CORPORATE GOVERNANCE AND SOCIAL IMPACT OF NON-PROFITS: EVIDENCE FROM A RANDOMIZED PROGRAM IN HEALTHCARE IN THE DEMOCRATIC REPUBLIC OF CONGO

ANICET A. FANGWA	CAROLINE FLAMMER	MARIEKE HUYSENTRUYT	BERTRAND V. QUÉLIN
HEC Paris	Boston University	HEC Paris	HEC Paris
anicet.fangwa@hec.edu	cflammer@bu.edu	huysentruyt@hec.fr	quelin@hec.fr

February 2020

ABSTRACT

How can non-profit organizations improve their governance to increase their social impact? This study examines the effectiveness of a bundle of governance mechanisms (consisting of pro-social incentives and auditing) in the context of a randomized governance program conducted in the Democratic Republic of Congo's healthcare sector. Within the program, a set of health centers were randomly assigned to a governance treatment while others were not. We find that the governance treatment leads to i) higher operating efficiency and ii) improvements in social performance (measured by a reduction in the occurrence of stillbirths and neonatal deaths). Furthermore, we find that funding is not a substitute for governance—health centers that only receive funding increase their scale, but do not show improvements in operating efficiency nor social performance. Overall, our results suggest that corporate governance plays an important role in achieving the non-profits' objectives and increasing the social impact of the funds invested.

Keywords: corporate governance; non-profit organizations; social impact; healthcare; Sustainable Development Goals (SDGs); developing countries; randomized experiment.

* We are grateful to Ruth Aguilera, Marco Becht, Vanessa Burbano, Olga Hawn, Natasha Hochberg, Steve Lydenberg, Mary-Hunter McDonnell, Ivan Png, Gui Deng Say, David Stolow, Haitao Yu, as well as seminar participants at Boston University, Georgia Institute of Technology, George Mason University, HEC Paris, IESE, Ivey, Lancaster University, Singapore Management University, Toulouse School of Economics, UCLA, University of Manchester, University of Zurich, UT Austin, the Ackerman Corporate Governance Conference (Tel Aviv), the Swiss Economists Abroad Conference (Geneva), and the Strategic Management Society Annual Conference (Minnesota) for helpful comments and suggestions. We thank Bluesquare for providing us with the health center data as well as their help and insights. This research is supported by a grant of the French National Research Agency (ANR) "Investissements d'Avenir" (LabEx Ecodec).

1. Introduction

A long-standing literature acknowledges the importance of corporate governance for firm performance and long-term success (for reviews, see Aguilera et al. 2016, Tirole 2006). The need for corporate governance arises from the separation between ownership and control, and the resulting agency conflict between shareholders (i.e., the owners) and the managers they hire. Indeed, as managers' interests might not be aligned with shareholders' interests (e.g., managers may have a preference for shirking), managers may act in a way that is detrimental to the firm and ultimately hurt firm value. To address this agency conflict, various governance mechanisms are used (e.g., performance pay, managerial ownership, takeover threats) that aim to better align managers' interests with those of the shareholders, thereby contributing towards the maximization of firm value.

While the spotlight of the academic literature has been on for-profit organizations, little is known about the governance of *non-profit* organizations. Non-profits are fundamentally different from for-profit organizations. By their very nature, non-profits pursue social as opposed to financial objectives. In this regard, an inherent feature of non-profits is the "non-distribution constraint" (Hansmann 1980)—that is, non-profits are not allowed to distribute profits to donors or employees; instead, any surplus they generate must be retained and devoted to their social objectives. A direct implication of this non-distribution constraint is that non-profits do not have owners. The investors who fund non-profits, through donations, do not have any claim to the non-profits' revenues and assets, nor do they have any control rights over the organization. Accordingly, many of the governance tools available to for-profits are not available to non-profits. As such, the insights gained from the existing literature on corporate governance offer only limited guidance to help us understand how to improve the governance of non-profit organizations.

Yet, understanding what governance mechanisms are available and effective for non-profits is an important question for academics and practitioners alike. Indeed, the non-profit sector represents a large part of the global economy. For example, the United Nations (2018a) report that non-profit organizations

account for about one-third of total employment in the social sector.[1] Every year, considerable efforts and large amounts of funds are invested in social and environmental causes aiming to, e.g., decrease maternal and infant mortality, reduce the number of malnourished children, provide more and better job opportunities for minorities and the long-term unemployed, reduce social unrest and violence, or mitigate climate change and protect the world's biodiversity. As such, these organizations constitute a major player in achieving the United Nations' Sustainable Development Goals (SDGs) which include, e.g., ending poverty, reducing hunger, promoting healthy lives and well-being, reducing inequalities, promoting the development of sustainable cities and communities, and addressing climate change. What is more, the efficient use of funds is also important for donors and impact investors who aim to make a difference in this world and maximize their funds' social impact. In sum, understanding what mechanisms are available and effective in improving the governance of non-profit organizations is important for the organizations per se, the donors and impact investors, as well as society at large and the natural environment.

The question of how to improve the governance of non-profits is difficult to answer, both theoretically and empirically. From a theoretical perspective, appropriate governance mechanisms need to be adopted that take into account the challenges and unique nature of non-profits. From an empirical perspective, there are two main obstacles. First, it is difficult to obtain fine-grained microdata on non-profit organizations, their governance, as well as their social impact. Second, even if detailed microdata were available, the adoption of governance practices is likely endogenous with respect to organizational outcomes—that is, unobservables may drive a spurious relationship between the adoption of different governance mechanisms and organizational outcomes. Addressing the endogeneity of governance requires a source of exogenous variation in the adoption of governance practices.

To overcome these obstacles, we study the governance of non-profits in the context of a randomized governance program implemented in the healthcare sector of the Democratic Republic of Congo (DRC).[2]

[1] In the U.S., the non-profit sector represents 5.5% of GDP and 9% of the labor force in 2010 (Urban Institute 2013).
[2] The program is conducted in the form of a randomized controlled trial (RCT). RCTs are widely used in economics to obtain a reliable identification of causal effects (e.g., Banerjee et al. 2007, Banerjee et al. 2015, Duflo, Dupas, and Kremer 2011).

In the DRC, primary healthcare services—and especially maternity and childbirth services—are administered in non-profit health centers spread across the country. The randomized governance program we exploit in this paper was administered in about 1,000 health centers at the beginning of 2017. Health centers in the program were randomly assigned to a treatment group and control group, respectively. While health centers in both groups received funding from the program, only those in the treatment group were subject to a "governance treatment" (consisting of pro-social incentives and auditing).[3] Hence, by design, this randomized governance program provides an ideal setup to study how the adoption of governance practices affects health centers' outcomes (e.g., their operating efficiency and social impact), holding everything else (including funding) constant.

Using a difference-in-differences methodology, we find that, within a 10-quarter period following the treatment, health centers in the treatment group experience significant improvements in both operating efficiency (captured by an increase in the number of services provided per employee) and social performance (captured by a reduction in the probability of stillbirths and neonatal deaths, respectively). These findings are consistent with our theoretical arguments predicting that the adoption of governance mechanisms (in the form of pro-social incentives and auditing) is beneficial to non-profits and contributes to their ability to achieve their intended social impact.

We also document that the benefits from the governance treatment are stronger for health centers in areas with a relatively low density of health centers. Arguably, the need for governance is higher in low-density areas—having fewer peers nearby reduces i) the competition for healthcare services (and the disciplinary role thereof), and ii) the potential for knowledge spillovers among health centers (e.g., in terms of sharing medical expertise and best practices).

In auxiliary analyses, we further examine whether funding can serve as a substitute for governance. To do so, we compare health centers in- and outside the randomized governance program. We refer to the latter group as the "outside group." Unlike the treatment group (i.e., health centers that receive both funding

[3] Pro-social incentives are a form of pay-for-social-performance. Specifically, additional funding is provided to the non-profit organization contingent on the organization's social performance. See section 2.2 for details.

and the governance treatment) and the control group (i.e., health centers that only receive funding), health centers in the outside group receive neither. Accordingly, by comparing the treatment group versus the outside group, we can estimate the impact of the combination of 'funding and governance' on health center outcomes. Similarly, by comparing the control group versus the outside group, we can measure the impact of 'funding as standalone.' This analysis reveals that funding is not a substitute for governance—health centers that only receive funding increase their scale, but do not show improvements in operating efficiency nor social performance. In contrast, health centers that receive both funding and the governance treatment improve both their scale as well as their operating efficiency and social performance.

Overall, our results suggest that corporate governance plays an important role in contributing to non-profits' objectives and increasing their social impact. Naturally, we caution that our findings are specific to the healthcare sector in a low-income country, and hence need not generalize to the overall non-profit sector. Nevertheless, studying this specific context is important—it speaks to the effective pursuit of one of the United Nations' SDG, namely the promotion of healthy lives and well-being, especially with respect to children's health. In the past years, major progress has been made in improving the health of millions of people, reducing premature deaths and increasing their life expectancy. In particular, according to the World Health Organization (WHO), the mortality rate of children under the age of five decreased from 9.3% (i.e., 93 deaths per 1,000 live births) in 1990, to 3.9% in 2017 (WHO 2018). This corresponds to a worldwide decline from 12.6 million deaths in 1990, to 5.4 million in 2017. Yet, despite this overall progress, stark disparities exist across regions and countries. In particular, Sub-Saharan Africa remains the region with the highest under-5 mortality rate in the world, with one child in thirteen dying before their fifth birthday—this is fourteen times higher than in high-income countries (WHO 2018). A similar picture arises with the mortality rate of infants under one-year old. As Figure 1 shows, the DRC is among the countries with the highest infant mortality rates in the world. An estimated 7% of infants died within the first year of their life in 2017, compared to 0.4% in France and 0.6% in the U.S. (United Nations 2018b). Reducing children mortality is of foremost importance, and this study helps inform how corporate governance can contribute to this objective.

----- Insert Figure 1 about here ----

In the following, we develop our theoretical arguments, describe the data and methodology, present the results, and conclude.

2. Theory and hypotheses

2.1 The nature of non-profit organizations and their governance challenges

A fundamental distinction between for-profit and non-profit organizations is their primary objective. While for-profit organizations aim to maximize firm value, the primary objective of non-profits is to maximize *social value* (with respect to the non-profit's specific social or environmental objective). Any profit generated by the non-profit has to be retained and devoted towards this objective; it cannot be distributed to the donors and employees. This "non-distribution" constraint is a defining feature of non-profits (Glaeser 2002, Hansmann 1980). It also implies that non-profits do not have owners (i.e., shareholders)—the non-distribution constraint ensures that the investors who fund non-profits, through donations, have no claim to the organization's profits. As such, the beneficiaries of non-profit organizations are society and the natural environment, as opposed to the providers of capital. These key differences between for-profit and non-profit organizations have important implications for the mitigation of governance challenges.

First, and in analogy to for-profit organizations, non-profits are subject to potential agency conflicts—i.e., the interests of the non-profits may not be aligned with those of their managers (and employees, respectively). In turn, this can lead to an inefficient use of the non-profits' resources, and undermine the non-profits' ability to pursue their social objective. While for-profit organizations can mitigate such agency conflicts through, e.g., profit-sharing incentives and equity-based compensation, such governance tools are not available to non-profits.[4] Indeed, the non-distribution constraint prevents non-profit organizations from distributing profits to their managers and employees, and from providing equity-

[4] This does not imply that non-profit organizations do not have governance structures. Notably, non-profits have boards, which are often composed of donors and their representatives. In fact, researchers have studied the role of non-profit boards (e.g., Aggarwal, Evans, and Nanda 2012, Bai 2013). However, as Glaeser (2002) highlights, the effectiveness of non-profit boards is limited, as they are "ultimately not accountable to shareholders or donors and they are generally self-perpetuating" (p. 2).

based compensation (as they cannot have shareholders). Moreover, and perhaps more importantly, providing incentives based on the organization's financial performance would defy the organization's purpose—it would (mis-)align managers' and employees' incentives with profit maximization as opposed to aligning them with social impact maximization.[5]

Second, managers and employees—especially in low-income countries where many non-profits operate—may suffer from a lack of knowledge on how to improve the organization's operating efficiency and the quality of services. For example, in the context of the health sector in the DRC, the WHO has identified several sources of inefficiencies such as lack of strategic and managerial planning, inadequate priorities in resource allocation, lack of transparency, lack of managerial competencies, and insufficient medical training of health workers (WHO 2015). These sources of inefficiencies are unlikely unique to the health sector in the DRC, but rather a common challenge found across sectors and across (low-income) countries.

Taken together, the above obstacles and unique nature of non-profit organizations highlight the challenge of designing appropriate governance mechanisms. Moreover, they raise the question of whether such governance mechanisms would be effective in improving the non-profits' operating efficiency and their ability to achieve their social objectives.[6]

2.2 Improving the governance of non-profit organizations, and the impact on operating efficiency and social outcomes

In the following, we explore the effectiveness of a bundle of governance mechanisms—consisting of pro-

[5] In addition, the provision of financial performance-based incentives could crowd out the motivation of intrinsically motivated managers and employees wishing to serve the organization's social cause (Bowles 2016, Cassar and Meier 2017, Gubler, Larkin, and Pierce 2016, Wrzesnieski et al. 2014).

[6] Another obstacle, which is specific to non-profits in low-income countries, is that countries may lag behind several of the United Nations' Sustainable Development Goals (SDGs). Indeed, taking the example of the healthcare sector in the DRC, the promotion of healthy lives and well-being is a complex issue that not only requires access to effective healthcare services, but also access to affordable and clean energy, clean water and sanitation, education, and the achievement of several other of the United Nations' SDGs. Achieving the SDGs is a complex task that likely takes a concerted effort by non-profits, for-profits, governments, and society more generally. As such, it is unclear whether an improvement in governance practices alone would bring about substantial improvements in non-profit organizations' operating efficiency and the quality of their services.

social incentives and auditing—for improving the non-profit organizations' operating efficiency and social outcomes.[7]

Pro-social incentives

To motivate managers and employees to use the non-profits' resources efficiently and maximize their social impact, donors (and other impact investors) can provide so-called "pro-social incentives." That is, additional funding is provided to the non-profit organization conditional on meeting specific social criteria. As such, pro-social incentives differ from the more traditional financial incentives in two ways: i) the additional funding is tied to social criteria instead of financial criteria, and ii) the direct beneficiary of pro-social incentives is the non-profit organization itself as opposed to the manager (and employee, respectively).

We expect pro-social incentives to motivate non-profit managers and employees—and hence mitigate potential agency issues—in two ways. First, by providing pro-social incentives, non-profits can leverage managers' and employees' intrinsic motivation to obtain additional funding for the non-profit's cause. Individuals may exert greater effort to help secure the additional funding for the organization because of the utility they obtain from the non-profit's social impact ("pure altruism") and the warm glow they may derive from financially contributing to the non-profit's social cause ("impure altruism").[8] This argument echoes well with the existing literature on for-profits in high-income countries. In particular, recent studies have shown that employees across various occupations (e.g., consultants, lawyers, and online workers) are willing to forgo financial compensation for the pursuit of "meaningful" work (e.g., Bode and Singh 2018, Burbano 2016, Carnahan, Kryscynski, and Olson 2017, Cassar 2019, Cassar and Meier 2018). Moreover, evidence from lab and online experiments suggests that pro-social incentives in the form of charitable

[7] Naturally, other governance mechanisms are available and potentially effective in the context of non-profit organizations. We focus on pro-social incentives and auditing, as these are the two governance mechanisms in the randomized governance program used in this study.

[8] In Andreoni's (1989) warm glow-giving framework, "pure altruists" are motivated solely by the desire to provide for a recipient, while "impure altruists" are motivated by the joy of giving (warm glow). Both forms of altruism are often at play, see Andreoni (1989).

contributions linked to the participants' work activity can increase their work effort (e.g., Imas 2014, Tonin and Vlassopoulos 2015).

Second, and in addition to these indirect benefits, we expect pro-social incentives to provide direct benefits to managers and employees. The additional funding allows non-profit organizations to, e.g., upgrade their equipment, provide training to their employees, pay higher wages, extend the scope of their services—all of which increase the attractiveness of the workplace and, as a result, can have a motivational effect on individuals' work behavior.[9] On top of the motivational aspect, providing employees and managers with training, upgraded equipment, etc., may empower them to further increase their productivity.

In sum, we expect pro-social incentives to increase the motivation and productivity of the non-profits' managers and employees, thereby improving the non-profits' operating efficiency and social performance.

Auditing

In addition to pro-social incentives, we also expect auditing to enhance non-profits' operating efficiency and social performance. Specifically, by conducting audits on a regular basis, independent third parties can verify that best practices and protocols are followed, adequate priorities are set in terms of resource allocation, a strategic and managerial plan is developed and pursued, and that the organization's practices and performance are correctly documented.[10, 11]

Moreover, given their business expertise, auditors can play an important role in providing feedback and recommendations to the non-profits' managers and employees, thereby acting as informal coaches.[12]

[9] Relatedly, non-financial benefits awarded to employees (e.g., through employer recognition, social visibility, or employee satisfaction programs) are found to motivate employees and improve their productivity (e.g., Ashraf, Bandiera, and Jack 2014, Ashraf, Bandiera, and Lee 2014, Dur, Non, and Roelfsema 2010, Flammer and Luo 2017, Gallus and Frey 2016, Gubler, Larkin, and Pierce 2017).

[10] For example, in the context of the DRC's healthcare sector, regular visits of independent auditors can ensure that general guidelines provided by the WHO are followed (PDSS 2016). In this regard, the WHO provides detailed recommendations on maternal and childhood healthcare, describing medical standards and requirements (in terms of staff and equipment) for each medical intervention performed at the health centers (WHO 2016).

[11] Relatedly, the accounting literature shows that auditing can improve the performance of for-profit firms (see, e.g., Aldamen et al. 2012, Chan and Li 2008).

[12] For instance, auditors of the DRC's health centers studied in this manuscript provide feedback to the audited health

Specifically, and as discussed in section 2.1, an inherent challenge faced by non-profits in low-income countries is to find competent managers and well-trained personnel.[13] Accordingly, by sharing valuable insights, auditors can help transfer best practices and improve the non-profits' effectiveness.

Overall, we expect that the governance bundle of pro-social incentives and auditing (henceforth, "governance mechanisms") enhances non-profits' operating efficiency as well as the quality of their services and, consequently, their social performance. This motivates the following hypotheses:

> HYPOTHESIS 1. *The implementation of governance mechanisms leads to improvements in non-profits' operating efficiency.*

> HYPOTHESIS 2. *The implementation of governance mechanisms leads to improvements in non-profits' social performance.*

2.3 Importance of governance mechanisms: the moderating role of the density of peer organizations

In the previous section, we argued that the adoption of a bundle of governance mechanisms—consisting of pro-social incentives and auditing—helps i) mitigate the non-profit's agency conflicts and ii) improve information flow and the sharing of valuable knowledge (e.g., with respect to best practices). This, in turn, contributes to improving the non-profit's operating efficiency and social performance.

These benefits from governance are likely to vary depending on the environment in which the non-profit operates. In particular—as we argue in this section—they may depend on the number of peer organizations located in close geographical proximity of the focal organization (i.e., the "density" of peer organizations). There are two main reasons.

First, information and knowledge are more easily shared when the geographic distance is smaller. In line with this argument, the existing literature finds that geographic proximity plays an important role in facilitating information flow and the diffusion of business practices (e.g., Abrahamson 1991, Forman,

centers in order to improve their operations and help them follow best practices (PDSS 2016).

[13] The lack of know-how can lead to, e.g., unrealistic planning, inefficient work deployment, inadequate priorities in resource allocation, improper interpretation and implementation of guidelines and procedures, and overall poor decision-making; all of which are likely to result in the inefficient use of the non-profit's already limited financial resources, inventory, and human capital.

Goldfarb, and Greenstein 2005, Galaskiewicz and Wasserman 1989). In this vein, non-profit organizations that are located closer to their peers are more likely to benefit from knowledge spillovers—i.e., the sharing of valuable knowledge and best practices among peers. In turn, this may reduce the need to improve the non-profit's expertise and operational know-how through targeted governance measures.

Second, non-profit organizations that have many peers in close proximity face higher competitive pressure, as their clientele can easily switch to the nearby peers. In this regard, competition can act as a disciplining device that mitigates agency issues—the threat of losing clientele pressures the non-profits' managers and employees to operate more efficiently and deliver higher-quality services, as they may otherwise go out of business.[14] As such, in areas with a higher density of peers, the disciplinary role of competition might reduce the need for governance improvements.[15]

Taken together, the above arguments imply that the need for governance might be stronger in areas with a lower density of peers—having fewer peers in close proximity reduces i) the potential for knowledge spillovers, and ii) competitive pressure. Accordingly, we expect the benefits from governance to be stronger for non-profits in areas with a lower density of peers. This leads to the following hypothesis:

> HYPOTHESIS 3. *The implementation of governance mechanisms is more effective (in terms of improving the non-profit's operating efficiency and social performance) in areas with a lower density of peers.*

2.4 The effectiveness of governance mechanisms vs. financial subsidies: complements or substitutes?

The above arguments suggest that pro-social incentives and auditing serve as effective governance mechanisms for non-profits. That being said, governance is only one dimension through which non-profits

[14] The argument that competition mitigates agency conflicts—and hence reduces the need for tight governance—has a long tradition in the economics literature (e.g., Alchian 1950, Stigler 1958). It traces back to Adam Smith's argument that "monopoly is a great enemy to good management" (Smith 1776, p. 163). Similarly, in their review of the governance literature, Shleifer and Vishny (1997) argue that "competition is probably the most powerful force towards economic efficiency in the world" (p. 738).

[15] In this vein, Bloom et al. (2015) show that higher competition among public hospitals in the U.K. increases their managerial quality. Relatedly, using data on U.S. publicly-traded companies, Giroud and Mueller (2010) show that firms in competitive industries benefit less from corporate governance.

can enhance their social impact. In addition to governance, donors (and other impact investors) can provide financial subsidies to the non-profits.[16] In this section, we discuss the potential complementarity (and substitutability, respectively) between governance and financial subsidies.

Financial subsidies can help non-profits alleviate financing constraints and invest in, e.g., the upgrading of their equipment, hiring more employees, and extending the scope of their services. Accordingly, we expect that the provision of financial subsidies in combination with the implementation of governance mechanisms leads to improvements in both i) the non-profit's scale of operations, as well as ii) the non-profit's operating efficiency and social performance. As such, financial subsidies and governance mechanisms likely serve as complements towards the objective of increasing the non-profit's overall social impact.

In contrast, the sole provision of financial subsidies (i.e., without improving the non-profit's governance) need not yield improvements along both dimensions. Indeed, given the challenges and unique nature of non-profits, the implementation of appropriate governance mechanisms that mitigate agency conflicts, foster knowledge transfer, and enhance competence building of managers and employees, are essential for improving the operating efficiency and social performance of non-profits. Thus, we expect that the sole provision of financial subsidies to non-profits—without improvements in governance—will likely increase the scale of the non-profits' operations, but without improving their operating efficiency nor the quality of their services. As such, financial subsidies are unlikely to be substitutes for the implementation of governance mechanisms. Overall, the above arguments motivate the following hypothesis:

> HYPOTHESIS 4. *Financial subsidies are complements (not substitutes) to the implementation of governance mechanisms in non-profit organizations.*

[16] In contrast to pro-social incentives, financial subsidies are not performance-based but rather paid as a lump sum.

3. Data

3.1 The PDSS program

Our baseline sample is obtained from the World Bank program "Projet de Développement du Système de Santé" (PDSS) administered in the Democratic Republic of Congo (DRC) as of the first quarter of 2017. The aim of the program is to help develop the DRC healthcare system, especially with regard to maternal and children's health.[17]

The PDSS program provides subsidies to selected health centers in 13 participating provinces in the DRC. (A map of the DRC and its provinces is provided in Figure 2.) The selection was made by a team of experts appointed by the World Bank, who assessed the health centers' suitability for the program.[18] The selected health centers were then randomly assigned into the treatment and control groups.[19] While health centers in both groups received subsidies from the program, only those in the treatment group received a "governance treatment." This governance treatment consisted of two components: i) pro-social incentives (i.e., the provision of additional funding to the health center conditional on meeting specific social objectives), and ii) auditing by independent third parties.[20]

----- Insert Figure 2 about here ----

By design, the PDSS program provides an ideal setup for our study. By comparing health centers that are randomly assigned to the treatment versus control group, we are able to identify the impact of the

[17] For a detailed description of the PDSS program, see PDSS (2016).
[18] Only health centers registered with the Ministry of Health were considered. Health centers can be public, private, or faith-based entities.
[19] The PDSS program refers to the treatment group as "subject group" and the control group as "referee group." In this paper, we deviate from the program's terminology and—in keeping with the terminology of randomized experiments—we simply refer to the two groups as treatment and control group.
[20] Pro-social incentives are administered in the form of a performance-based financing (PBF) contract. The PBF contract provides additional subsidies to the health center conditional on achieving pre-determined social objectives (e.g., higher quality of healthcare services, adherence to specific guidelines and best practices, conformity with quality standards). The assessment is conducted by a team of experts on the basis of a dedicated assessment grid. At the end of the evaluation, the center receives a score from 0 to 100%. The "subsidy bonus" is then computed as follows: i) if the score is below 50%, no subsidy bonus is provided; if the score is between 50% and 80%, the subsidy bonus is computed as the score × 25% × the initial subsidy; iii) if the score is higher than 80%, the subsidy bonus is computed as 25% × the initial subsidy. See PDSS (2016) for details.

governance intervention on health centers' operating efficiency and social performance, holding everything else—including subsidies—constant.[21]

A total of 999 health centers were included in the PDSS program, out of which 674 were assigned to the treatment group, and 325 to the control group.[22] For each health center, we have data for 10 quarters, ranging from the first quarter of 2017 (i.e., the quarter in which the PDSS program started) until the second quarter of 2019. The dataset includes detailed information on the health centers' operations (e.g., staff, number of consultations, number of births), along with the name and location of each health center.[23]

3.2 Outcome variables

Our objective is to study how the "governance treatment" affects health centers' outcomes. In the following, we describe the outcome variables.

Health center's operating efficiency

We compute a health center's operating efficiency as the number of primary healthcare services performed divided by the number of employees. This measure captures the health center's labor productivity (i.e., output per employee).[24]

Health center's employees

We use several variables to examine changes in the health center's staff. First, we use the total number of employees working at the health center. Second, we decompose this total into the number of doctors, nurses, and administrative personnel, respectively.[25]

---

[21] A potential concern with randomized controlled trials (RCTs) is the so-called "Hawthorne effect"—i.e., treated subjects might feel "observed" and alter their behavior in response (for reasons unrelated to the treatment), which could contaminate the experiment. Nevertheless, this concern is mitigated in our study since the World Bank personnel visits both the treated and control health centers. As such, the Hawthorne effect is unlikely to distort the experiment.
[22] Selected health centers were treated in 2016 in a pilot-like setting. Since we do not have pre-2017 data, those are not included in our analysis.
[23] These data are compiled by the Système National d'Information Sanitaire (SNIS) of the DRC's Ministry of Health.
[24] Health centers in our sample only offer primary healthcare services. Secondary healthcare services are typically administered at hospitals, often upon referrals from the health centers.
[25] Doctors are physicians who diagnose, prevent, and treat disease, illness, and injury. Nurses include generalist nurses,

Volume of healthcare services

To measure the volume (or "quantity") of healthcare services, we use the number of primary healthcare services performed.[26] Since antenatal care and childbirth are the main services performed at the health centers, we also use two other metrics: the number of maternity and childhood healthcare services performed, and the number of births.

Quality of healthcare services

To measure the quality of healthcare services, we focus on infant mortality at birth. This is a natural metric in our context since antenatal care and childbirth are the main services performed at the health centers. Infant mortality at birth can occur in two forms: stillbirth and neonatal death. Stillbirth refers to a baby born with no sign of life at or after 28 weeks of gestation; neonatal death refers to a baby who dies within the first 28 days of life (WHO 2019a, 2019b). We compute the ratio of stillborn babies to the total number of births (henceforth "share of stillbirths"), the ratio of neonatal deaths to the total number of births ("share of neonatal deaths"), and the complement ("share of live births"). These three ratios allow us to assess not only the quality of the childbirth services per se, but also the quality of antenatal care services. Indeed, medical research has shown that antenatal care reduces the likelihood of stillbirth and neonatal death (Adam et al. 2005, Hollowell et al. 2011). As such, the above measures capture the quality of the main services performed at the health centers.

3.3 Summary statistics

Table 1 provides summary statistics for the 999 health centers in the PDSS program. All statistics refer to the first quarter of 2017 (i.e., the quarter in which the program begins). On average, health centers in our sample performed 1,787 primary healthcare services (261 on a per employee basis). The vast majority (1,651 out of 1,787) were maternity and childhood healthcare services. As discussed above, antenatal care

anesthetists, and midwives. Administrative personnel include technicians, pharmacists, and other administrative staff (e.g., accountants, receptionists, and drivers).

[26] These services include, e.g., HIV antiretroviral drug treatments, screenings for HIV+ and TBC+, minor surgical interventions, family planning treatments, prenatal and postnatal consultations, births, and others.

and childbirth are the main services performed at the health centers. The summary statistics reflect this institutional feature of the DRC's health system.

----- Insert Table 1 about here ----

Other statistics are worth highlighting. The average number of employees is 7.4, consisting mainly of nurses and administrative personnel. The average (quarterly) number of births is 60.1, out of which 0.75% are stillbirths, and 0.46% neonatal deaths. The average health center receives a subsidy of CDF 43.4K, and generates revenues of CDF 376K.[27] Lastly, as can be seen from the bottom panel, the average health center is located in a health district of 204,409 inhabitants, and a health area of 11,135 inhabitants.[28]

To further illustrate the health centers from our sample, Figure 3 provides pictures featuring three of them.

----- Insert Figure 3 about here ----

3.4 Randomization tests

Our identification strategy relies on the random assignment of health centers to the treatment and control groups. Since randomization is a feature of the PDSS program, this requirement should hold by design.

To empirically assess the validity of the randomization, we can examine the covariate balance prior to the treatment—intuitively, if the assignment is truly random, there should be no systematic difference between health centers in the treatment and control groups based on pre-treatment characteristics.

We conduct this analysis in Table 2, where we report the same set of summary statistics as in Table 1, but separately for the 674 health centers in the treatment group and the 325 health centers in the control group. The statistics are again computed in the first quarter of 2017 (i.e., the quarter in which the PDSS program starts).[29] The last column of the table provides the *p*-value of the difference-in-means test for each

[27] The Congolese Democratic Franc (CDF) is the DRC's currency.
[28] The DRC is partitioned into 516 health districts (also called health "zones") and 8,504 health areas. The Appendix provides a description of the DRC's health system along with a characterization of the health districts and health areas, respectively.
[29] Strictly speaking, the pre-period would be the fourth quarter of 2016 (i.e., the quarter preceding the start of the program). However, we do not have access to the pre-2017 data. This nuance is unlikely to matter for our analysis,

covariate.

----- Insert Table 2 about here ----

As can be seen, there is no systematic difference between the treated and control health centers. For all covariates, the summary statistics are very similar in economic terms. They are similar in statistical terms as well—the difference-in-means is always insignificant with *p*-values ranging from 0.229 to 0.928.[30] Overall, the evidence in Table 2 confirms the random assignment of health centers.

This randomization is further illustrated in Figure 4, in which we plot the location of the health centers in the treatment group (blue markers) and control group (red markers). As is shown, the PDSS program does not span all DRC areas. Importantly, in those areas in which the PDSS program operates, there is no apparent imbalance between treated and control health centers.

----- Insert Figure 4 about here ----

3.5 Health centers outside the PDSS program ("outside" group)

As discussed above, our baseline sample consists of 999 health centers that were selected for the PDSS program. Out of those, 325 are in the control group (receiving PDSS funding) and 674 in the treatment group (receiving PDSS funding and the governance treatment).

In auxiliary analyses, we consider a third group of health centers, namely those that are not part of the PDSS program. We refer to this group as the "outside group" (i.e., health centers outside the PDSS program). By construction, the outside group does not receive any funding nor the governance intervention from the PDSS program. Accordingly, we can use the outside group to examine the relationship between financing and governance. Specifically, by comparing the treatment group (that receives funding and the governance treatment) versus the outside group (that receives neither), we can assess the benefits of the

though. When we examine the dynamics of the treatment effect, we find that it takes several quarters for the program to bring about significant changes in health center outcomes (see section 5.2).

[30] In particular, it is worth highlighting that there is no significant difference in terms of the subsidies received by the health centers (*p*-value = 0.365). This rules out the possibility that health centers in the treatment group may receive more funding from the PDSS program, and that a differential in funding (as opposed to the governance intervention) would explain our results.

'financing and governance' bundle. Similarly, by comparing the control group (that receives funding) versus the outside group, we can assess the effectiveness of 'financing only.'

Our dataset covers a total of 5,832 health centers in the outside group. Appendix Table A1 provides summary statistics for those. Compared to the 999 health centers in our sample, the "outside" health centers are on average smaller (5.4 versus 7.4 employees) and provide a lower volume of services (1,015 versus 1,787 primary healthcare services performed).

These differences are not surprising. Indeed, as described in section 3.1, inclusion in the PDSS program is not random. (What is random is the assignment to the treatment versus control group *within* the PDSS program.) Hence, a caveat of using the outside group is that we can no longer rely on randomization for identification. To mitigate this caveat, in the auxiliary analyses that rely on the "outside group," we use a nearest-neighbor matching in which health centers in the treatment group (and control group, respectively) are matched to health centers in the outside group based on a large set of observables. See section 4.2 for details.

4. Methodology

4.1 Difference-in-differences specification

To examine how the governance treatment affects health center outcomes, we use a difference-in-differences methodology. Our dataset spans 10 quarters, ranging from the start of the PDSS program in the first quarter of 2017 (henceforth, "Q1") until the second quarter of 2019 ("Q10").

For each health center and each outcome variable y (e.g., share of stillbirths, share of neonatal deaths, operating efficiency), we then compute the change from Q1 until Q10, which we denote by $\Delta y_{\text{Q1–Q10}}$.[31, 32] We then estimate the following difference-in-differences specification:

$$\Delta y_{i,\text{Q1–Q10}} = \alpha_p + \beta \times treatment_i + \varepsilon_i \quad (1)$$

[31] Whenever y is a ratio (e.g., the share of stillbirths), Δy represents the difference in the ratio from Q1 to Q10; whenever y is a level (e.g., the number of employees), Δy represents the percentage change in y from Q1 to Q10 (denoted by $\%\Delta y$ in the tables, see section 5).

[32] In section 5.2 we examine the dynamics of the treatment effect. To do so, we compute Δy for increasing time intervals on a quarterly basis (i.e., $\Delta y_{\text{Q1–Q2}}$, $\Delta y_{\text{Q1–Q3}}$, …, $\Delta y_{\text{Q1–Q9}}$, $\Delta y_{\text{Q1–Q10}}$).

where i denotes health centers; α_p are province fixed effects; *treatment* is the treatment indicator, which is equal to one for health centers in the treatment group (and zero for those in the control group); and ε is the error term. We cluster standard errors at the health district level to account for potential dependence of the error term at the local level. The coefficient of interest is β, which measures the difference in Δy_{Q1-Q10} between the treated and control health centers (i.e., the difference-in-differences). In other words, it measures the effect of the governance treatment on y accounting for contemporaneous changes in y at otherwise similar health centers.

The inclusion of province fixed effects in regression (1) ensures that we compare treated and control health centers within the same province. Note that we do not include control variables. Given the random assignment of health centers to the treatment and control groups, health center characteristics are orthogonal to the treatment (see section 3.4) and hence need not be included. Nevertheless, in robustness tests, we show that our results are very similar if we control for health center characteristics (see section 5.2).

4.2 Analysis of the outside group

In our baseline analysis, we estimate regression (1) with the 999 health centers in the PDSS program (674 in the treatment group, 325 in the control group). In auxiliary analyses, we estimate variants of regression (1) in which—instead of comparing treatment group versus control group—we compare i) treatment group versus outside group, and ii) control group versus outside group. In the following, we describe how we adjust our empirical setup to conduct both comparisons.

Treatment group versus outside group

By comparing health centers in the treatment group (i.e., health centers that receive both PDSS funding and the governance treatment) with health centers in the outside group (i.e., health centers that receive neither), we can examine how the combination of financing and governance affects health center outcomes.

In principle, we could conduct this analysis by estimating a variant of regression (1) in which we use the outside group (5,832 health centers) in lieu of the control group. The coefficient β would then measure the difference in Δy_{Q1-Q10} between health centers in the treatment group and outside group. Such

analysis might be misguided, though. Since selection into the PDSS program is not random, health centers in the outside group need not provide a valid counterfactual. Symptomatic of this issue is the lack of covariate balance between the two groups. Indeed, as we noted in section 3.5, health centers in the outside group differ from those in the PDSS program along several dimensions.

To mitigate this caveat, we use a nearest-neighbor matching—that is, for each of the 674 health centers in the treatment group, we match the nearest (i.e., most similar) health center out of the pool of 5,832 health centers in the outside group. The matching is done in two steps. First, we require that the matched health center be located in the same province as the treated health center. Second, out of the remaining candidates, we select the nearest neighbor based on the health center characteristics in Appendix Table A1 (measured in Q1). The nearest neighbor is the one with the lowest Mahalanobis distance to the treated health center along the matching characteristics.[33]

This matching procedure ensures that the matched health centers from the outside group are as similar as possible to the treated health centers ex ante (i.e., at the time the PDSS program starts). The covariate balance analysis, provided in columns (1) and (2) of Appendix Table A2, confirms that there is no significant difference between the two groups.

To compare outcomes in the treatment versus outside groups, we can then estimate a variant of regression (1), using the 674 treated health centers and the 674 matched health centers from the outside group (i.e., the regression has 1,348 observations).

Control group versus outside group

Another relevant comparison is between health centers in the control group (i.e., health centers that receive PDSS funding, but are not subject to the governance treatment) and health centers in the outside group. By comparing the two groups, we can examine how financing as standalone (i.e., without governance improvements) affects health center outcomes.

[33] Formally, the Mahalanobis distance δ between treated health center i and candidate health center j is given by $\delta = [(\mathbf{X}_i - \mathbf{X}_j)' \, \mathbf{\Sigma}^{-1} \, (\mathbf{X}_i - \mathbf{X}_j)]^{½}$, where $\mathbf{X}$ is the vector of matching characteristics and $\mathbf{\Sigma}$ the corresponding covariance matrix.

To conduct this analysis, we use the same nearest-neighbor matching as above, but applied to the control group. That is, for each of the 325 health centers in the control group, we select the nearest neighbor among the pool of 5,832 health centers in the outside group.[34] We then estimate another variant of regression (1), using the 325 health centers from the control group and the 325 matched health centers from the outside group (i.e., the regression has 650 observations).

5. Results

5.1 Impact of the governance treatment on health center outcomes

Table 3 presents our main results for the various dependent variables introduced in section 3.2. The estimates are obtained from regression (1) using the 999 health centers in the PDSS program. In columns (1) and (9)-(11), where the dependent variable y is a ratio, Δy represents the difference in y from Q1 to Q10. In columns (2)-(8), where the dependent variable y is a level, $\%\Delta y$ represents the percentage change in y from Q1 to Q10.

----- Insert Table 3 about here ----

As can be seen from column (1), operating efficiency increases significantly following the governance treatment. The coefficient of 93.1 (p-value = 0.004) implies that the number of primary healthcare services per employee increases by 93.1. Given a pre-treatment average of 266.8 (Table 2), this corresponds to a 34.9% increase in operating efficiency. This finding is consistent with Hypothesis 1, predicting that the implementation of governance mechanisms leads to higher operating efficiency.

In columns (2)-(8), we unpack this change in operating efficiency by examining changes in the numerator (number of services performed) and denominator (number of employees). In terms of the denominator, we find that, following the treatment, health centers significantly reduce their administrative staff—the number of administrative employees decreases by 9.9% (p-value = 0.083)—while there is

[34] The covariate balance analysis, provided in columns (3) and (4) of Appendix Table A2, confirms again that there is no significant difference between the two groups.

virtually no change in the number of doctors and nurses.[35, 36] In terms of the numerator, we find that the level of services performed increases, but not significantly so.[37] Overall, this finer analysis suggests that the efficiency gains are derived mainly from a reduction in administrative overhead.

In columns (9)-(11), we find that the quality of healthcare services increases significantly following the treatment. Specifically, we find that the share of stillbirths decreases by 0.35 percentage points (*p*-value = 0.002), and the share of neonatal deaths by 0.28 percentage points (*p*-value = 0.049). (Correspondingly, the share of life births increases by 0.62 percentage points, *p*-value = 0.004.) Put differently, for every 1,000 new births, the governance treatment helped save about 3.5 lives at birth (reduction in stillbirths) and 2.8 lives within the first 28 days after birth (reduction in neonatal deaths). These are large effects in light of the baseline probabilities. Indeed, the pre-treatment share of stillbirths is on average 0.8 percentage points (i.e., 0.8% of the total number of births, see Table 2). Hence, a decrease by 0.35 percentage points corresponds to a 43.8% reduction in the probability of stillbirth. Similarly, since the pre-treatment share of neonatal deaths is on average 0.48 percentage points, a decrease by 0.28 percentage points corresponds to a 58.3% reduction in the probability of neonatal death. Overall, these results are consistent with Hypothesis 2, predicting that the implementation of governance mechanisms leads to higher social performance.

5.2 Robustness

Inclusion of controls

The regressions in Table 3 do not include control variables. As discussed in section 4.1, controls need not be included given the random assignment of health centers to the treatment and control groups. Nevertheless, in Appendix Table A3, we re-estimate our baseline regressions, controlling for i) the subsidies received by the health center and ii) the size of the health center (measured by the number of employees)

[35] If at all, the number of doctors and nurses increases slightly by 1.3% (*p*-value = 0.413) and 0.1% (*p*-value = 0.993), respectively.
[36] Note that the decrease in administrative overhead is not about layoffs per se. In fact, both the treatment and control group increase their staff during the 10-quarter periods. The observed difference between the two groups indicates that treated health centers hire fewer additional administrative employees compared to the control group.
[37] The number of primary healthcare services increases by 13.4% (*p*-value = 0.608), the number of maternal and childhood healthcare services by 6.9% (*p*-value = 0.787), and the number of births by 12.8% (*p*-value = 0.449).

in Q1. Doing so accounts for the possibility that differences in PDSS subsidies or size may confound the treatment effect. As can be seen—and not surprisingly given the randomization—our estimates are very similar to before.

Gaming behavior

A potential concern is that health centers may try to "game" the pro-social incentives in order to secure additional funding. In particular, they may strategically refuse high-risk patients (e.g., pregnant mothers who face a high risk of stillbirth), referring them to nearby health centers and hospitals.

Nevertheless, this concern is mitigated, for two reasons. First, as part of their protocol, the evaluators who assess the health centers' social performance (to determine the subsidy bonus) interview locals from the community (PDSS 2016). Accordingly, if health centers were to transfer high-risk patients elsewhere, they would likely find out. Second, in Appendix Table A4, we examine whether the share of stillbirths and neonatal deaths increases (and the share of live births decreases, respectively) at other healthcare facilities that are located in the same health district as the treated health centers. As can be seen, we find no such evidence, which is inconsistent with the gaming argument.[38]

A related concern is that treated health centers may improve their birth-related services at the expense of other services. They may choose to do so if the assessment criteria underlying the subsidy bonus are directly tied to the number of stillbirths and neonatal deaths. However, this is not the case. The assessment grid includes criteria related to i) processes (e.g., following best practices), ii) the overall conditions at the health center (e.g., cleanliness), and iii) the quality of services. Importantly, none of our outcome variables (e.g., the share of stillbirths) is part of the assessment grid.[39] This concern is further mitigated by the fact that, as mentioned above, evaluators conduct interviews with the local community. If the treated health centers were to focus on certain types of services at the expense of others, they would

[38] The point estimates in Appendix Table A4 are small and insignificant. Note that the table distinguishes between hospitals (columns (1)-(3)), control health centers (columns (4)-(6)), and health centers in the "outside group" (columns (7)-(9)) that are located in the same health district as the treated health centers.
[39] For the description of the assessment grid, see pp. 88–89 in PDSS (2016); for the actual assessment grid, see pp. 257–285.

likely find out.

Dynamics of the treatment effect

Next, we examine the dynamics of the governance treatment. To do so, we re-estimate regression (1), but instead of computing changes in outcomes over a 10-quarter horizon (i.e., Δy_{Q1-Q10}), we compute changes in outcomes for increasing time intervals on a quarterly basis (i.e., Δy_{Q1-Q2}, Δy_{Q1-Q3}, …, Δy_{Q1-Q9}, Δy_{Q1-Q10}).

The results are presented in Appendix Table A5. Each estimate in the table is obtained from a different regression, depending on the outcome variable (columns) and time horizon (rows). As can be seen, the benefits from the governance treatment take a few quarters to materialize. The first tangible effect is observed in Q5, when the reduction in administrative overhead becomes significant. In contrast, the improvements in the quality of healthcare services take longer to materialize. It is only as of Q7-Q8 that the birth mortality statistics start showing significant improvements. These patterns seem reasonable. Arguably, adjusting overhead costs takes less time than improving the quality of birth-related practices.

Panel specification

Our baseline specification is a cross-sectional regression in which the dependent variable is the change in outcome variable y over a 10-quarter period (i.e., Δy_{Q1-Q10}). An alternative would be to use a panel specification that pools all health center-quarter observations, and includes health center fixed effects and quarter fixed effects. We use this panel specification in Appendix Table A6. In this specification, the treatment dummy is equal to one for the treated health centers in the post-treatment quarters (i.e., after Q1). To capture the dynamics of the treatment, we decompose the treatment dummy into three-quarter intervals (i.e., Q2-Q4, Q5-Q7, and Q8-Q10). The results are similar to those in Appendix Table A5—the treatment effect takes a few quarters to materialize and is largest (and statistically significant) in Q8-Q10.

5.3 Density of health centers in the same health district

In Table 4, we examine how the treatment effect varies depending on the density of health centers in the health district, measured as the number of health centers per capita (i.e., the number of health centers

divided by the health district's population).

----- Insert Table 4 about here ----

To conduct this analysis, we augment regression (1) by interacting *treatment* with two dummy variables indicating whether the number of health centers per capita is below (*low # of health centers*) and above the median (*high # of health centers*), respectively, in the health center's health district. As is shown, we find that our results are large and significant for health centers in low-density districts, while they are small and insignificant for health centers in high-density districts.[40] This is in line with Hypothesis 3, predicting that the benefits from adopting governance mechanisms are stronger in areas with a lower density of peer organizations.

5.4 Relationship between funding and governance

In the analysis so far, we compared health centers in the treatment group (i.e., health centers that receive both PDSS funding and the governance treatment) versus health centers in the control group (i.e., health centers that only receive PDSS funding). By doing so, we were able to identify the impact of the governance treatment, holding everything else (including funding) constant.

Effectiveness of funding and governance combined

In Table 5, we use the "outside" group in lieu of the control group. That is, we now compare health centers in the treatment group versus health centers in the outside group (i.e., health centers that receive neither PDSS funding nor the governance treatment). This comparison allows us to examine how the combination of both funding *and* governance affects health center outcomes.[41]

----- Insert Table 5 about here ----

[40] The difference between the two coefficients is significant in columns (1) and (5) (with *p*-values of 0.076 and 0.004, respectively), it is marginally insignificant in columns (9) and (11) (with *p*-values of 0.121 and 0.181, respectively) and it is insignificant in column (10) (with *p*-value of 0.272). Since we are relying on subsets of the data to identify cross-sectional differences, we caveat that this analysis has lower power compared to our baseline.

[41] As discussed above, health centers in the outside group differ from health centers in the treatment group along several dimensions. To match health centers from the treatment group to otherwise similar health centers from the outside group, we use the nearest-neighbor matching methodology described in section 4.2.

As can be seen, we find again that operating efficiency (column (1)) and the quality of healthcare services (columns (9)-(11)) significantly improve following the treatment. The economic magnitudes are stronger than in Table 3.[42] What is more, we find that health centers significantly increase the scale of their operations—the number of employees increases by 19.1% (p-value = 0.022), the number of primary healthcare services by 76.4% (p-value = 0.001), the number of maternal and childhood healthcare services by 70.3% (p-value = 0.003), and the number of births by 63.0% (p-value = 0.000).[43] This suggests that funding i) amplifies the benefits from the governance treatment (in terms of both operating efficiency and quality of healthcare services), and ii) contributes to increasing the scale of the health centers.

Effectiveness of funding alone

In Table 6, we consider another variant in which we compare health centers in the control group versus health centers in the outside group. Since the control group receives PDSS funding, and the outside group does not, this comparison allows us to examine how funding as standalone (i.e., without governance improvements) affects health center outcomes.[44]

----- Insert Table 6 about here ----

As is shown, we find that funding as standalone leads to increases in the scale of the health center's operations—the number of employees increases by 25.0% (p-value = 0.001), the number of primary healthcare services by 33.5% (p-value = 0.087), the number of maternal and childhood healthcare services by 34.3% (p-value = 0.075), and the number of births by 28.7% (p-value = 0.003)—but does not bring about significant improvements in operating efficiency (column (1)) nor in the quality of healthcare services

[42] In particular, the number of primary healthcare services per capita increases by 98.1 (compared to 93.1 in Table 3); the share of neonatal deaths decreases by 0.43 percentage points (compared to 0.28 percentage points in Table 3); the share of live births increases by 0.75 percentage points (compared to 0.62 percentage points in Table 3). The only exception is the share of stillbirths, where we observe no noticeable difference—it decreases by 0.33 percentage points (compared to 0.35 percentage points in Table 3).

[43] Note that, unlike in Table 3, we do not observe a significant decrease in the number of administrative employees in column (5). This likely reflects the increase in the scale of the health centers' operations. Indeed, the number of employees increases significantly (column (2)). Importantly, this increase is not driven by an increase in administrative staff, consistent with the interpretation that the governance treatment reduces the reliance on administrative overhead.

[44] Again, we match health centers from the control group to otherwise similar health centers from the outside group, using the nearest-neighbor matching methodology described in section 4.2.

(columns (9)-(11)).

Taken together, the results from Tables 3, 5, and 6 suggest that i) governance alone increases operating efficiency and social performance, but not the scale of the health centers (Table 3); ii) funding alone increases the scale of the health centers, but does not improve operating efficiency nor social performance (Table 6); iii) the combination of funding and governance leads to improvements in both the scale of the health centers, as well in health centers' operating efficiency and social performance (Table 5). As such, these results show that funding is *not* a substitute for good governance. Instead, they complement each other in improving the health centers' social impact, in line with Hypothesis 4.

6. Discussion and conclusion

How can non-profit organizations improve their governance in order to maximize their intended social and environmental impact? This question is of foremost importance not only for the non-profits themselves (as well as their donors and impact investors), but also for achieving the United Nations' SDGs—in short, improving the governance of the non-profit sector is important from an economic, environmental, and social perspective.

In a nutshell, our main theoretical argument is that the joint implementation of pro-social incentives and auditing helps mitigate key challenges faced by non-profits (by mitigating the non-profit's agency conflicts, fostering knowledge transfer, and enhancing competence building), thereby improving the non-profits' operating efficiency and social performance.

To test our theoretical arguments, we exploit a randomized governance program conducted in the DRC's healthcare sector. The program was administered in about 1,000 non-profit health centers that were randomly assigned into a treatment and control group. While health centers in both groups received financial subsidies from the program, only those in the treatment group were subject to the "governance treatment" (consisting of pro-social incentives and auditing). As such, this randomized program provides an ideal setup to study how the adoption of governance mechanisms affects health centers' outcomes, holding everything else (including financial subsidies) constant.

We find that the governance treatment leads to i) a significant increase in the number of services performed per employee, and ii) a significant reduction in the share of stillbirths and neonatal deaths. These findings indicate that corporate governance plays an important role in improving non-profits' operating efficiency and social performance, respectively.

We further document that the effect of the governance treatment is stronger in areas with a lower density of health centers. Arguably, the benefits from governance are higher in these areas—having fewer peers within close proximity reduces i) the potential for knowledge spillovers (e.g., in terms of expertise and best practices), and ii) the disciplinary role of competition.

Finally, we find that financial subsidies are not a substitute for governance. Health centers that only receive financial subsidies increase their scale, but do not show improvements in operating efficiency nor in the quality of their services. In contrast, health centers that receive both financial subsidies and the governance treatment improve both their scale as well as their operating efficiency and the quality of their services. This suggests that financial subsidies and corporate governance operate as complements towards the objective of increasing the non-profit's overall social impact.

By examining how the adoption of governance mechanisms affects non-profit organizations, this study relates to the large literature on corporate governance in the context of for-profit organizations (e.g., Aguilera et al. 2016, Tirole 2006).[45] In the for-profit context, shareholders (or owners, more generally) adopt governance mechanisms to align managers' interest with the objective of profit maximization. The non-profit context is fundamentally different. Non-profits do not have shareholders (nor owners, more generally), nor do they aim to maximize profits. Instead, their objective is to maximize social impact. Our study sheds light on how corporate governance operates in this fundamentally different context.

In addition, our study contributes to the literature that examines the social performance of i) for-profit organizations (e.g., Eccles, Ioannou, and Serafeim 2014, Flammer 2015, Flammer, Hong, and Minor 2019, King and Lenox 2001), ii) for-profit organizations in collaboration with non-profits and non-

[45] Similarly, it is related to the growing literature that studies how management practices affect the performance and productivity of for-profit organizations (e.g., Bloom and Van Reenen 2010, Bloom et al. 2013).

governmental organizations (e.g., Ballesteros and Gatignon 2019, Cabral et al. 2019, Chatain and Plaksenkova 2019, Durand and Huysentruyt 2019, Rousseau, Berrone, and Gelabert 2019), and iii) hybrid organizations (e.g., Battilana and Dorado 2010, Cobb, Wry, and Zhao 2016, Jay 2013, Pache and Santos 2013, Quélin, Kivleniece, and Lazzarini 2017).[46] Our study complements this line of work by exploring how the governance of non-profit organizations contributes to their social impact and the attainment of the United Nations' SDGs. In this regard, our study also contributes to the growing literature that examines how management research can help understand and address societal grand challenges (e.g., Berrone et al. 2016, George et al. 2016, Vakili and McGahan 2016).

Moreover, our study examines an underexplored institutional context: Africa, and more specifically the DRC in Sub-Saharan Africa. While most of the insights from the corporate governance literature have been obtained by studying organizations in developed and emerging countries, much less is known about (for-profit and non-profit) organizations in developing countries.[47] Yet, understanding how to improve the governance of these organizations—and the implications for operating efficiency and social performance—is crucial in order to promote their development and the attainment of the United Nations' SDGs.

Our study calls for future research. First, our findings are specific to the healthcare sector in a low-income country (namely, the DRC). In this regard, a fruitful avenue for future research is to examine whether our findings have external validity across sectors and countries, including higher-income countries. Arguably, the challenges faced by non-profit organizations in higher-income countries are similar but likely less severe than in low-income countries. As such, the effectiveness of the governance bundle considered in this study might differ. Future research may find it worthwhile to explore and characterize these differences. Second, a limitation of the PDSS program is that the "governance treatment" is administered through a bundle of governance mechanisms (i.e., pro-social incentives and auditing), and hence we cannot separate between them. Accordingly, another exciting avenue for future research would be to "un-bundle"

[46] Hybrid organizations are organizations with a dual mission that combines social and financial objectives.
[47] Similarly, the operations research literature in healthcare—which studies how to optimize hospitals' operating processes—has focused on large-scale hospitals in the U.S. and other high-income countries (Berry Jaeker and Tucker 2016, Roth, Tucker, and Venkataraman 2019, Song et al. 2018).

the governance bundle and examine how individual governance mechanisms contribute to non-profits' social impact. Third, and relatedly, future research could explore the effectiveness of other types of governance mechanisms available to non-profit organizations.

Lastly—and perhaps most importantly—our findings have important implications for practice. Every year, large amounts of funding are invested in non-profit organizations pursuing social and environmental causes and aiming to achieve the seventeen SDGs of the United Nations (e.g., ending poverty, reducing hunger, promoting healthy lives and well-being, reducing inequalities, addressing climate change, protecting life on land and below water). The insights of this study help inform non-profit organizations, as well as their donors and impact investors, about the governance mechanisms that are available and effective in achieving the non-profits' objectives and maximizing the social impact of the funds invested.

Appendix

Structure of the DRC's health system

This appendix provides a brief description of the structure of the DRC's health system.[48] The health system of the DRC is organized in three levels (central, provincial, and operational):

- At the *central level* (also referred to as "national level"), the Ministry of Health develops health policies and health standards. It plays a normative role, regulating and supporting the provincial health divisions.
- At the *provincial level* (also referred to as "intermediate level"), each province has a provincial ministry of health with its own provincial health division. Provincial health divisions are mainly responsible for the technical supervision and logistic support of health districts (at the operational level). They also manage the provincial hospital as well as other provincial health structures.

[48] For a more detailed description, see WHO (2015).

- At the *operational level*, the DRC is divided into 516 health districts (also called "health zones") that cover a population of roughly 100,000 to 200,000. Each health district is administered by a health district management team ("équipe cadre de la zone") that manages a network of health centers and the district hospital. Health districts are further divided into 8,504 health areas. Each health area contains approximately one health center.

References

Abrahamson E (1991) Managerial fads and fashions: the diffusion and rejection of innovations. *Acad. Management J.* 16(3):586–612.

Adam T, Lim SS, Mehta S, Bhutta ZA, Fogstad H, Mathai M, Zupan J, Darmstadt GL (2005) Cost effectiveness analysis of strategies for maternal and neonatal health in developing countries. *British Medical J.* 331(7525):1107.

Aggarwal RK, Evans ME, Nanda D (2012) Nonprofit boards: size, performance and managerial incentives. *J. Accounting and Econom.* 53(1–2):466–487.

Aguilera R, Florackis C, Kim H (2016) Advancing the corporate governance research agenda. *Corporate Governance: An International Rev.* 24(3):172–180.

Alchian A (1950) Uncertainty, evolution and economic theory. *J. Political Economy* 58(3):211–221.

Aldamen H, Duncan K, Kelly S, McNamara R, Nagel S (2012) Audit committee characteristics and firm performance during the global financial crisis. *Accounting and Finance* 52(4):971–1000.

Andreoni J (1989). Giving with impure altruism: applications to charity and Ricardian equivalence. *J. Political Economy* 97(6):1447–1458.

Ashraf N, Bandiera O, Jack BK (2014) No margin, no mission? A field experiment on incentives for public service delivery. *J. Public Econom*. 120(6):1–17.

Ashraf N, Bandiera O, Lee S (2014) Awards unbundled: evidence from a natural field experiment. *J. Econom. Behav. Organ.* 100(4):44–63.

Bai G (2013) How do board size and occupational background of directors influence social performance in for-profit and non-profit organizations? Evidence from California hospitals. *J. Business Ethics* 118(1):171–187.

Ballesteros L, Gatignon A (2019) The relative value of firm and nonprofit experience: tackling large-scale social issues across institutional contexts. *Strategic Management J.* 40(4):631–657.

Banerjee AV, Cole S, Duflo E, Linden L (2007) Remedying education: evidence from two randomized experiments in India. *Quart. J. Econom*. 122(3): 1235–1264.

Banerjee AV, Duflo E, Glennerster R, Kinnan C (2015) The miracle of microfinance? Evidence from a randomized evaluation. *American Econom. J: Applied Econom*. 7(1): 22–53.

Battilana J, Dorado S (2010) Building sustainable hybrid organizations: the case of commercial microfinance organizations. *Acad. Management J.* 53(6):1419–1440.

Berrone P, Gelabert L, Massa-Saluzzo F, Rousseau HE (2016) Understanding community dynamics in the study of grand challenges: how nonprofits, institutional actors, and the community fabric interact to influence income inequality. *Acad. Management J.* 59(6):1940–1964.

Berry Jaeker JA, Tucker AL (2016) Past the point of speeding up: the negative effects of workload saturation on efficiency and patient severity. *Management Sci.* 63(4):1042–1062.

Bloom N, Eifert B, Mahajan A, McKenzie D, Roberts J (2013) Does management matter? Evidence from India. *Quart. J. Econom.* 128(1):1–51.

Bloom N, Propper C, Seiler S, Van Reenen J (2015) The impact of competition on management quality: evidence from public hospitals. *Rev. Economic Stud*. 82(2):457–489.

Bloom N, Van Reenen J (2007) Measuring and explaining management practices across firms and countries. *Quart. J. Econom.* 122(4):1351–1408.

Bode C, Singh J (2018) Taking a hit to save the world? Employee participation in a corporate social initiative. *Strategic Management J.* 39(4):1003–1030.

Bowles S (2016) *The Moral Economy: Why Good Incentives are no Substitute for Good Citizens* (Yale University Press, New Haven, CT).

Burbano VC (2016) Social responsibility messages and worker wage requirements: field experimental evidence from online labor marketplaces. *Organ. Sci.* 27(4):1010–1028.

Cabral S, Mahoney JT, McGahan AM, Potoski M (2019) Value creation and value appropriation in public and nonprofit organizations. *Strategic Management J.* 40(4):465–475.

Carnahan S, Kryscynski D, Olson D (2017) When does corporate social responsibility reduce employee turnover? Evidence from attorneys before and after 9/11. *Acad. Management J.* 60(5):1932–1962.

Cassar L (2019) Job mission as a substitute for monetary incentives: benefits and limits. *Management Sci.* 65(2):896–912.

Cassar L, Meier S (2017) Intentions for doing good matter for doing well: the (negative) signaling value of prosocial incentives. NBER Working Paper 24109 (National Bureau of Economic Research, Cambridge, MA).

Cassar L, Meier S (2018) Nonmonetary incentives and the implications of work as a source of meaning. *J. Economic Perspectives* 32(3):215–238.

Chan KC, Li J (2008) Audit committee and firm value: evidence on outside top executives as expert-independent directors. *Corporate Governance: An International Rev.* 16(1):16–31.

Chatain O, Plaksenkova E (2019) NGOs and the creation of value in supply chains. *Strategic Management J.* 40(4):604–630.

Cobb JA, Wry T, Zhao EY (2016) Funding financial inclusion: institutional logics and the contextual contingency of funding for microfinance organizations. *Acad. Management J.* 59(6):2103–2131.

Duflo E, Dupas P, Kremer M. 2011. Peer effects, teacher incentives, and the impact of tracking: evidence from a randomized evaluation in Kenya. *American Econom. Rev.* 101(5):1739–1774.

Durand R, Huysentruyt M (2019) Performance of corporate social initiatives: evidence from a field experiment in France. Working paper, HEC Paris.

Dur R, Non A, Roelfsema H (2010) Reciprocity and incentive pay in the workplace. *J. Economic Psychology* 31(4):676–686.

Eccles RG, Ioannou I, Serafeim G (2014) The impact of corporate sustainability on organizational processes and performance. *Management Sci.* 60(11):2835–2857.

Flammer C (2015) Does corporate social responsibility lead to superior financial performance? A regression discontinuity approach. *Management Sci.* 61(11):2549–2568.

Flammer C, Hong B, Minor DB (2019) Corporate governance and the rise of integrating corporate social responsibility criteria in executive compensation: effectiveness and implications for firm outcomes. *Strategic Management J.* 40(7):1097–1122.

Flammer C, Luo J (2017) Corporate social responsibility as an employee governance tool: evidence from a quasi-experiment. *Strategic Management J.* 38(2):163–183.

Forman C, Goldfarb A, Greenstein S (2005) How did location affect adoption of the commercial internet? Global village vs. urban leadership. *J. Urban Econom.* 58(3):389–420.

Galaskiewicz J, Wasserman S (1989) Mimetic processes within an interorganizational field: an empirical test. *Admin. Sci. Quart.* 34(3):454–479.

Gallus J, Frey BS (2016) Awards: a strategic management perspective. *Strategic Management J.* 37(8):1699–1714.

George G, Howard-Grenville J, Joshi A, Tihanyi L (2016) Understanding and tackling societal grand challenges through management research. *Acad. Management J.* 59(6):1880–1895.

Giroud X, Mueller HM (2010) Does corporate governance matter in competitive industries? *J Financial Econom*. 95(3):312–331.

Glaeser EL (2002) The governance of not-for-profit firms. NBER Working Paper 8921 (National Bureau of Economic Research, Cambridge, MA).

Gubler T, Larkin I, Pierce L (2016) Motivational spillovers from awards: crowding out in a multitasking environment. *Organ. Sci.* 27(2):286–303.

Gubler T, Larkin I, Pierce L (2017) Doing well by making well: the impact of corporate wellness programs on employee productivity. *Management Sci.* 64(11):4967–4987.

Hansmann HB (1980) The role of nonprofit enterprise. *Yale Law J.* 89(5):835–901.

Hollowell J, Oakley L, Kurinczuk JJ, Brocklehurst P, Gray R (2011) The effectiveness of antenatal care programmes to reduce infant mortality and preterm birth in socially disadvantaged and vulnerable women in high-income countries: a systematic review. *BMC Pregnancy and Childbirth* 11(1):13.

Imas A (2014) Working for the "warm glow": on the benefits and limits of prosocial incentives. *J. Public Econom.* 114(6):14–18.

Jay J (2013) Navigating paradox as a mechanism of change and innovation in hybrid organizations. *Acad. Management J.* 56(1):137–159.

King AA, Lenox MJ (2001) Does it really pay to be green? An empirical study of firm environmental and financial performance. *J. Industrial Ecology* 5(1):105–116.

Pache AC, Santos F (2013) Inside the hybrid organization: selective coupling as a response to competing institutional logics. *Acad. Management J.* 56(4):972–1001.

PDSS (2016) *Manuel Opérationnel du Financement Basé sur la Performance* (Ministry of Health, Democratic Republic of Congo).

Quélin BV, Kivleniece I, Lazzarini S (2017) Public-private collaboration, hybridity and social value: towards new theoretical perspectives. *J. Management Stud*. 54(6):763–792.

Roth A, Tucker AL, Venkataraman S (2019) Being on the productivity frontier: identifying "triple aim performance" hospitals. *Production and Operations Management* 28(9):2165–2183.

Rousseau HE, Berrone P, Gelabert L (2019) Localizing sustainable development goals: nonprofit density and city sustainability. *Acad. Management Discoveries* 5(4):487–513.

Shleifer A, Vishny R (1997) A survey of corporate governance. *J. Finance* 52(2):737–783.

Smith A (1776) *An Inquiry into the Nature and Causes of the Wealth of Nations*. Campbell RH, Skinner AS, Todd WB, eds. (The Clarendon Press, Oxford, U.K., 1979).

Song H, Tucker AL, Murrel KL, Vinson DR (2018) Closing the productivity gap: improving worker productivity through public relative performance feedback and validation of best practices. *Management Sci.* 64(6):2628–2649.

Stigler G (1958) The economics of scale. *J. Law and Econom.* 1:54–71.

Tirole J (2006) Corporate governance. *The Theory of Corporate Finance*, Chapter 1 (Princeton University Press, Princeton, NJ), 15–74.

Tonin M, Vlassopoulos M (2015) Corporate philanthropy and productivity: evidence from an online real effort experiment. *Management Sci*. 61(8):1795–1811.

United Nations (2018a) *Satellite Account on Non-profit and Related Institutions and Volunteer Work* (The United Nations, New York, NY).

United Nations (2018b) *Levels & Trends in Child Mortality* (The United Nations Inter-Agency Group for Child Mortality Estimation, New York, NY).

Urban Institute (2013) *The Nonprofit Almanac 2012* (Urban Institute Press, Washington, DC).

Vakili K, McGahan AM (2016) Health care's grand challenge: stimulating basic science on diseases that primarily afflict the poor. *Acad. Management J.* 59(6):1917–1939.

WHO (2015) *Democratic Republic of the Congo: Improving Aid Coordination in the Health Sector* (World Health Organization, Geneva).

WHO (2016) *Standards for Improving Quality of Maternal and Newborn Care in Health Facilities* (World Health Organization, Geneva).

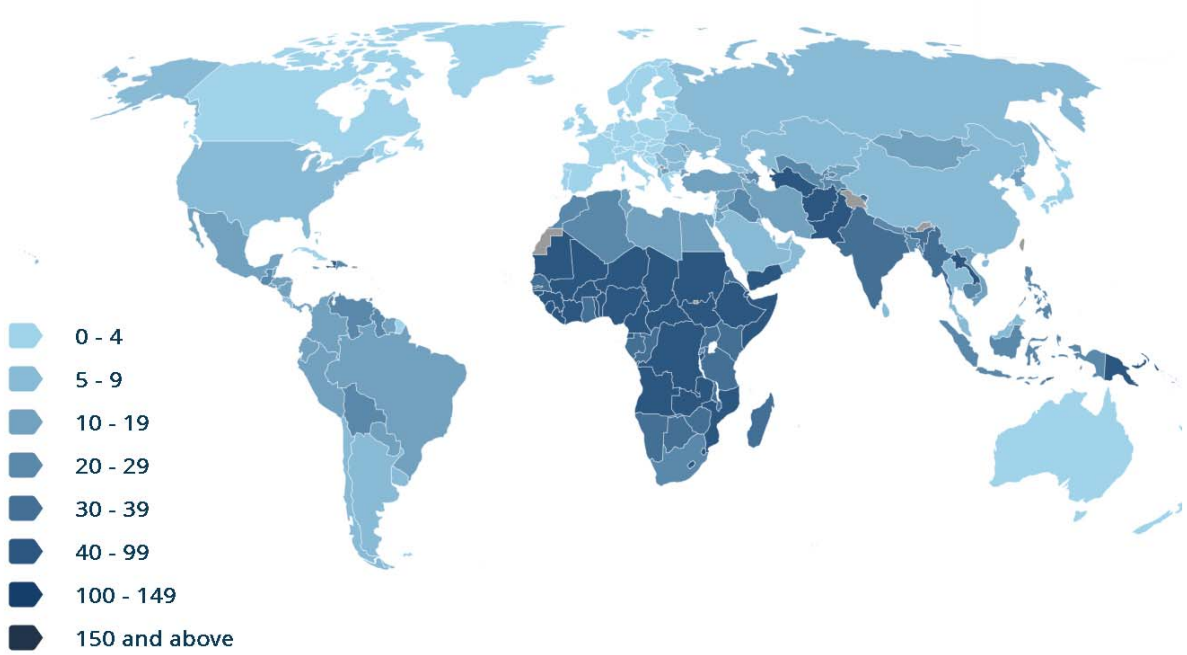
WHO (2018) *Children: Reducing Mortality* (World Health Organization, Geneva).

WHO (2019a) *Stillbirths* (World Health Organization, Geneva).

WHO (2019b) *Neonatal Mortality* (World Health Organization, Geneva).

Wrzesniewski A, Schwartz B, Cong X, Kane M, Omar A, Kolditz T (2014) Multiple types of motives don't multiply the motivation of West Point cadets. *Proceedings of the National Acad. of Sciences* 111(30):10990–10995.

Figure 1. Infant mortality rate



Notes. Infant mortality rate is measured by the number of deaths of infants under one-year old per 1,000 births alive. Source: United Nations Inter-Agency Group for Child Mortality Estimation (https://childmortality.org/data).

Figure 2. Institutional context—The Democratic Republic of Congo and its provinces

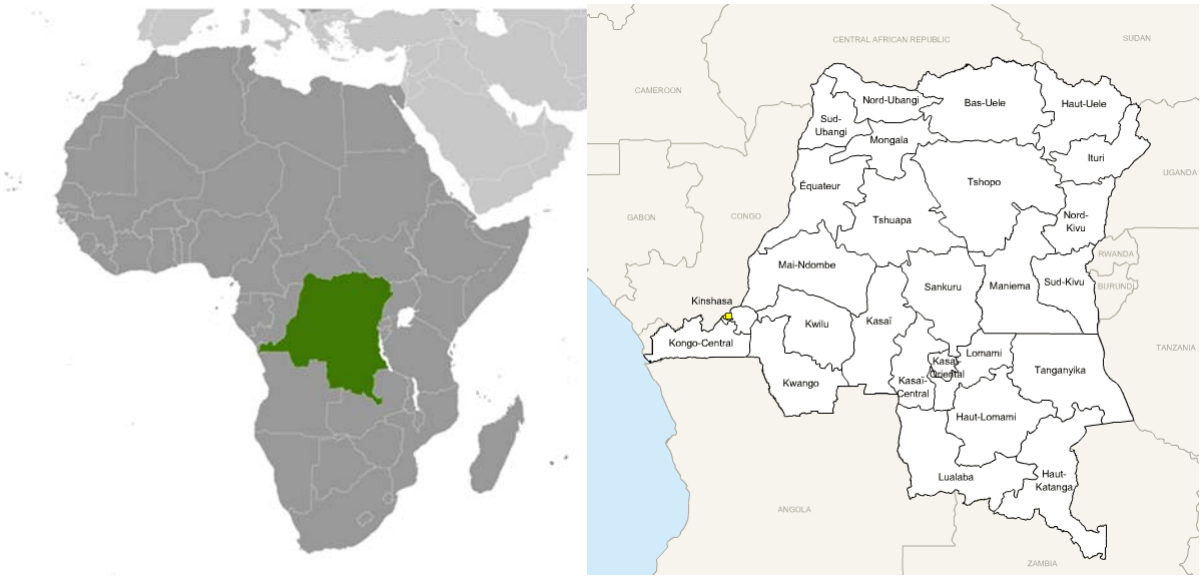


Figure 3. Examples of health centers

Source: Bluesquare.

Figure 4. Location of treatment and control health centers

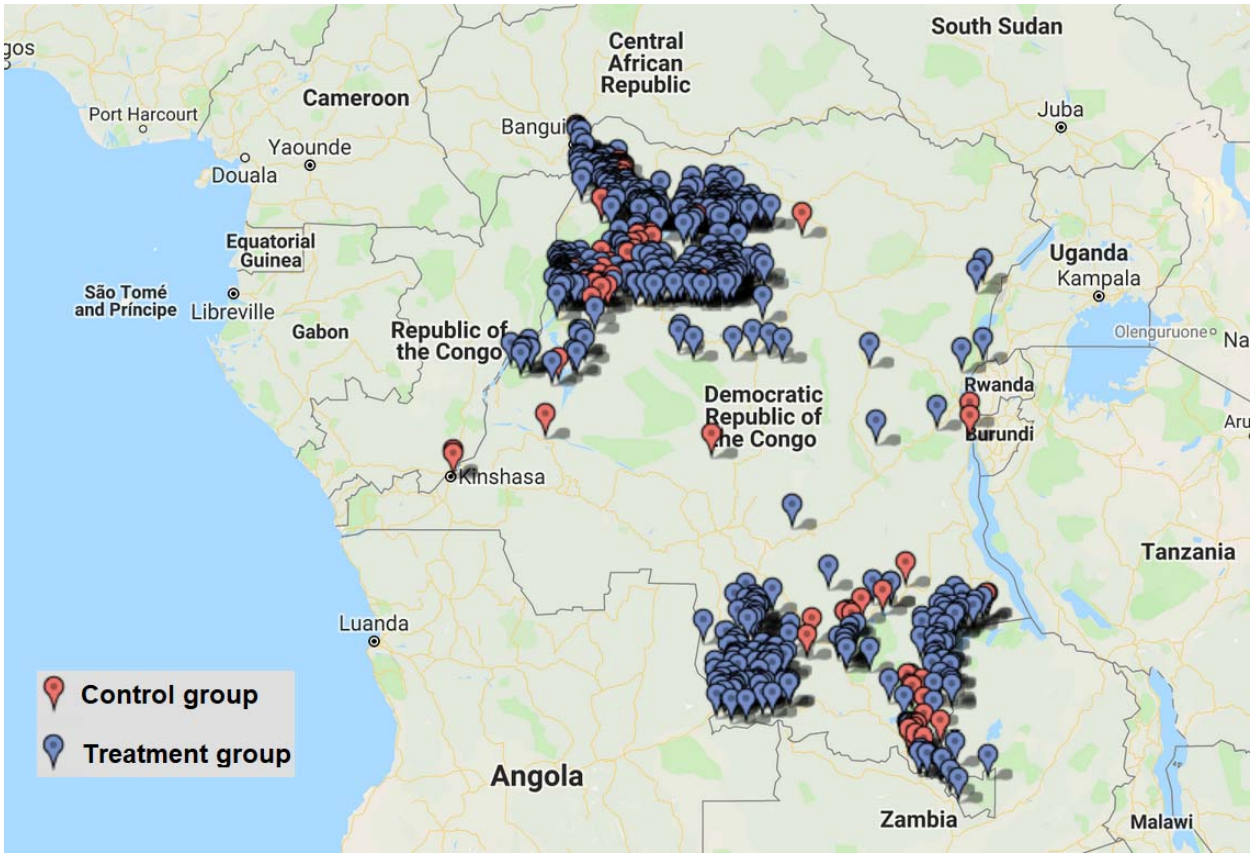


Table 1. Summary statistics

	Obs.	Mean	Median	Std. Dev.
Panel A. Health centers statistics				
Primary healthcare services per employee	999	260.81	200.29	245.18
Employees	999	7.39	6	6.94
Doctors	999	0.08	0	0.41
Nurses	999	3.67	3	4.98
Administrative	999	3.63	3	3.48
Primary healthcare services	999	1,787	1,537	1,309
Maternal and childhood healthcare services	999	1,651	1,400	1,199
Births	999	60.09	53	41.28
Stillbirths (in %)	999	0.75	0	1.51
Neonatal deaths (in %)	999	0.46	0	1.23
Live births (in %)	999	98.78	100	2.23
Revenues (in CDF 1,000)	999	376.36	194.89	580.49
Subsidies (in CDF 1,000)	999	43.40	0.00	188.02
Panel B. Population statistics				
Population in center's health area	999	11,135	9,508	7,734
Population in center's health district	999	204,409	181,565	80,683

Table 2. Randomization tests

		Obs.	Mean	Median	Std. Dev.	*p*-value (diff. in means)
Panel A. Health centers statistics						
Primary healthcare services per employee	Treated	674	266.83	197.69	253.33	0.604
	Control	325	248.33	203.50	227.23	
Employees	Treated	674	7.49	6	6.58	0.649
	Control	325	7.19	6	7.65	
Doctors	Treated	674	0.09	0	0.41	0.702
	Control	325	0.07	0	0.42	
Nurses	Treated	674	3.78	3	3.90	0.346
	Control	325	3.45	3	6.69	
Administrative	Treated	674	3.62	3	3.65	0.928
	Control	325	3.66	3	3.09	
Primary healthcare services	Treated	674	1,850	1,567	1,378	0.316
	Control	325	1,655	1,470	1,142	
Maternal and childhood healthcare services	Treated	674	1,709	1,427	1,253	0.343
	Control	325	1,532	1,357	1,070	
Births	Treated	674	62.64	55	42.66	0.241
	Control	325	54.80	51	37.76	
Stillbirths (in %)	Treated	674	0.80	0	1.57	0.229
	Control	325	0.66	0	1.39	
Neonatal deaths (in %)	Treated	674	0.48	0	1.26	0.701
	Control	325	0.44	0	1.19	
Live births (in %)	Treated	674	98.73	100	2.27	0.343
	Control	325	98.90	100	2.13	
Revenues (in CDF 1,000)	Treated	674	365.16	177.93	581.07	0.578
	Control	325	399.59	249.07	579.49	
Subsidies (in CDF 1,000)	Treated	674	48.82	0.00	199.61	0.365
	Control	325	32.16	0.00	161.07	
Panel B. Population statistics						
Population in center's health area	Treated	674	11,090	9,491	6,377	0.896
	Control	325	11,227	9,847	9,988	
Population in center's health district	Treated	674	201,829	181,565	73,925	0.716
	Control	325	209,760	177,275	93,047	

Notes. All variables are recorded in the first quarter of 2017. The last column reports the *p*-value of the difference-in-means test comparing treated and control health centers. *, **, and *** denotes significance at the 10%, 5%, and 1% level, respectively.

Table 3. The impact of the governance treatment on health center outcomes

	Health center operating efficiency	Health center employees				Volume of healthcare services			Quality of healthcare services		
	Δ Primary healthcare services per employee	%Δ Emp.	%Δ Doctors	%Δ Nurses	%Δ Admin. employees	%Δ Primary healthcare services	%Δ Maternal and childhood healthcare services	%Δ Births	Δ Share of stillbirths	Δ Share of neonatal deaths	Δ Share of live births
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Treatment	93.075***	-0.085	0.013	0.001	-0.099*	0.134	0.069	0.128	-0.345***	-0.276**	0.621***
	(31.022)	(0.089)	(0.016)	(0.075)	(0.056)	(0.261)	(0.253)	(0.169)	(0.108)	(0.138)	(0.209)
Province fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.198	0.055	0.018	0.046	0.028	0.162	0.155	0.080	0.016	0.017	0.021
Observations	999	999	999	999	999	999	999	999	999	999	999

Notes. For each dependent variable we compute the change between the initial quarter (Q1) and the tenth quarter (Q10) after the treatment. When the dependent variable is a ratio—i.e., in columns (1) and (9)-(11)—Δy represents the difference in y from Q1 to Q10. When the dependent variable is a level—i.e., in columns (2)-(8)—%Δy represents the percentage change in y from Q1 to Q10. In column (1), the units are in number of primary healthcare services per employee; in columns (9)-(11), the units are in percentage points. Standard errors (reported in parentheses) are clustered at the health district level. *, **, and *** denotes significance at the 10%, 5%, and 1% level, respectively.

Table 4. Density of health centers in the same health district

	Health center operating efficiency	Health center employees				Volume of healthcare services			Quality of healthcare services		
	Δ Primary healthcare services per employee	%Δ Emp.	%Δ Doctors	%Δ Nurses	%Δ Admin. employees	%Δ Primary healthcare services	%Δ Maternal and childhood healthcare services	%Δ Births	Δ Share of stillbirths	Δ Share of neonatal deaths	Δ Share of live births
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Treatment	110.577***	-0.089	0.023	0.026	-0.138**	0.143	0.089	0.128	-0.399***	-0.377***	0.776***
× Low # of health centers	(35.556)	(0.102)	(0.017)	(0.084)	(0.058)	(0.301)	(0.292)	(0.193)	(0.115)	(0.112)	(0.189)
Treatment	21.819	-0.067	-0.028	-0.102	0.063	0.100	-0.015	0.130	-0.125	0.134	-0.010
× High # of health centers	(41.613)	(0.097)	(0.032)	(0.072)	(0.064)	(0.338)	(0.326)	(0.196)	(0.154)	(0.450)	(0.557)
Province fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.202	0.055	0.023	0.048	0.042	0.162	0.156	0.080	0.017	0.024	0.027
Observations	999	999	999	999	999	999	999	999	999	999	999

Notes. This table presents variants of the regressions in Table 3, interacting *treatment* with two dummy variables—*low # of health centers* and *high # of health centers*, respectively—indicating whether the health center is located in a health district with below-median (and above-median, respectively) number of health centers per capita. Standard errors (reported in parentheses) are clustered at the health district level. *, **, and *** denotes significance at the 10%, 5%, and 1% level, respectively.

Table 5. Treatment group vs. "outside" group

	Health center operating efficiency	Health center employees				Volume of healthcare services			Quality of healthcare services		
	Δ Primary healthcare services per employee	%Δ Emp.	%Δ Doctors	%Δ Nurses	%Δ Admin. employees	%Δ Primary healthcare services	%Δ Maternal and childhood healthcare services	%Δ Births	Δ Share of stillbirths	Δ Share of neonatal deaths	Δ Share of live births
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Treatment vs. outside	98.125***	0.191**	-0.008	0.221***	-0.022	0.764***	0.703***	0.630***	-0.325**	-0.428*	0.753**
	(26.170)	(0.082)	(0.015)	(0.067)	(0.046)	(0.234)	(0.230)	(0.135)	(0.156)	(0.223)	(0.312)
Province fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.180	0.085	0.015	0.067	0.041	0.156	0.149	0.126	0.017	0.018	0.023
Observations	1,348	1,348	1,348	1,348	1,348	1,348	1,348	1,348	1,348	1,348	1,348

Notes. This table presents variants of the regressions in Table 3, except that the treatment group is compared to the "outside" group (in lieu of the control group). Health centers from the outside group are matched to health centers in the treatment group using the nearest-neighbor matching described in section 4.2. Standard errors (reported in parentheses) are clustered at the health district level. *, **, and *** denotes significance at the 10%, 5%, and 1% level, respectively.

Table 6. Control group vs. "outside" group

	Health center operating efficiency	Health center employees				Volume of healthcare services			Quality of healthcare services		
	Δ Primary healthcare services per employee	%Δ Emp.	%Δ Doctors	%Δ Nurses	%Δ Admin. employees	%Δ Primary healthcare services	%Δ Maternal and childhood healthcare services	%Δ Births	Δ Share of stillbirths	Δ Share of neonatal deaths	Δ Share of live births
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Control vs. outside	-38.789	0.250***	-0.013	0.193***	0.071	0.335*	0.343*	0.287***	-0.137	-0.193	0.330
	(53.040)	(0.070)	(0.013)	(0.058)	(0.045)	(0.193)	(0.190)	(0.094)	(0.183)	(0.257)	(0.368)
Province fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.170	0.103	0.034	0.077	0.068	0.305	0.313	0.189	0.019	0.032	0.024
Observations	650	650	650	650	650	650	650	650	650	650	650

Notes. This table presents variants of the regressions in Table 5, except that the control group (in lieu of the treatment group) is compared to the "outside" group. Health centers from the outside group are matched to health centers in the control group using the nearest-neighbor matching described in section 4.2. Standard errors (reported in parentheses) are clustered at the health district level. *, **, and *** denotes significance at the 10%, 5%, and 1% level, respectively.

Appendix Table A1. Summary statistics for the "outside" group

	Obs.	Mean	Median	Std. Dev.
Panel A. Health centers statistics				
Primary healthcare services per employee	5,832	146.86	83.66	378.89
Employees	5,832	5.39	4	6.97
Doctors	5,832	0.22	0	0.82
Nurses	5,832	2.84	2	4.71
Administrative	5,832	2.33	2	2.81
Primary healthcare services	5,832	1,015	459	1,619
Maternal and childhood healthcare services	5,832	945	436	1,496
Births	5,832	26.91	13	41.68
Stillbirths (in %)	5,832	0.53	0	1.93
Neonatal deaths (in %)	5,832	0.31	0	1.65
Live births (in %)	5,832	99.17	100	2.88
Panel B. Population statistics				
Population in center's health area	5,832	11,918	9,495	8,700
Population in center's health district	5,832	215,158	194,315	94,966

Appendix Table A2. Covariate balance post matching

	Treatment vs. matched "outside" group		Control vs. matched "outside" group	
	Obs.	*p*-value (diff. in means)	Obs.	*p*-value (diff. in means)
	(1)	(2)	(3)	(4)
Panel A. Health centers statistics				
Primary healthcare services per employee	1,348	0.265	650	0.112
Employees	1,348	0.575	650	0.594
Doctors	1,348	0.354	650	0.680
Nurses	1,348	0.692	650	0.836
Administrative	1,348	0.403	650	0.223
Primary healthcare services	1,348	0.758	650	0.178
Maternal and childhood healthcare services	1,348	0.766	650	0.214
Births	1,348	0.839	650	0.352
Stillbirths (in %)	1,348	0.943	650	0.466
Neonatal deaths (in %)	1,348	0.412	650	0.856
Live births (in %)	1,348	0.949	650	0.893
Panel B. Population statistics				
Population in center's health area	1,348	0.952	650	0.754
Population in center's health district	1,348	0.706	650	0.845

Notes. All variables are recorded in the first quarter of 2017. The table reports the *p*-value of the difference-in-means test comparing treated health centers vs. matched "outside" health centers (columns (1) and (2)), and control health centers vs. matched "outside" health centers (columns (3) and (4)). Health centers from the outside group are matched to health centers in the treatment and control groups using the nearest-neighbor matching described in section 4.2. *, **, and *** denotes significance at the 10%, 5%, and 1% level, respectively.

Appendix Table A3. Specification with controls

	Health center operating efficiency	Health center employees				Volume of healthcare services			Quality of healthcare services		
	Δ Primary healthcare services per employee	%Δ Emp.	%Δ Doctors	%Δ Nurses	%Δ Admin. employees	%Δ Primary healthcare services	%Δ Maternal and childhood healthcare services	%Δ Births	Δ Share of stillbirths	Δ Share of neonatal deaths	Δ Share of live births
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Treatment	89.697***	-0.078	0.012	0.007	-0.098*	0.140	0.073	0.139	-0.340***	-0.265*	0.605***
	(29.873)	(0.081)	(0.016)	(0.069)	(0.056)	(0.239)	(0.232)	(0.145)	(0.109)	(0.142)	(0.214)
Log(subsidies)	6.816	0.007	0.002	0.001	0.004	0.027	0.029	0.001	-0.003	-0.024	0.028
	(8.493)	(0.012)	(0.003)	(0.011)	(0.005)	(0.029)	(0.029)	(0.018)	(0.024)	(0.024)	(0.039)
Log(employees)	42.344	-0.647***	-0.017	-0.487***	-0.142***	-1.102***	-1.081***	-0.743***	-0.185**	-0.117	0.302**
	(26.595)	(0.068)	(0.017)	(0.051)	(0.038)	(0.274)	(0.269)	(0.150)	(0.073)	(0.081)	(0.126)
Province fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.207	0.351	0.022	0.268	0.071	0.290	0.285	0.237	0.020	0.020	0.027
Observations	999	999	999	999	999	999	999	999	999	999	999

Notes. This table presents variants of the regressions in Table 3, including as controls *log(subsidies)* and *log(employees)* in the initial quarter (Q1). Standard errors are clustered at the health district level. *, **, and *** denotes significance at the 10%, 5%, and 1% level, respectively.

Appendix Table A4. Quality of healthcare services at other healthcare facilities in the same health district as the treated health centers

	Hospitals in same health district as treated health centers			Control health centers in same health district as treated health centers			Outside health centers in same health district as treated health centers		
	Δ Share of stillbirths	Δ Share of neonatal deaths	Δ Share of live births	Δ Share of stillbirths	Δ Share of neonatal deaths	Δ Share of live births	Δ Share of stillbirths	Δ Share of neonatal deaths	Δ Share of live births
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Mean	-0.037	-0.056	0.093	-0.124	0.015	0.109	0.088	-0.008	-0.080
	(0.258)	(0.053)	(0.274)	(0.110)	(0.116)	(0.186)	(0.088)	(0.051)	(0.118)
Observations	121	121	121	72	72	72	1,192	1,192	1,192

Notes. This table reports the mean of the dependent variable Δy_{Q1-Q10} across all healthcare facilities (hospitals in columns (1)-(3), control health centers in columns (4)-(6), and health centers from the "outside" group in columns (7)-(9)) that are located within the same health district as the treated health centers. Standard errors are clustered at the health district level. *, **, and *** denotes significance at the 10%, 5%, and 1% level, respectively.

Appendix Table A5. Dynamics

	Health center operating efficiency	Health center employees				Volume of healthcare services			Quality of healthcare services		
	Δ Primary healthcare services per employee	%Δ Emp.	%Δ Doctors	%Δ Nurses	%Δ Admin. employees	%Δ Primary healthcare services	%Δ Maternal and childhood healthcare services	%Δ Births	Δ Share of stillbirths	Δ Share of neonatal deaths	Δ Share of live births
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Treatment	12.867	-0.026	0.012	0.006	-0.045	-0.094	-0.111	-0.105	-0.035	-0.078	0.113
(Δ Q1 – Q2)	(19.724)	(0.064)	(0.008)	(0.045)	(0.030)	(0.196)	(0.192)	(0.140)	(0.126)	(0.117)	(0.169)
Treatment	10.618	-0.028	0.013	-0.001	-0.041	-0.112	-0.147	-0.170	-0.015	-0.156	0.171
(Δ Q1 – Q3)	(25.628)	(0.059)	(0.010)	(0.041)	(0.031)	(0.192)	(0.184)	(0.125)	(0.138)	(0.108)	(0.192)
Treatment	-6.064	0.015	0.014	0.037	-0.035	0.003	-0.043	-0.004	0.026	-0.021	-0.005
(Δ Q1 – Q4)	(28.691)	(0.071)	(0.010)	(0.054)	(0.034)	(0.229)	(0.219)	(0.158)	(0.138)	(0.090)	(0.176)
Treatment	2.106	-0.022	0.006	0.041	-0.069*	0.028	-0.020	-0.027	-0.179	-0.172	0.351
(Δ Q1 – Q5)	(30.014)	(0.068)	(0.014)	(0.063)	(0.039)	(0.191)	(0.185)	(0.149)	(0.152)	(0.128)	(0.216)
Treatment	2.760	0.042	0.011	0.104	-0.073*	0.079	0.034	0.000	-0.165	-0.036	0.201
(Δ Q1 – Q6)	(34.077)	(0.083)	(0.012)	(0.065)	(0.043)	(0.218)	(0.208)	(0.162)	(0.136)	(0.133)	(0.234)
Treatment	45.171	-0.021	-0.005	0.059	-0.075*	0.120	0.084	0.086	-0.192	-0.167	0.358*
(Δ Q1 – Q7)	(32.000)	(0.066)	(0.014)	(0.053)	(0.044)	(0.217)	(0.208)	(0.164)	(0.130)	(0.120)	(0.202)
Treatment	27.349	-0.014	-0.004	0.080	-0.089*	0.031	-0.008	0.051	-0.350**	-0.056	0.406*
(Δ Q1 – Q8)	(34.870)	(0.085)	(0.015)	(0.063)	(0.051)	(0.229)	(0.218)	(0.178)	(0.137)	(0.143)	(0.222)
Treatment	82.690**	-0.056	0.004	0.052	-0.112**	-0.000	-0.050	0.007	-0.335***	-0.212	0.546***
(Δ Q1 – Q9)	(37.829)	(0.087)	(0.016)	(0.069)	(0.056)	(0.232)	(0.224)	(0.173)	(0.113)	(0.132)	(0.189)
Treatment	93.075***	-0.085	0.013	0.001	-0.099*	0.134	0.069	0.128	-0.345***	-0.276**	0.621***
(Δ Q1 – Q10)	(31.022)	(0.089)	(0.016)	(0.075)	(0.056)	(0.261)	(0.253)	(0.169)	(0.108)	(0.138)	(0.209)

Notes. This table presents variants of the regressions in Table 3, in which different time intervals (from Q1 – Q2 until Q1 – Q10) are used to compute changes in the dependent variables. Each coefficient is obtained from a different regression. Standard errors are clustered at the health district level. *, **, and *** denotes significance at the 10%, 5%, and 1% level, respectively.

Appendix Table A6. Panel specification

	Health center operating efficiency	Health center employees				Volume of healthcare services			Quality of healthcare services		
	Primary healthcare services per employee	Employees (log)	Doctors (log)	Nurses (log)	Admin. employees (log)	Primary healthcare services (log)	Maternal and childhood healthcare services (log)	Births (log)	Share of stillbirths	Share of neonatal deaths	Share of live births
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Treatment (Q2 – Q4)	-7.978	0.015	0.007	0.032	-0.024	-0.030	-0.072	-0.089	0.043	-0.066	0.023
	(16.399)	(0.054)	(0.009)	(0.039)	(0.026)	(0.164)	(0.159)	(0.111)	(0.104)	(0.082)	(0.148)
Treatment (Q5 – Q7)	-8.331	0.017	0.000	0.066	-0.050	0.133	0.081	0.041	-0.096	-0.105	0.201
	(16.787)	(0.065)	(0.013)	(0.052)	(0.036)	(0.181)	(0.178)	(0.139)	(0.103)	(0.092)	(0.154)
Treatment (Q8 – Q10)	46.184***	-0.035	0.001	0.041	-0.077*	0.146	0.067	0.094	-0.286***	-0.152*	0.438***
	(17.211)	(0.073)	(0.015)	(0.060)	(0.046)	(0.213)	(0.209)	(0.148)	(0.102)	(0.086)	(0.149)
Health center fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Quarter fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.434	0.624	0.814	0.685	0.741	0.481	0.491	0.625	0.308	0.264	0.334
Observations	9,990	9,990	9,990	9,990	9,990	9,990	9,990	9,990	9,990	9,990	9,990

Notes. This table presents variants of the regressions in Table 3, using a panel specification that pools all health center-quarter observations. The dependent variable is the level of y in columns (1) and (9)-(11) (i.e., outcome variables for which Δy was used in Table 3), and $\log(1 + y)$ in columns (2)-(8) (i.e., outcome variables for which $\%\Delta y$ was used in Table 3). The regressions include health center and year fixed effects. *Treatment (Q2 – Q4)*, *Treatment (Q5 – Q7)*, and *Treatment (Q8 – Q10)* are indicator variables equal to one for the treated health centers in quarters Q2-Q4, Q5-Q7, and Q8-Q10, respectively, and zero otherwise. Standard errors are clustered at the health district level. *, **, and *** denotes significance at the 10%, 5%, and 1% level, respectively.