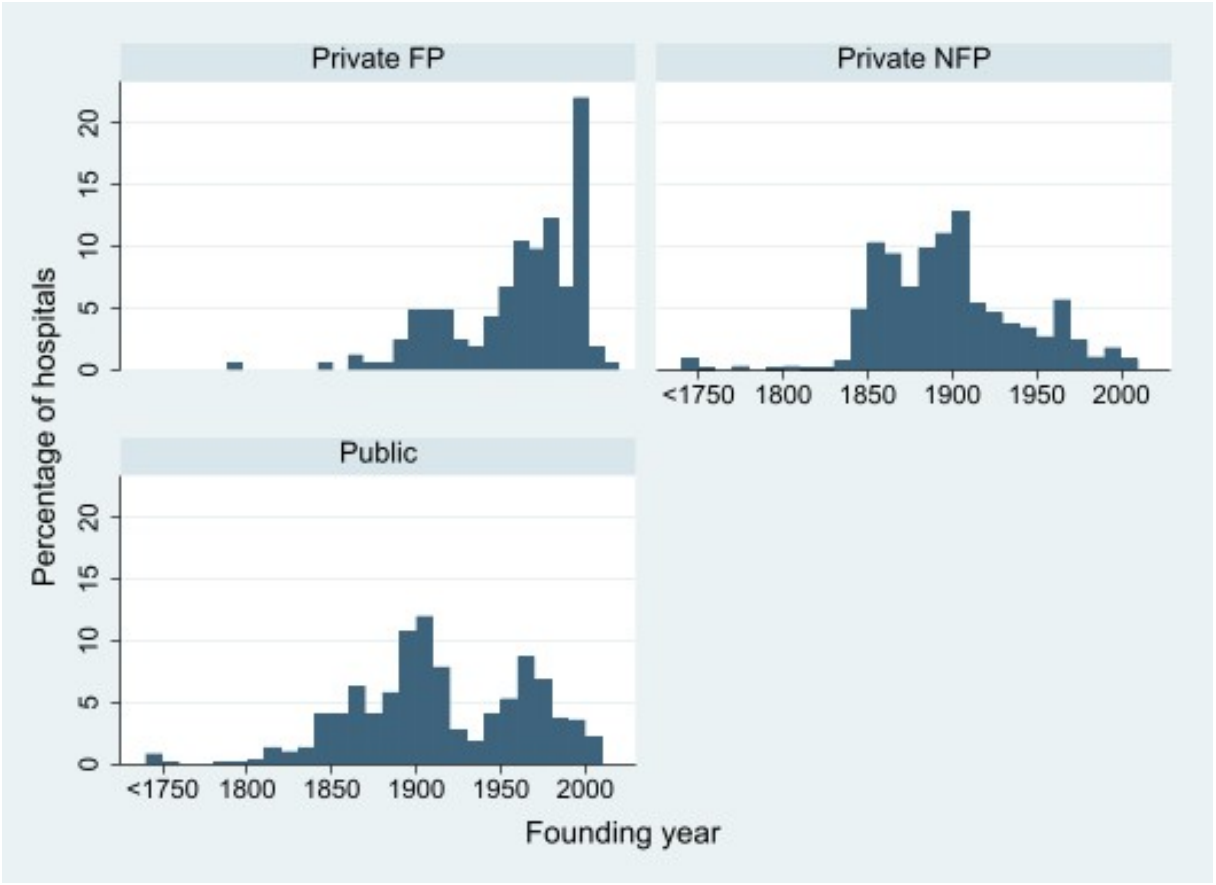
Table B7 shows that including more granular fixed effects on the county level instead of the state fixed effects used in the main regressions does not have any impact on the magnitude or level of significance of the coefficients or on the interpretation of our results.

C Additional Figures

C.1 Founding Dates

Figure C1 shows that the large majority of public and private NFP hospitals was founded in the 19^{th} and early 20^{th} century, while the majority of private FP hospitals was founded in the second half of the 20^{th} century.

Figure C1: Hospital founding dates by ownership types



Notes: Percentage of hospitals founded in each decade by ownership type. Leftmost bar aggregates all hospitals founded prior to 1750. Includes 1400 hospitals in total, 163 private FP, 658 private NFP, and 579 public (referring to ownership type in the founding year, not ownership type in 2009).

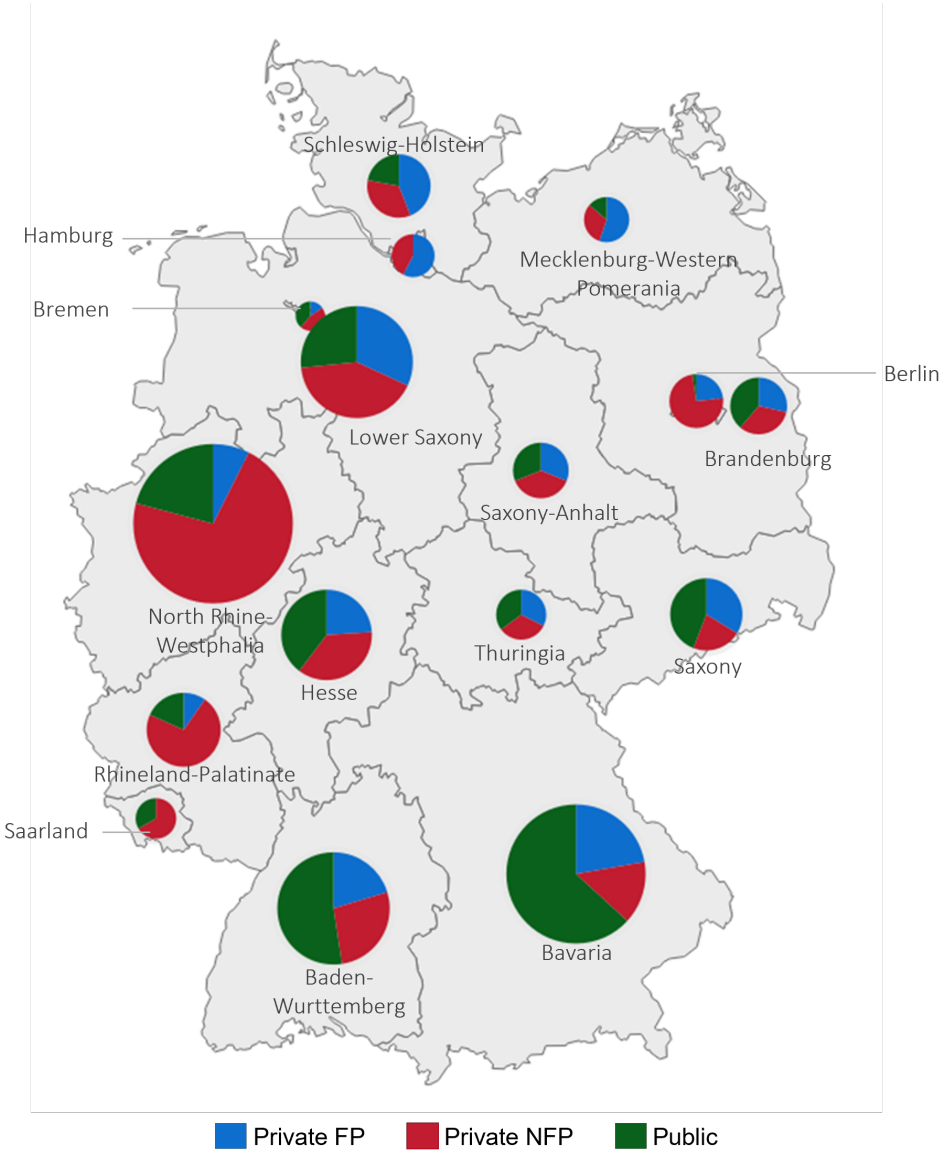
C.2 Distribution of Hospital Types accross Federal States

Figure C2 displays the shares of private FP, private NFP, and public hospitals in the 16 German states. These shares vary, but the variation is not related to the wealth or population density of a state. For example, there are no public hospitals in the rich city state of Hamburg, and very few in the poor city state of Berlin and in the poor rural state Mecklenburg-Western Pomerania. On the other hand, there is a large share of public hospitals in the prosperous territorial states Bavaria and Baden-Wurttemberg, but also in the poor city state Bremen and the poor territorial states Saarland and Thuringia. If anything, public hospitals tend to be more prevalent in the southern and south-eastern states. Private not-for-profit hospitals

dominate in the largest state of North Rhine Westphalia and in other states in the West, while the share of private for-profit hospitals tend be larger in northern and eastern Germany.

This may be explained by differences in the health insurance system introduced in the 19th century in the different states. In the southern states, many cities required factory

Figure C2: Distribution of ownership types across federal states



Notes: Map showing the share of hospitals by ownership types in each of the 16 German states. The size of the pie chart represents the total number of hospitals in each state.

workers, craftsmen and service staff to buy hospital insurance that would pay for the cost of hospitalization. In northern Germany, in particular in Prussia, mandatory health insurance was introduced in the 1860s. However, in the beginning this insurance covered only the loss of earnings if a person got sick or injured, but not the cost of hospitalization.[30] In southern Germany, municipalities may have been more inclined to found hospitals because the running cost could be recovered from the insurance, while in Northern Germany the foundation of hospitals was more often left to religious and charitable organizations. In eastern Germany the communist government did not expropriate hospitals but kept their nominal ownership structure that was reconstituted after reunification.

[30]See Spree (1995) for a survey of the history of hospitals in Germany in the 19$^{\text{th}}$ century.