Shine a (night)light: Decentralisation and Economic Development in Burkina Faso

Working Paper

Author(s):
Bargain, Olivier B.; Caldeira, Émilie; Vincent, Rose Camille

Publication date:
2023-02

Permanent link:
https://doi.org/10.3929/ethz-b-000604542

Originally published in:
ODI Working Paper

Working paper

Shine a (night)light: Decentralisation and economic development in Burkina Faso

Olivier B. Bargain, Emilie Caldeira and Rose C. Vincent

February 2023

Public finance and service delivery

Series

Abstract

Decentralisation has been one of the most prominent public sector reforms endorsed by international institutions. It has been initiated in a large number of developing economies, particularly in sub-Saharan Africa. To date, few studies propose a quasi-experimental evaluation of its capacity to contribute to local development, or do so but only focus on specific components (e.g. decentralised programmes). We suggest a unique assessment of decentralisation in its essence by exploiting the progressive implementation of the decentralisation agenda at the commune level in Burkina Faso starting in 1995. We use satellite information on night-time light density as a proxy for local development levels, which has the advantage of being measured and comparable over time and space. The communes that were decentralised first can be compared to the others after the reform relative to the pre-reform situation. The difference-in-difference approach includes commune fixed effects and inverse propensity score reweighting to account for time-varying differences across communes. We find a positive impact of decentralisation on the nightlight intensity trends of the early-decentralised communes. We provide extensive checks regarding the possibility of confounding dynamics associated with the communes that were decentralised first. We also provide suggestive evidence that decentralisation did not lift all boats: heterogeneity analyses show that the gains from decentralisation depend more on the ability to generate local own-source revenues than on the capacity to attract state transfers.

How to cite: Bargain, O., Caldeira, E. and Vincent, R. (2023) *Shine a (night)light: Decentralisation and economic development in Burkina Faso.* ODI Working Paper. London: ODI (www.odi.org/en/publications/shine-a-nightlight-decentralisation-and-economic-development-in-burkina-faso/).

Acknowledgements

Olivier Bargain is affiliated with the Bordeaux School of Economics, Bordeaux University, and IZA, Bonn; Emilie Caldeira with CERDI, University Clermont Auvergne; and Rose Camille Vincent with the Chair of Public Economics, ETH Zürich.

We are grateful to Justine Knebelmann, Michael Mbate, Jean Paul-Faguet, Thierry Madiès, Jorge Martinez-Vasquez, Marko Kothenbürger, Serdar Yilmaz, Jamie Boex, Malte Lier, Kazuko Nakata, Shun-Ichiro Bessho, Luke Heath Milsom, Odd-Helge Fjeldstad, and to participants of the 2022 Symposium of Public Economics, the 2022 Annual Congress of the IIPF, and the 2022 Royal Economic Society Junior Symposium, and the 2022 International Conference on Development Economics (ICDE) and two seminars, organized by ODI and by the World Band respectively, for in-depth reviews, comments and suggestions for improvements. We are also grateful to Oulla André Ouattara (Programme d'Appui aux Collectivités Territoriales, Ouagadougou), Martial Wilfried Bassole (Ministère de l'Economie et des Finances, Burkina Faso), Sekou Kone (World Bank), and Ousmane Kolie (World Bank) for providing us with valuable information.

This work was supported the Bill & Melinda Gates Foundation [Grant Number INV-021455]. Under the grant conditions of the Foundation, a Creative Commons Attribution 4.0 Generic License has already been assigned.

Contents

Display items

Tables

Figures

Appendix

Acronyms

DD	difference-in-difference
DGTCP	Treasury and Public Accountancy Directorate (*Direction Générale du Trésor et de la Comptabilité Publique*)
DMSP	US Air Forces Defense Meteorological Satellite Program
FE	fixed effects
GDP	gross domestic product
OECD	Organisation for Economic Co-operation and Development
PS	propensity score

1 Introduction

The unflagging search for good institutions and more equitable access to public goods has placed decentralisation at the centre of policy experiments in many developing and emerging countries. The transfer of powers to local authorities has emerged as a means of ensuring political stability, increasing the effectiveness of public policies and ultimately reducing poverty (Bardhan, 2002). By the late 1990s, several developing economies, especially in sub-Saharan Africa, had embarked on a process of creating new frameworks for intergovernmental governance and fiscal management, as well as conducting local democratic elections.[1] Global development agendas, such as the Millennium Project, have put an additional emphasis on decentralisation by recognising the far-reaching role of subnational governments in helping countries meet their development targets (UNDP, 2005). It has subsequently become one of the main proposals for institutional reform and has been endorsed by international donor institutions.

To date, however, there are limited quasi-experimental evaluations of decentralisation and its effectiveness in improving households' living standards, access to public services and local economic development. This is especially the case for developing economies, and particularly in sub-Saharan Africa. While some research has been carried out on components of decentralisation – such as the decentralisation of educational funding (Pitt and Khandker, 1998; Galasso and Ravallion, 2005) or changes in fiscal discretion at the local level (Wang et al., 2012) – there is a notable paucity of empirical research that seeks to identify the effects of decentralisation reform at its core, and the experiences of countries that engaged in it. Two essential factors explain this. First, decentralisation mainly occurred as a uniform policy, established through legal texts that define the attributions and rights of lower-tier governments and simultaneously affect all sub-national units. This implies a lack of counterfactuals or comparison groups, which impedes causal evaluations of the reform. Second, there is a severe lack of credible time-series data on local governments, especially for least-developed economies, most of which have embarked on the decentralisation wagon.[2]

Exploiting original information and data on Burkina Faso, this paper attempts to fill this literature gap by proposing a quasi-experimental evaluation of the decentralisation reform on local

1 For insights on the emergence of decentralisation trends in developing economies, and particularly in Africa, see for instance Vaillancourt and Bird (1999); Crawford and Hartmann (2008); Martinez-Vazquez and Vaillancourt (2011); Brosio (2002); Dafflon and Madiès (2013); Dickovick and Wunsch (2014); Caldeira and Rota-Graziosi (2014).

2 While multi-level governance, intergovernmental fiscal relations and local democracy are taken as given in most well-established federal and industrialised economies, low- and middle-income countries have less than three decades of experience in these policy settings. The initiation of local democracy through elections and the establishment of local governments across the board began in Senegal in 1996, in Burkina Faso in 1995 (as described below), in Benin in 2003, and in Niger in 2004. There is still a crucial lack of information and fiscal data on these established local governments, both within and across countries.

development. Unlike in most countries, decentralisation reform in Burkina Faso was implemented gradually, with communes joining the reform in different waves – effectively in 1995, 2000 and 2005 – thereby creating counterfactual groups among localities. In 1995, 33 communes joined the first wave of reform through local elections and the institution of local government councils. These were followed by 16 communes in 2000 and the rest of the country in 2005. We take advantage of this phased-in reform and adopt a difference-in-difference (DD) approach to study the differential changes in outcomes among established cities with increased autonomy before and after each wave of reform. As such, our setting provides one of the rare quasi-experimental assessments of the effect of decentralisation in sub-Saharan Africa.

The suggested approach requires outcomes that are available and comparable across time and space, i.e. over the 1990s and 2000s and across all communes. For that, we rely on satellite information on night-time light density at the local level, which is available from 1992 to 2010 (Henderson et al., 2012). This is used as a proxy for local economic development or local economic activity, as promoted in key publications (Henderson et al., 2012; Hodler and Raschky, 2014; Alesina et al., 2016). Several studies, for instance Mellander et al. (2015) and Bruederle and Hodler (2018), corroborate the strong correlations between night-time light density and location-specific indicators of development. We show that nightlight data is relevant in the case of Burkina Faso and strongly correlated with cross-sectional and time variation in local potential resources and – when available – with data on local fiscal capacities. We complement the specification of the DD model with key time-varying controls such as climatic conditions, which influence energy production and potentially affect nightlight intensity.

We find a positive and sizeable impact of the early phase of the decentralisation reform on local development for communes decentralised in 1995 relative to other communes. We address two sources of concern. The first potential issue is the lack of external validity due to heterogeneous responses to decentralisation. There are indeed difficulties in generalising results if the communes most able/likely to take advantage of decentralisation may have been chosen to go first, which seems consistent with the political economy of decentralisation. In this situation, the other communes, decentralised later, might still be a relevant counterfactual to capture the outcome trend in absence of treatment. However, the DD approach only provides a measure of the average treatment effect on the treated, i.e. the communes for which the largest effects are perhaps expected. A second, more serious problem could undermine the internal validity of the DD if the communes chosen to initiate the decentralisation process cannot be reasonably compared with other communes because the former would have experienced a different development path anyway (i.e. if decentralisation had not taken place). This time-varying selection bias may occur for instance if communes that were already on a better economic trajectory were encouraged to be part of the first round.

The empirical model includes commune fixed effects, which account for time-invariant confounders such as communes' endowments at the start of the reform, their historical administrative role and influence (as provincial or regional capital), their geographic

characteristics or unobserved political factors (such as favouritism and ethnic distribution for the part that remained stable over the period). Moreover, to mitigate the internal validity concern, the parallel trend assumption is verified, which means that the first decentralised and the remaining communes followed the same trend in nightlight intensity before the reform. While this is not conclusive evidence that they would follow the same trajectory in the absence of decentralisation after 1995, it provides some reassurance that non-decentralised communes can provide a reasonable counterfactual, particularly if they most closely resembled the communes decentralised in 1995. So, in order to compare treated and control communes that are most similar, we also suggest DD estimations adjusted by a quasi-matching strategy. Assuming that the matching variables are highly related to unobserved confounders, this approach should reduce the potential bias affecting trend differences between the groups of communes decentralised at different points in time.[3] We also test whether results hold when we include commune characteristics (administrative functions, population size) interacted with time fixed effects or when we focus on more homogenous groups of communes (e.g. provincial communes) while imposing common support. Even if the results remain suggestive, a battery of alternative estimations tend to consolidate our conclusions.

To address the lack of external validity, we examine potential heterogeneity within the group of 1995-decentralised communes. Some border communes or trade centres (hubs) show rapid development patterns, which is most likely due to their special status than decentralisation. For the bulk of the initial communes, being regional capitals provides only a small advantage. We also avail ourselves of the detailed information on the nature of communes' resources, for the early-decentralised communes, and ask which ones benefit most from decentralisation between those that were better able to attract central government funding (measured by per-capita transfers) and those with a greater capacity to raise local resources (measured by own-source revenues). We find that decentralisation did not lift all boats: only the communes that had the capacity to implement the reform through own-source revenues – more than state transfers – show significant returns to decentralisation.

The rest of the paper is organised as follows. Section 2 provides an overview of the background literature and details the institutional context and decentralisation reform in Burkina Faso. Section 3 describes our data and methodology. Section 4 presents the empirical results, first in graphical form, then with the complete set of estimations. Concluding remarks are in section 5.

3 We assume that this bias can be reduced by conducting the DD in a way that compares treated and untreated communes that are similar in terms of observable characteristics, in the spirit of matching approaches. We do so by applying an inverse propensity score reweighting to capture time-varying differences across communes.

2 Background information

2.1 Existing literature and contributions

Theoretical advantages of decentralisation. Oates (2005) provides a seminal summary of the theoretical advantages of decentralisation. The mechanisms through which the reform can be beneficial are manifold. First, local governments may have an informational advantage (principle of proximity), i.e. a more holistic understanding of the needs and preferences of their constituents. Hence, by bringing political decision-making closer to citizens, decentralisation is argued to reduce information asymmetries, thereby improving the adequacy of public policies.[4] Second, there is a possible mechanism associated with Tiebout (1961)'s 'voting-by-feet' argument, according to which preferences for public goods can be revealed through interjurisdictional self-sorting, leading to the optimum provision of local public goods. This could give rise to competition among local authorities as they attempt to attract and retain mobile tax bases. Some have argued that the Tiebout rationale for decentralisation does not apply to developing economies because there are limits to mobility (see the discussion in Gadenne and Singhal, 2014) and insufficient preference differentiation (e.g. Smoke, 2001). Third, 'yardstick' competition may exist through the ability of citizens to compare politicians across jurisdictions and operate even in the absence of population mobility.[5] Finally, there are more pragmatic advantages to decentralisation related to the proximity between policy-makers and their constituents, whether informational advantages of local governments over central authorities to better target social programmes (Alderman, 2002; Galasso and Ravallion, 2005), or a sense of accountability that should lead to more efficient public service delivery (Prud'homme, 1995; Seabright, 1996).

Empirical evidence for developing countries. There is only limited evidence on the different mechanisms described above in the context of developing countries. Few studies examine fiscal competition and yardstick competition between districts after decentralisation reforms (see Arse del Granado et al., 2008, for Indonesia, and contributions in Faguet and Pöschl (eds), 2015, for instance, for the Philippines and China). Some authors suggest that greater local discretion in China in the 1980s has boosted local economic performance and thereby fostered

4 Several empirical studies have corroborated these arguments by highlighting the informational gain resulting from decentralisation, which enables public policies to be more in line with local needs (e.g. Bird and Rodriguez, 1999; Faguet, 2004; Galiani et al., 2008; Enikolopov and Zhuravskaya, 2007).

5 With yardstick competition, voters penalise their governments in the electoral process based on a comparison with neighbouring jurisdictions, while representatives attempt to stay in power by mimicking the policies of their neighbours (Besley and Case, 1995).

the country's economic boom (Montinola et al., 1995; Jin et al., 2005; Caldeira, 2012), or point to the existence of strategic complementarity in public spending across jurisdictions (for instance Caldeira et al., 2015, for Benin).[6]

More generally, several empirical studies corroborate the hypothesised gains from decentralisation by studying the impacts of *specific components* of decentralisation reforms on various socio-economic outcomes. For instance, decentralisation has proven to positively impact educational outcomes in Bolivia (Faguet, 2004) and Argentina (Galiani et al., 2008), yet sometimes in an unequal way. Positive effects have also been evidenced regarding health outcomes in Argentina (see Habibi et al., 2003) and other countries (see Robalino et al., 2001, for a cross-country analysis). Decentralisation has been shown to increase overall social spending in Eastern Europe (del Granado et al., 2018), and citizens' satisfaction and trust in governments in the Organisation for Economic Co-operation and Development (OECD) and European Union countries (see e.g. Ligthart and van Oudheusden, 2015; Dias-Serrano and Rodrígues-Pose, 2015). Other contributions have confirmed that decentralisation fosters better targeting of the lower-income thresholds of the population (e.g. Alatas et al., 2012, in Indonesia; Alderman, 2002, in Albania; Bardhan and Mookherjee, 2005; 2006, in West Bengal; or Galasso and Ravallion, 2005, in Bangladesh).[7] However, the literature also points to unequal effects of decentralisation in poor countries (Prud'homme, 1995; Manor, 1999; West and Wong, 1995; Galiani et al., 2008; Caldeira et al., 2012), which is important in our context and will be discussed extensively below.

Whether decentralisation improves the well-being of households and communities in Africa remains an under-researched question, despite more than three decades of reforms in sub-Saharan countries. Among the few attempts at quantifying the impact of decentralisation, two studies analyse a *specific component* of decentralisation – fiscal decentralisation – and its impact on various poverty-sensitive public goods and services. Caldeira et al. (2012) show that decentralisation, as measured by the percentage of own sources in total local government revenue, contributes to poverty reduction by improving household access to essential public services in Benin. Sanogo (2019) denotes a positive effect of revenue decentralisation on access to public services and poverty alleviation in Côte d'Ivoire, using a proxy similar to Caldeira et al. (2012). Finally, Livingston and Asfar (2010) show that, through decentralisation, better targeting for public goods delivery seems to be achieved by local governments in Uganda.

---

6 There is also little evidence on the extent to which voters use information on outcomes in neighbouring jurisdictions to infer the performance of their local politicians, but a growing literature directly considers the role of information in improving government accountability in developing countries (e.g. Ferraz and Finan, 2008, on imperfect information about corruption in Brazil, or Reinikka and Svensson, 2011, on information about education grants in Uganda).

7 See the enlightening surveys and discussions by Channa and Faguet (2016), Gadenne and Singhal (2014) or Bardhan (2002). Note that there is also a large literature on the effects of decentralisation on countries' macroeconomic performance: see Martinez-Vazquez et al. (2017) for a review.

Contributions. This paper departs from most of the above publications in essential aspects. *First*, beyond all aspects of decentralisation analysed in the literature, it evaluates the reform at its core by asking whether there is any economic dividend to a decentralised jurisdiction in a low-income country. The loss of economies of scale and fiscal erosion are often pointed to as threats of decentralisation, even more so in countries with a high degree of ethnic fragmentation and limited resources. *Second*, this paper falls within a very restricted group of publications. As argued earlier, decentralisation and territorial reforms are often uniform, leaving limited scope for counterfactuals among jurisdictions within a given country. Closer to us, several studies have used natural experiments to elicit the impact of decentralised governance in low- or middle-income countries. Faguet (2004) finds that the 1994 decentralisation reform in Bolivia was associated with a large increase in reported local public investment in education and health. Faguet and Sanchez (2014) exploit the gradual nature of the decentralisation process in Colombia to assess its effect on access to health and education. Kis-Katos and Sjahrir (2017) study the 2001 expenditure decentralisation in Indonesia, which created two new layers of subnational governments and led to higher investments in public infrastructure in districts that had little infrastructure to start with. Galiani et al. (2008) use a DD-type strategy to examine the effects of a school decentralisation programme in Argentina, and find improvements in test score performance on average, although these gains are concentrated in non-poor municipalities. Malesky et al. (2014) exploit the re-centralisation of Vietnam – namely the abolition of the elected district councils based on defined criteria – as a quasi-experiment to assess the impact of centralisation on public services.[8] Cortes et al. (2010) and Khanna (2023) use the eligibility threshold to evaluate the impact of increased local responsibilities for educational programmes on education outcomes in Colombia and India, respectively.[9] Thus, in the African context, this paper stands as the first to assess the impact of decentralisation on socio-economic development using a quasi-experimental design.

2.2 Institutional context and legal background

Context. Similar to other French-speaking West African countries, Burkina Faso had placed decentralisation as a means of enhancing economic development and ensuring a more inclusive

8 Several papers exploit time and province variation in fiscal discretion in China, namely the province-managing-county reform whereby counties move upwards in the vertical ladder (becoming directly managed by provinces instead of prefectures). This reform has resulted in the flattening of the government structure and led to more fiscal autonomy in these counties (Jia et al., 2020), to a lower share of spending on education (Wang et al., 2012), and to a misuse of funds and corruption (Bo et al., 2020; Li et al., 2016).

9 For richer countries, Myck and Najsstub (2020) explore the implications of the Polish administration reform of 1999, which reduced the number of regions from 49 to 16 and thus increased the distance between communes and their regional administrative capital, on socio-economic indicators. Exploiting the spatial decay of communes vis-à-vis their provincial capital, they find no evidence of slower socio-economic development for communes at the periphery. For Switzerland, Flèche (2021) uses variation in the tasks and responsibilities of local governments across cantons and points to the detrimental effect of centralisation on well-being and political/civic participation.

management of public affairs (Brosio, 2002; Dafflon and Madiès, 2013). The implementation of the decentralisation reform was rolled out in three phases over 10 years. Before the reform became effective, the Constitution of 1991 had prepared the ground.[10] Articles 143–145 of the Constitution established the current multi-level governance structure and set the basis for self-administration of local units (*collectivités territoriales*) and local democratic participation. The process also mobilised national and international actors that contributed to level-up public debates and provided the financial means at every stage. The reform was designed and implemented gradually, aiming to grant all stakeholders the time and means to adapt to the new mode of governance (Champagne and Ouedraogo, 2008). It was anchored in a global trend to modernise the public sector in developing and emerging economies in the late 1990s and early 2000s (Vaillancourt and Bird, 1999; Martinez-Vazquez and Vaillancourt, 2011). However, the success of the newly implemented local governance may also have varied across communes.

The phased roll-out of decentralisation reform. Appendix **Table 5** provides a brief chronology of the reform steps and highlights the fact that the phased roll-out of the reform effectively resulted in three waves of decentralisation of communes. To begin with, a set of decrees and laws were enacted to operationalise the prescriptions of the Constitution. Adopted by parliament in 1993, these introduced guidelines for territorial administration and local governance, and outlined the special status of the communes of Ouagadougou and Bobo-Diouslasso (respectively the capital and second-largest cities – in practice, the administrative and economic capitals). These legal provisions materialised two years later, *in February 1995, with the first wave of effective decentralisation*, i.e. the organisation of local elections in 33 communes, the establishment of local councils, the effective transfer of competencies to local authorities, and the initiation of the reform's expansion to the entire country. In 1998, the government adopted a series of legal provisions that further defined territorial governance, the organisation and functioning of decentralised communes and the competencies of different tiers of authority across the vertical spectrum of the public sector. The reform implied significant changes in the country's governance structure as it marked the initiation of local democracy, the transfer of administrative roles and resources to local authorities, and the formal establishment of intergovernmental fiscal relations. Subnational governance was further strengthened through these legal provisions with the introduction of *16 additional decentralised communes in September 2000*, resulting in a total of 49 self-governed units, following local elections held that year. Lastly, the decentralisation

10 Proposals for decentralising Burkina Faso are in fact much older, dating back to the colonial period, notably with the establishment of two cities – Bobo-Dioulasso in 1926 and Ouagadougou in 1952 – as '*communes mixtes*' (mixed communes) managed by appointed administrators. In 1955, new legislation took a step further in restructuring these two cities and converting them into fully functioning communes with full status and elected mayors. After several reforms, the advent of the National Council of the Revolution in 1983 led to a reorganisation of the territory, notably with the creation of the provinces and the establishment of Committees of Defense of the Revolution as the basic units of democratic power. Yet, despite this long history, several elements of these agendas remained unimplemented or altered according to changes in the political landscape. For instance, under the military or revolutionary governments, local management bodies were often appointed by central leaders, considerably reducing local self-administration in the districts.

reform was *expanded to the entire territory in 2005*, with the effective creation of 321 additional communes. The 2006 general elections were a turning point as communes and regions were fully integrated into a democratic electoral process for the first time in the country's history. A decree passed in 2009 was another important step towards fiscal decentralisation by pushing forward the prerogative of communes (Englebert and Sangaré, 2010, 2014).

2.3 Early decentralised communes: criteria and treatment

Decentralisation criteria. Officially, the decentralisation process in Burkina Faso prioritised communes that fulfilled two criteria: having a population size of at least 10,000 inhabitants and a municipal budget of at least 15 million CFA francs (around $24,000) (Ouédraogo et al., 2009; Assemblée Nationale du Burkina Faso, 1998). However, as shown below, the population criterion was not really a binding constraint (only 11.6% of all communes in 1995 were below the population threshold) and the budget criterion was not respected in practice: very few of those that joined the reform in the first two waves had complied with the minimum local budget requirement. Administrative functions seemed more relevant in the selection process. Out of the 33 early decentralised communes, 13 were the regional capitals (and also provincial capitals) while 18 others were provincial capitals. The remaining two communes, Pouytenga and Niangoloko, were none of these but had their own economic dynamics, as described below. Thus, in our attempt to capture the effect of decentralisation, a possible confounder is the mere choice of some communes as the go-first due to their pre-existing administrative power, especially if these communes were likely to follow a specific development path in the absence of reform (internal validity issue) or likely to benefit more than the average from decentralisation (external validity issue). In what follows, we closely explore the interplay between the territorial-administrative function of a commune and the reform itself to try to mitigate these central concerns.

Administrative functions and hubs. A first attempt in this direction is to provide descriptive information about these functions and examine whether the regional or provincial administrative roles were likely to bring more power and, hence, access to transfers from central government to these communes. In fact, administrative texts convey that, even though provincial capitals have official representatives (known as high commissaries), they are merely administrative intermediaries between the communes and the regions and do not benefit from much political leverage at the central level (Ouédraogo et al., 2009). The 13 regional capitals, on the other hand, are represented by a governor at the national level and have potentially more influence on decisions regarding central funds and public investments. Beyond the ability to attract state transfers, another key criterion is the ability to generate resources locally and to collect taxes. In francophone systems, the Ministry of Finance plays an important role in collecting revenues and disbursing expenditures for communes. The fact that the Ministry is present in regional capitals (but not in other communes) could have helped them process revenue collection or disbursement requests (Mahieu and Yilmaz, 2010). Finally, another aspect is the mere capacity to generate resources. The two communes decentralised in 1995, which were neither regional nor provincial capitals but met the population and budget criteria, were major economic hubs.

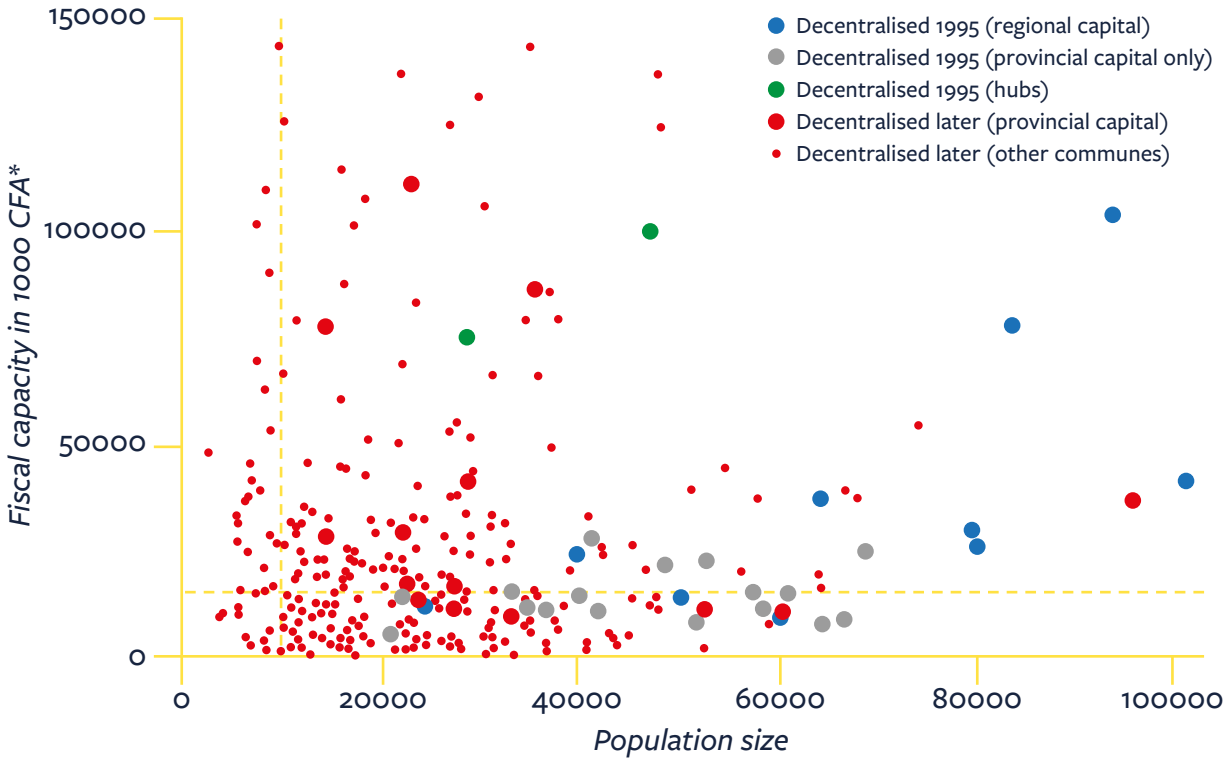
Pouytenga is the fourth largest city and a centre for trade (imports) and commercial activities (including livestock). Niangoloko is on the border between Côte d'Ivoire and Burkina Faso, and a crucial entry point for this landlocked country. As confirmed by our empirical analysis hereafter, the economic and strategic relevance of these communes has turned them into priority localities in the decentralisation process as they had demonstrated the capacity to leverage their own resources and handle decentralised fiscal responsibilities.[11]

The dispersion of communes in terms of population and budget. In **Figure 1**, we visualise this dispersion for the year 1995. Note that, here and for most of the outputs presented in the paper, we tend to exclude Ouagadougou and Bobo-Diouslasso: as administrative and economic capitals, these cities benefit from a specific administrative status and are directly related to central power, by definition, so that they are not relevant for an analysis of decentralisation. More generally, they are clear outliers on many dimensions (in terms of population size for instance). In terms of information, population size is recorded for all communes, while fiscal capacity (including own-source revenues and transfers from central government) is available only for the early-decentralised communes; for those decentralised later, we report on the graph the results of an imputation method described in the data section hereafter. The graph shows the 13 regional capitals in dark blue, which are also provincial capitals and were decentralised first. Among provincial capitals that were not also regional capitals, 18 were decentralised in 1995 (light blue) and the other 13 in 2000 (red). Other, late-decentralised communes are in small pink circles. We see that there is a lot of dispersion among decentralised communes, as much as among non-decentralised ones, and that the two groups are not completely different. Admittedly, regional capitals (and, to a lesser extent, provincial capitals) tend to be larger than other communes, but there is an overlap with other communes. In particular, some of the regional capitals and many of the provincial capitals decentralised in 1995 have fewer than 50,000 inhabitants, as can be seen on the focus of **Figure 2**. Some of the provincial capitals are small and tend to be close to the average of the communes decentralised last.[12]

11 Note that some of the later-decentralised communes – Bittou and Garango – were also economically strong. Similarly to Niangoloko, Bittou is a border city between Burkina Faso and Ghana, and is therefore of commercial and strategic interest. Garango became an economic hub as a direct result of foreign investment and remittances, mainly from Burkinabe migrants in Italy, a large portion of which are from that specific region (cf. Hazard, 2004).

12 Historical criteria for a commune to become a provincial capital were a population size of at least 25,000 inhabitants and a fiscal capacity above 25 million CFA francs (Article 19, *Code général des collectivités territoriales*).

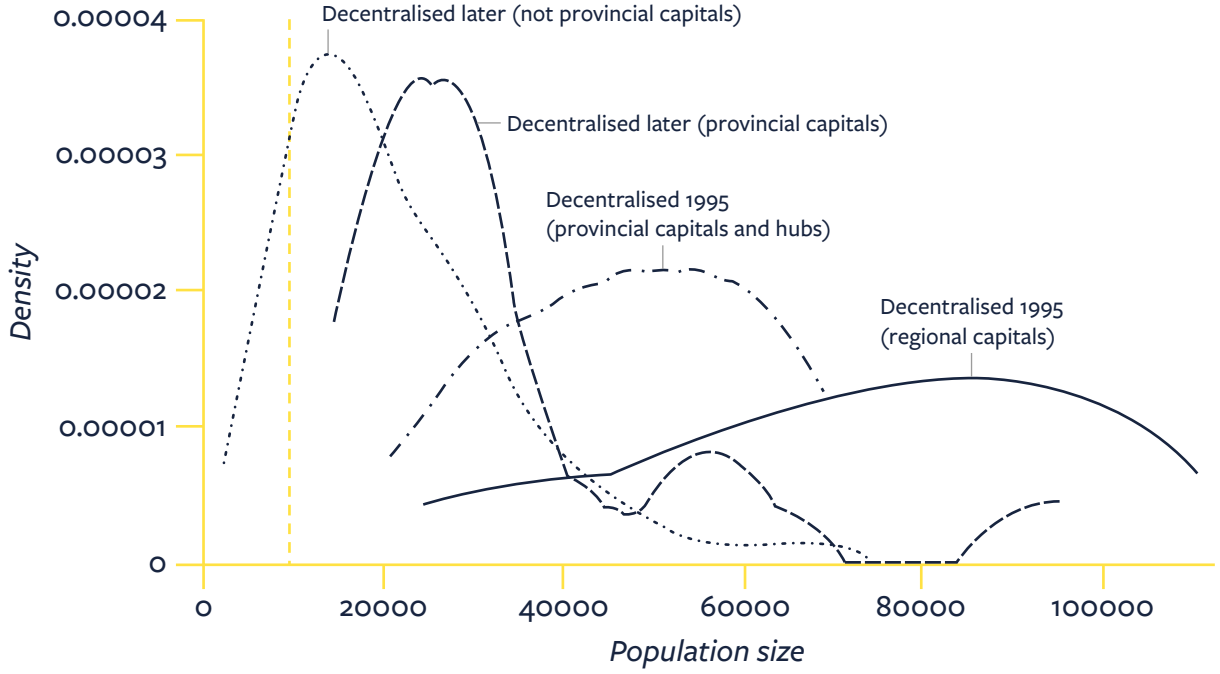
Figure 1 Fiscal capacity (actual or predicted) versus population size in 1995, by commune type according to their administrative function



Dashed lines represent official criteria: population above 10,000 inhabitants and fiscal capacity above 15 million CFA francs.

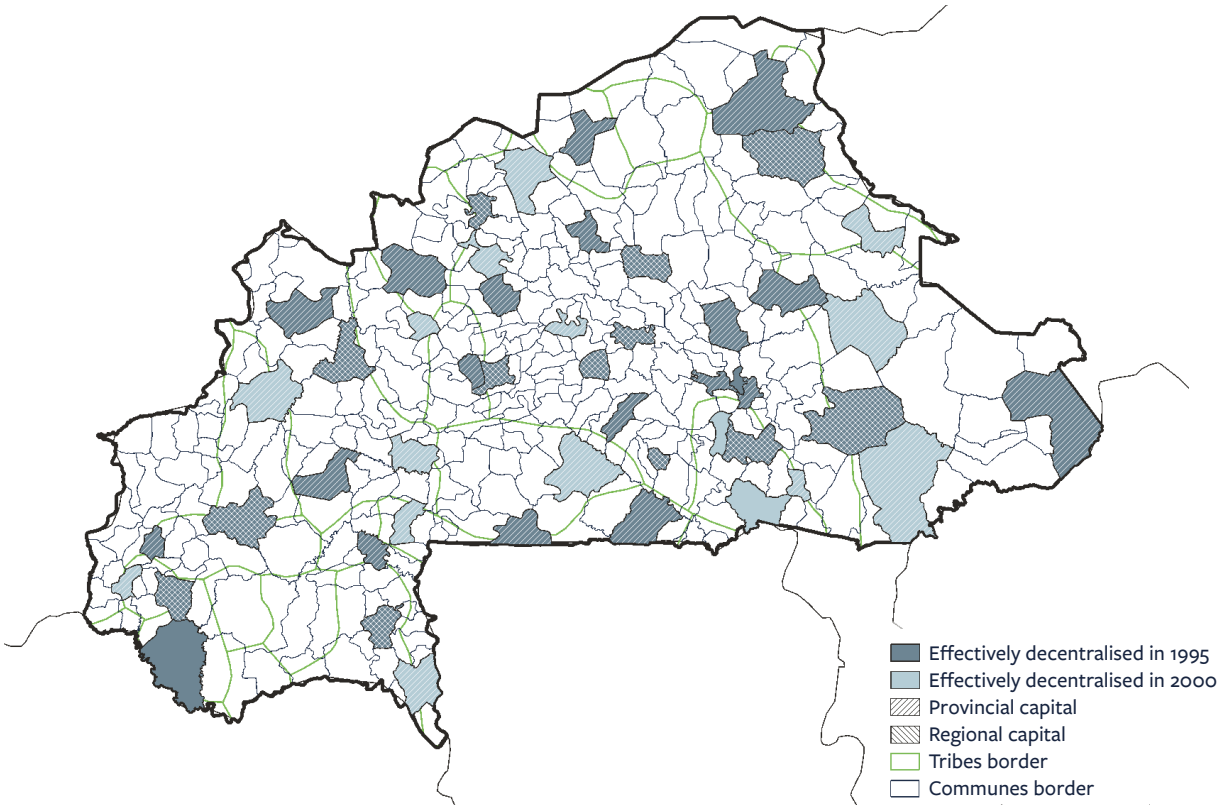
*Fiscal capacity is imputed for late decentralised communes.

Figure 2 Distribution of population size in 1995 by commune type



Dashed line represents the population criterion (early decentralisation if pop. >10,000 inhabitants).

Figure 3 Distribution of communes with administrative role and decentralisation status



In terms of fiscal capacity, information for early-decentralised communes is available, not imputed. **Figure 1** shows that many decentralised capitals had large fiscal capacities but not all: many fall below the budget threshold (horizontal dashed line). This diversity is important for our empirical demonstration: it tends to indicate that there may be enough *common support*, at least along population and budget dimensions, for fruitful comparisons between communes. We shall enforce this proximity in our robustness checks by means of matching techniques.

Figure 3 completes this description and conveys that there is also a geographical common support: indeed, communes decentralised in 1995 are not concentrated in a specific area, or disproportionately urban. They are often close to other communes that are part of the later decentralisation waves, while being similar in terms of administrative status (provincial capital). Ethnic borders cover broader areas that also contain a diversity of communes in terms of decentralisation status and administrative function (note that ethnic groups are implicitly included in communes' fixed effects in our estimations).

Treatment: the implications of decentralisation. The reform had significant implications for decentralised communes both in 1995 and in 2000. These implications were, first and foremost, political, with the organisation of local democratic elections and the establishment of local councils. Second, they were administrative, with a new organisational structure, the creation of legislative bodies and coordination with central authorities. Third, and most importantly, they were fiscal, with the transfer of competencies from central government. On the revenue

side, communes were granted revenue-raising powers from local taxes, user fees and charges as well as fiscal transfers from central government, whereas, on the expenditure side, they were put in charge of various tasks, such as the management of land and urban planning and natural resources, health services and hygiene, education and vocational training, culture, civil protection, assistance and relief, water management, electricity and public lighting (OECD and UCLG, 2019). These aspects are important for us given the nature of our outcome, as explained below.

3 Empirical framework

3.1 Empirical model

Specification of the DD approach. We adopt a DD strategy, using a comprehensive panel dataset. We focus on nightlight intensity as a proxy for local development between 1992 and 2005, our key outcome of interest. As discussed previously, the selection of communes at each stage of the reform 'phase-in' was not random. Therefore, the main challenge is to correct for selection into the reform, i.e. to account for differences between decentralised and non-decentralised jurisdictions that could have influenced the outcome. The DD identification strategy makes it possible to correct for the initial difference in local economic development and thus estimate the differential changes in outcomes across communes before and after each wave of the reform. In technical terms, we estimate the following equation in which y_{it} is the outcome variable, i.e. nightlight intensity for commune i in year $t = 1, ..., T$:

$$\log(y_{it}) = \alpha + \beta D_i^{1995} \text{POST}_{it} + \theta_t + \eta_i + \rho x'_{it} + \varepsilon_{it} \quad (1)$$

with D_i^{1995} a dummy variable equal to 1 if the commune i belongs to the group of communes decentralised in 1995 and POST_{it} a dummy equal to 1 if the observation is post-1995. We also include θ_t, which denotes time fixed effects, implicitly accounting for time variation that is common to all communes, for instance broad climate conditions or other, nationally applied policy measures.

Importantly, η_i represents the fixed effects (FE) for communes and accounts for their background conditions, such as initial size, the extent of urbanisation, administrative status and initial fiscal capacity. It also critically captures the time-invariant factors, broadly unobserved, that might help explain why a commune has eventually been chosen to be among the first to be decentralised. As explained, some of this is related to their administrative roles (regional provinces) and their economic and fiscal capacity (hubs). Other factors may play a role in general, for instance geographic characteristics (such as land use) and political and cultural factors (including favouritism by the central power towards specific regions and ethnic influence, cf. Hodler et al., 2014; Alesina et al., 2016). In our context, none of these other factors changed over time in a significant way so they tend to be captured by commune FE. In particular, we have verified that cross-region ethnic composition remained stable (Harsch, 2017), as did the ruling government (the presidency of Blaise Compaoré throughout the period) and the structure of the party system (Riedl and Dickovick, 2014).

We also control for a vector x'_{it} that accounts for communes' time-varying characteristics, such as local weather conditions; these variables further capture cross-commune variations, improve precision and reduce bias in the coefficient estimates. As further discussed below, they are important given the nature of our outcome. Finally, in order to check

if the decentralisation effect is robust to time trends that could be specific to certain communes, and in particular the decentralised ones, we suggest specifications where key commune characteristics z'_i (such as communes' administrative functions or initial population size) are interacted with $POST_{it}$ or, in a more flexible way, with time fixed effects.

Parallel trends. The coefficient of interest is β, i.e. the DD estimator of the early decentralisation phase, derived from the comparison between changes in the outcome variable for early-decentralised and non-decentralised communes in pre- and post-policy periods. We will do so when focusing on the 1992–2000 period, i.e. before any other commune is being decentralised. Since identification hinges on the assumption that the change in outcome experienced by control units is a good proxy for the outcome change experienced by treated units in absence of treatment, that assumption must be checked for years where no one is treated, i.e. a check of common trends before the first decentralisation of 1995.

Handling multiple treatments and periods. Using several years of data makes our approach a two-way fixed effects (TWFE) linear regression. Recent methodological papers characterise the potential issues surrounding TWFE with multiple time periods and multiple treatments (Callaway and Sant'Anna, 2021; Borusyak and Jaravel, 2018; Goodman-Bacon, 2021; de Chaisemartin and d'Haultfoeuille, 2020; Sun and Abraham, 2021). One issue addressed in this literature is the *cross-unit heterogeneity* of treatment. We focus on the outcome path of the 1995-decentralised communes and discuss extensively why the decentralisation 'effect' may or may not generalise to the rest of the country. Other issues include the *time-heterogeneity* of treatment and the *use of units that eventually become treated as control groups*. When focusing on the period 1995–2000, our setting is a standard, two-period DD. When extending to 1995–2005, we try to capture longer-term effects and check if there is an increasing advantage of early decentralisation (for instance if the 1995-decentralised communes make the most of increased transfers of responsibility at later stages of the process in the 2000s). We also acknowledge a small group of communes decentralised during an intermediary wave in 2000, which might slightly perturbate the control group as some units become treated. To address this, we suggest additional estimations where we explicitly account for the two types of treatment, using additional years of observation post-2000, namely the model:

$$\log(y_{it}) = a + \beta^{1995} D_{it}^{1995} + \beta^{2000} D_{it}^{2000} + \theta_t + \eta_i + \rho z'_{it} + \varepsilon_{it} \qquad (2)$$

with D^k_{it} the treatment dummy variable equal to 1 if the commune *i* belongs to the group of communes decentralised in year *k=1995, 2000* and is observed after that year.

Inverse propensity score reweighting. To slightly enhance the DD setup, we also suggest a propensity score approach as in Abadie (2005). This type of approach usually brings flexibility

to DD specifications.[13] Most importantly, it is used here to try to reduce unobserved time-varying differences between early- and late-decentralised communes that could confound our results. For this, we are going to mobilise a set of variables m'_{it} that are assumed to be correlated to some extent with time-varying confounders and that allow for comparing subgroups of treated and control communes that are more alike. For example, if large communes are the ones that were decentralised first and, at the same time, are the ones that benefit from more dynamic development trends (internal validity issue) or stand to benefit most from decentralisation because their size means more leverage on the central government to attract transfers (external validity issue), then we might overstate the benefits of decentralisation. Assuming that the unobservable advantages (e.g. economic dynamics, political leverage) are correlated with observable characteristics (e.g. population size), we could reduce the bias by comparing treated and control communes that are most similar along a relevant set of observed characteristics of that sort.

Rather than using matching on many different characteristics, which brings a 'curse of dimensionality' issue, we rely on a propensity score (PS) that concentrates all the useful information from these characteristics. The PS, denoted p hereafter, is obtained as the prediction of a first-stage estimation of a '1995-decentralised' dummy on the set m'_{it} of relevant variables including key demographic dimensions (population size), geographic characteristics (elevation, distance to the coast, to large cities and to a border) and economic dimensions (access to natural resources including gold, diamonds, gems, onshore petrol). To consider treated and untreated communes that are more similar to each other according to these different criteria simultaneously, we reweight observations using the inverse PS, as suggested by Abadie (2005) for the DD approach.[14] Namely, we carry out estimations that account for the following weights: $1/\tilde{p}(m'_{it})$ for early-decentralised communes and $1/(1-\tilde{p}(m'_{it}))$ for the other communes. In this way, the modified estimation gives more weight to the late (early) decentralised that are most similar to the early (late) decentralised. We will also explore the heterogeneous impact of the reform by explicitly zooming on groups with similar characteristics (e.g. treated and control communes with high wealth). All estimations are clustered at the commune level to account for auto-correlation.

3.2 Data sources and key variables

Outcome variable: night-time light density. Indicators measuring gross domestic product (GDP) or economic activity at the subnational level in low-income countries are limited or non-existent. Renowned economic and political science publications have overcome this limitation by using geo-localised night-time light density as a proxy for economic activity

13 In general, this approach helps to relax the linearity assumption, as any matching technique, and to better account for the different distributions of time-varying observables between treated and control groups in a DD. Yet these aspects are not very important here since our basic set of time-varying variables zit' is limited (i.e. essentially limited to local climatic conditions).

14 It is close to Smith and Todd (2001), who combine DD estimations and matching techniques. An inverse PS reweighting approach is also suggested by Hirano, Imbens and Ridder (2002) in a general context.

in local communities (e.g. Henderson et al., 2012; Hodler and Raschky, 2014; Alesina et al., 2016; Iddawela et al., 2021).[15] Following this trend, we use satellite data on nocturnal light intensity provided by the US Air Forces Defense Meteorological Satellite Program (DMSP) as a proxy for local development in Burkina Faso. The indicator is derived from the average visible band digital number of cloud-free light detections, weighted by the percent frequency of light detection to normalise for variations in the persistence of lighting. For instance, the value for light only detected half the time is discounted by 50%. The quality is such that the effects of cloud cover, ephemeral lights and other noises carry sensors that detect light emission from the Earth's surface at night can be neutralised (Mamo et al., 2016). Their spatial resolution makes it possible to obtain a reliable indicator of economic development for subnational units in Burkina Faso. The night-time light density data covers annual averages for the period 1992–2010, providing comparable data points for before and after each of the major waves of decentralisation.

Control variables. To the above, we adjoin geo-localised climatic and resource-based information for the communes. This data is gathered and compiled by AidData using official geographical and administrative boundaries of respective localities. We focus on variables that are related to climatic and geographical conditions: average annual temperature and average annual precipitation. In addition to communes and time fixed effects, these variables z'_{it} control for features that may explain variations in local socio-economic outcomes across communes and time. Above all, they correlate with the level of electricity production and consumption due to hydro-electrical sources (Ouédraogo, 2010): as discussed later, it is therefore important to clean nightlight variation from what is due to climatic and geographical conditions.

Grouping variables for heterogeneity analyses. The data mobilised in **Figures 1**, on population and local public finance, is provided by the Treasury of Burkina Faso (*Direction Générale du Trésor et de la Comptabilité Publique*, hereafter DGTCP) for the period under study. Population data is available throughout, but local fiscal capacity is unfortunately available only for a limited number of communes, namely those decentralised in 1995 and 2000. For them, the information is also decomposed between own-source revenues and intergovernmental fiscal transfers in the total budget of the commune. We shall use this information to study heterogeneous decentralisation effects across subgroups of the early-decentralised communes.

15 Donaldson and Storeygard (2016) provide a comprehensive review of the use of satellite data in different areas of economics including growth, development and regional and environmental economics while Gibson et al. (2020) discuss when this type of data can be appropriately used. Elvidge et al. (1997) was the first paper to analyse the relationship between night-time lights and economic activity, studying the connection of luminosity with population, GDP and electric power consumption for 21 countries at different levels of economic development, during the period 1994–1995. Henderson et al. (2012) used panel data of GDP and nightlight intensity between 1992–1993 and 2002–2003 to estimate income growth at national and subnational level and measure the effect of malaria on growth in sub-Saharan Africa. Several other papers find positive correlation between economic development and nightlight intensity at the subnational level (e.g. Sutton and Costanza, 2002; Guerrero and Mendoza, 2019).

For a comparison across all communes in our graphical analyses, and given the absence of time-series local wealth data, we rely on composite indicators. One is simply the average distance to natural resources (gold, gems, water, onshore petrol) and infrastructure/trade (distance to coasts, borders, roads and large cities). The other is based on a regression of fiscal capacity on a set of relevant variables, which include demographics (population), geographic data (elevation, distance to coasts, borders, roads and large cities) and economic characteristics (distance to natural resources as detailed above). Imputed fiscal capacity, as used in **Figure 1**, is simply the predicted value – for all – of these estimations carried out on the sample of decentralised communes, i.e. for which we have the fiscal data for all years.[16]

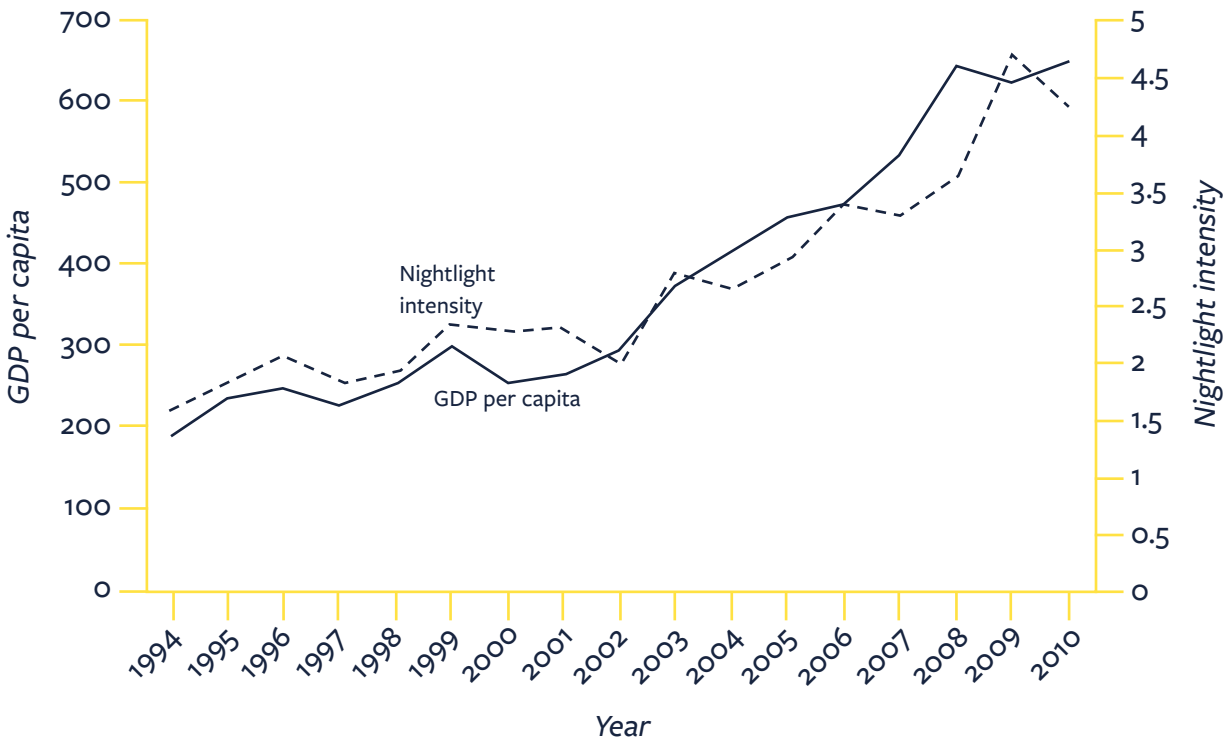
3.3 Discussion and a first look at nightlight data

The main justification for our nightlight measure is that access to electricity is a key measure of development. We also show that decentralisation has possibly been a factor of change in local electricity supply and consumption, reflecting local evolution in terms of economic activity and welfare.

Nightlight density and development. Several studies demonstrate that night-time light density is closely related to electricity consumption and is regarded as an indicator of economic development (Elvidge et al., 2012; Henderson et al., 2012; Keola et al., 2015). Empirical evidence from Mellander et al. (2015) and Bruederle and Hodler (2018) corroborates the strong positive correlation between nightlight density and location-specific indicators of human development or economic activity. To illustrate this in the context of Burkina Faso, we relate nightlight density to other measures of local wealth or to its determinants. Suggestive estimations along these lines are reported in Appendix **Table 7**. When available, we can correlate nightlight intensity with communes' fiscal capacity for 33 communes decentralised in 1995 (cf. column 1). Fiscal capacity is highly significant, and its correlation with nightlight density is 0.589, which is equivalent to the R^2 of 0.347 in this estimation. Next, we bring in the whole set of communes and use a broader set of variables, including imputed fiscal capacity, as described above, and climatic variables. We first examine between-commune variation in nightlight density in 2005. Fiscal capacity has a positive and highly significant coefficient (column 2). Among climatic and geographic conditions, communes experiencing less rainfall and higher temperatures suffer more from chronic electricity shortages, which reflects on nightlight intensity and is probably a key factor affecting local welfare. Very similar results are obtained when combining spatial and time variation (column 3). Finally, we can more directly compare nightlight intensity with standard development measures such as GDP per capita, yet only at national level. **Figure 4** reports trends in GDP per capita (based on the World Development Indicators) and for yearly nightlight data (averaged over all communes, here including Ouagadougou and Bobodioulasso, and weighted by population size). We observe relatively consistent trends over the period and, in particular, faster growth after 2001.

16 The different variables used in the empirical work are presented in a synthetic way in Appendix **Table 6**.

Figure 4 GDP per capita versus nightlight intensity

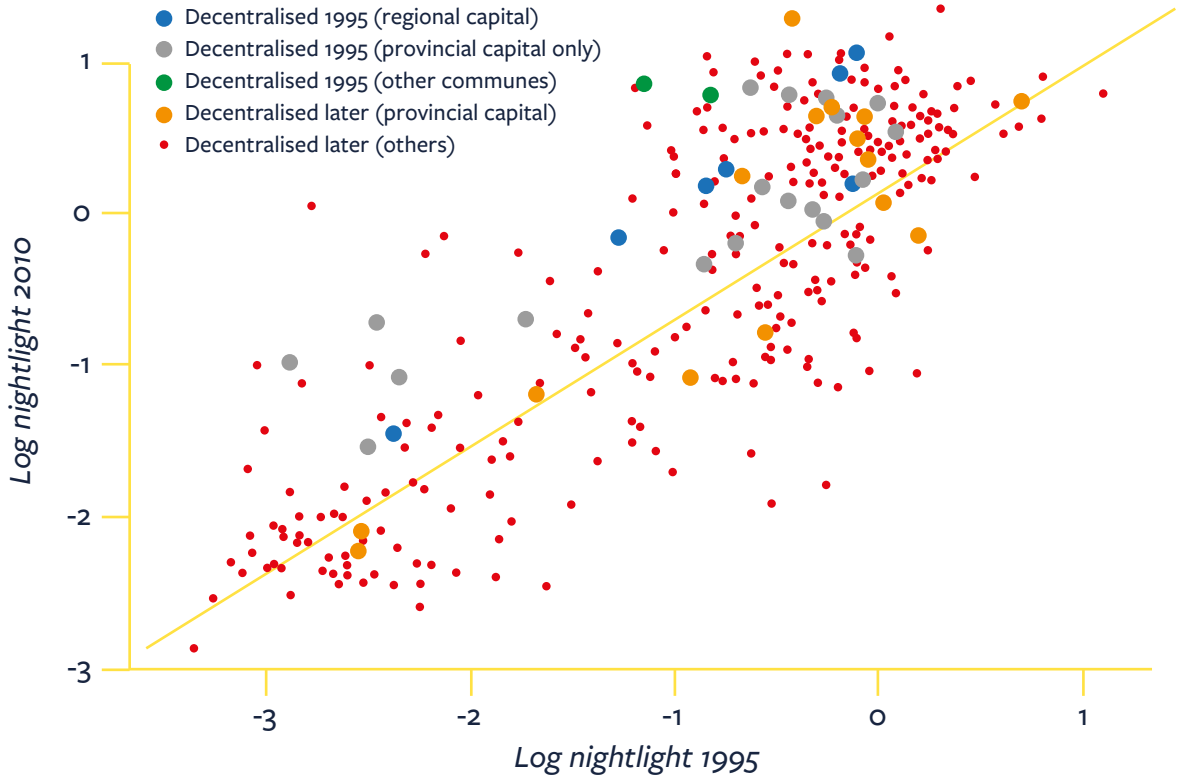


GDP per capita (PPP USD) from the World Development Indicators. Nightlight intensity: DMSP-OLS Night-time light density corrected for ephemeral events (average over all communes weighted by their population size).

Electricity and decentralisation. The other aspect is whether electricity remains a prerogative of the central state or whether decentralisation can instead lead to visible changes in electricity supply. In Burkina Faso, electricity supply relies on imports (from Côte d'Ivoire and Ghana in particular), thermal-fossil fuel (28 power stations, 70% of total supply) and hydropower (four hydropower stations). The main supply strategy is to establish interconnections with neighbouring countries and to extend and repair the existing network. Nonetheless, responsibility for electricity is shared between the central government and local actors. While the state remains the main decision-maker in terms of energy policy and the planning of electrification strategy, with SONABEL the national company in charge of implementing it, communes have a margin of action as they are in charge of creating and managing energy infrastructure, public lighting and the hydraulic sector.[17] Finally, individual solar panels and private equipment such as generators also reflect local economic dynamics and wealth growth.

17 Note that these aspects are relevant for both urban and rural areas. Access to basic public services, and in particular, public lighting is often a co-responsibility between the central state and local administrations in both areas. While growth in rural areas does not always translate into more light, public lighting remains an indicator of the quality of decentralised public services. Electrification is a major development issue (via its effects on education, in particular) and, in this respect, measuring the effect of decentralisation on lighting seems relevant even in rural areas.

Figure 5 Nightlight intensity in 1995 (first decentralisation) and 2010 (end period) by decentralisation status



The solid line is the 45 line: it shows that 1995-decentralised communes (in blue/green) have almost all experienced an increase in nightlight intensity.

Change in nightlight density distribution. A preview of our main results is presented in **Figure 5**. We plot nightlight intensity at commune level for the first year of decentralisation, 1995, versus the last available year, 2010.[18] The graph shows that first-wave decentralised communes experience a quasi-systematic improvement in nightlight intensity – being scattered almost exclusively above the line – whereas this is not necessarily the case for other communes. This is suggestive of the 1995-decentralisation effect elicited in the next section. Moreover, this effect seems not to be confined to communes with local tax capacity and political influence (regional communes, dark blue) or those with a vibrant economy (hubs, in green). Provincial capitals (light blue) also show large improvements, even especially among those with low initial levels of nightlight intensity.

18 Ouagadougou and Bobodioulasso are excluded.

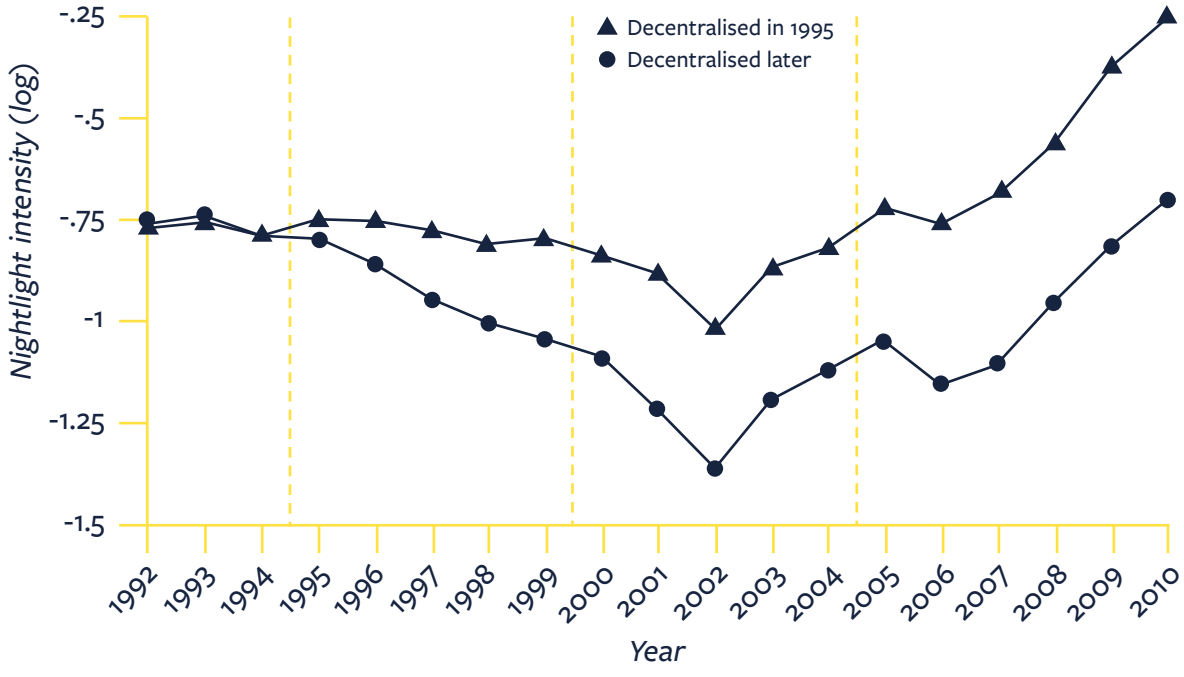
4 Results

We first present some suggestive graphical results. We then move to panel estimations, robustness checks and heterogeneity analyses. We exclude Ouagadougou and Bobodioulasso: as explained above, these two major cities are very specific in a context of decentralisation.

4.1 Graphical results

We suggest a simple graphical description of the trends in (log) nightlight intensity taken as a proxy of local economic development. In **Figure 6**, we compare communes decentralised in 1995 and those decentralised later, taking a long-term perspective (1992–2010). For the pre-reform period, 1992–1995, we observe not only a common trend but also similar nightlight levels for the 33 communes decentralised in 1995 and those decentralised later. The graph also shows a marked divergence in nightlight intensity after the decentralisation of 1995. If we focus on the late 1990s and early 2000s, we observe a slow decline for the early decentralised communes but a sharper drop among others. The overall decrease in nightlight intensity is consistent with the severe droughts experienced by Burkina Faso in the late 1990s, which induced a rise in cereal prices, slow GDP growth and increased poverty (Traore and Owiyo, 2013), followed by the adverse effects of the crisis in Côte d'Ivoire in 2001–2002. The turnaround after 2002 is consistent with fast growth in 2003 and following years, explained among other things by a better climate, very good harvests and a relatively fast reorganisation of the country's import and export channels (Grimm and Günther, 2007). Note that these trends differ from the upward trend seen in **Figure 4**, which is driven by Ouagadougou and Bobodioulasso.

Figure 6 Nightlight trends across decentralisation phases



Moving average nightlight intensity. Dashed vertical lines: decentralisation years.

The decentralisation 'effect', as we interpret it, materialises gradually during the period 1995–2000, i.e. before the later decentralisation waves. It does not decrease afterwards: the advantage of the 1995-decentralised communes even slightly increases in the 2000s, which could be interpreted as early decentralisation helping to better cope with adverse climate and economic conditions or enabling the initial communes to benefit from the ramp-up of the decentralisation process (with increased transferred responsibility after the generalised decentralisation and specific enhancements such as the 2009 decree, as discussed above).

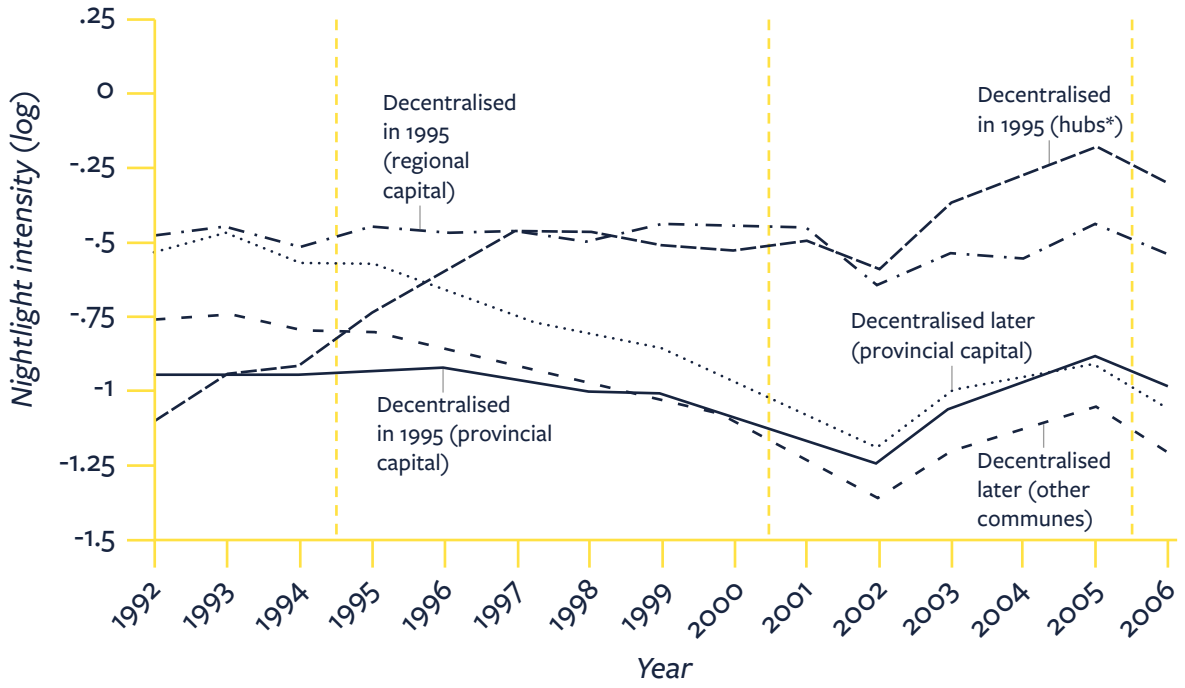
Alternatively, this is also possibly related to the fact that urban communes decentralised in 1995 had better access to local resources (due to better local economic conditions) or transfers (due to greater political influence), hence more capacity to take advantage of each step enhancing the prerogatives of the communes – a limit to the external validity of our quasi-experiment. It may also be due to better economic trends for these communes, even in the absence of reform, i.e. a threat to internal validity that we investigate in depth in the estimations hereafter.

We can actually provide preliminary graphical evidence regarding these concerns. We check heterogeneous trends across communes by focusing on the central factor that influenced the choice of early decentralised communes, namely their political function. Out of 33 initial communes, 13 were the regional capitals, which are represented centrally by a governor defending their interests and may benefit from the presence of the Finance Ministry in their locality. In this way, they may have had a greater ability to attract funding from the central state and manage tax collection. Provincial capitals and other communes also have representatives of deconcentrated structures (high commissioners and prefects), but with less power, as discussed. The two communes that are not regional or provincial capitals, Pouytenga and Niangoloko, are economic hubs and have other advantages, namely a fertile economic environment that help them draw on their own resources. **Figure 7** distinguishes nightlight trends between these different categories.

Hubs (in green) outperform all other communes and do not respect parallel trends before 1995. Thus, they probably follow specific economic paths and should not be considered in our attempt to build relevant control groups to study decentralisation.[19] All the other groups show relatively parallel trends before decentralisation. Interestingly, despite their administrative advantages and higher initial nightlight levels, regional capitals (dark blue) do not display very different trends compared to the early-decentralised provincial communes (light blue). Remarkably, the latter progress faster than the provincial capitals that are decentralised later (dashed red line), and to whom they are most comparable, and than other communes (dashed pink line).

19 It shows that, while political influence may matter, economic potential and the ability to generate local resources seem crucial. We provide further evidence along these lines in the next sections.

Figure 7 Nightlight trends by decentralisation status and administrative role



Moving average nightlight intensity. Dashed vertical lines: decentralisation years.
*Two communes: Niangolokmo and Pouytenga

We also provide preliminary evidence of whether our main results are actually driven by alternative factors that may be associated with the very nature of decentralised communes beyond administrative functions (regional and provincial capitals). Interestingly, there is enough variation in communes' wealth and size, both within the groups of early- and late-decentralised communes, to disentangle the role of these factors. We focus on the two types of wealth proxies described above, namely a measure of potential resources (based on the average distance to natural resources) and an imputed fiscal capacity measure (based on an estimation on early decentralised communes and using similar natural resource variables). Results are reported in the first two rows of Appendix **Figure 8**. The last row shows heterogeneity in terms of communes' size. The bargaining power of administrative entities and, in particular, their ability to capture centrally distributed resources possibly increase in a disproportionate way compared to their size (Grossman and Lewis, 2014).

We normalise the curves at zero log nightlight intensity for the year 1992 in order to inspect differences in trends. The conclusion from this analysis is, first, that parallel trends seem to hold in all the subgroups and, second, that the advantage materialising during the initial decentralisation phase is visible in all subgroups and not only among those with favourable factors. In other words, those decentralised early grow faster than other communes, whatever their potential wealth or size. While we implicitly compare communes with different political status here, we reproduce this analysis on the subgroup of provincial communes, which are present in both initial and later waves, and results in Appendix **Figure 9** tend to be the same. Both high- and low-capacity

communes that decentralised early outperform high- and low-capacity communes that decentralised late.[20] We now move to estimations that follow the same logic while controlling for many other dimensions.

4.2 Baseline estimation results

Baseline DD estimations are reported in **Table 1**. We report estimates of model (1), as well as relative effects based on a regression of nightlights in levels (rather than log) expressed in percentage of the pre-treatment mean outcome. In column (1), we use the first period only (1992–2000) and a DD regression focusing on the effect of the 1995 decentralisation wave, as per equation (1), including time and commune FE. All estimations also control for time-varying factors affecting or related to electricity production, namely precipitation and temperature ('climatic controls').

Table 1 Nightlight baseline estimations

Sample from 1992 to:	**2000**	**2005**
	(1)	**(2)**
Decentralised 1995 × POST 1995	0.224***	0.295***
	(0.064)	(0.078)
Relative to pre-1995 control mean outcome	**14.0%**	**18.8%**
Observations	3,120	4,854
R-squared	0.900	0.897
Year FE	YES	YES
Commune FE	YES	YES
Climatic controls	YES	YES

Estimation of nightlight intensity on a dummy for being decentralised in 1995 and observed post-1995, using different end years. Estimations control for year FE, commune FE and climate variables (precipitation, temperature and vegetation at the time of observation). Robust standard errors in parentheses, clustered at commune level. Significance level: *** p<0.01, ** p<0.05, * p<0.1

The DD estimate is highly significant, suggesting a positive effect of decentralisation. It corresponds to a 14% increase in local development, as measured by nightlight intensity, interpreted as an increase in local development, for those communes decentralised in 1995 compared to those decentralised later.[21] We then extend the period to 1992–2005, in column (2)

20 Note that small communes seemed to suffer more from the climatic hardship of the early 2000s.

21 If we ignore the group of 16 communes decentralised in 2000 in this estimation, i.e. if we compare the 1995-decentralised communes to the bulk of communes decentralised in the end, the point estimate and the relative effect hardly change (cf. Appendix **Table 8**, column 1).

of **Table 1**. The estimates are consistent with the graphical results: the decentralisation premium for those decentralised first increases slightly, i.e. the relative effect is now 18.8% and may capture slightly longer-term effects of the early decentralisation process. Note that the presence of the 2000-decentralised group in these estimations may be an issue for the interpretation of β since this group represents a non-decentralisation backdrop for 1992–2000 only. In fact, excluding this small group from the sample leads to a similar estimate (i.e. a relative effect of 18.2%: see Appendix **Table 8**, column II). The reason is that the intermediary decentralisation does not seem to have any effect. To show this, we estimate the model of equation (2), keeping all groups in the estimation and simultaneously testing the effects of belonging to the first and second decentralisation waves (compared to being in the third wave). As shown in Appendix **Table 8** (column III), the estimate of β^{2000} is insignificant while the estimate of β^{1995} is very similar to the baseline of **Table 1** (a relative effect of 18.6%).[22]

4.3 Robustness checks

As highlighted before, the main empirical issue pertains to unobservable characteristics associated with the early decentralised communes and potentially responsible for specific time trends in nightlight intensity for this group even in the absence of treatment. We suggest four checks to mitigate this concern of internal validity.

Commune FE and climatic controls. As extensively discussed, communes FE account for time-invariant confounders such as communes' geographic characteristics (e.g. border cities, more engaged in international trade and more apt to levy and manage their own resources), their endowments at the start of the reform (including potential development capacity for own-source revenue), their historical administrative role as regional capital (and the political weight that this may represent), or unobserved political factors (such as favouritism and ethnic distribution, which in any case remained stable over the period). We have also emphasised the necessity to control for key time-varying factors, such as climatic controls, that may affect energy provision and nightlight intensity. Results in **Table 2** provide estimates using either the observations for the 1992–2000 period (upper panel) or the whole period (lower panel), introducing the different controls gradually to check whether some have an impact on the magnitude of our estimates. We first account for time dummies only (column 1), then add commune FE (column 2) and time-varying climatic conditions (column 3, baseline). Results are very stable in all these cases.

22 The small number of communes decentralised in 2000, the short period before generalised decentralisation, and the economic hardships of the early 2000s (as seen in the preceding figures) make it impossible to seriously interpret the insignificant estimates of this intermediary batch of decentralised communes.

Table 2 Robustness checks

	(1)	(2)	(3)	(4)
			[baseline]	
Using observations from 1992 to 2000				
Decentralised 1995 × POST 1995	0.220***	0.222***	0.224***	0.225***
	(0.061)	(0.064)	(0.064)	(0.065)
Relative to pre-1995 control mean outcome	**13.8%**	**13.9%**	**14.0%**	**13.6%**
Observations	3,120	3,120	3,120	2,998
R-squared	0.010	0.900	0.900	0.900
Using observations from 1992 to 2005				
Decentralised 1995 × POST 1995	0.294***	0.295***	0.295***	0.275***
	(0.075)	(0.078)	(0.078)	(0.087)
Relative to pre-1995 control mean outcome	**18.8%**	**18.8%**	**18.8%**	**17.7%**
Observations	4,854	4,854	4,854	4,655
R-squared	0.035	0.896	0.897	0.895
Year FE	**YES**	YES	YES	YES
Commune FE	NO	**YES**	YES	YES
Climatic controls	NO	NO	**YES**	YES
Inverse PS reweighting	NO	NO	NO	**YES**

Estimation of nightlight intensity on a dummy for being decentralised in 1995 and observed post-1995, using different end years. All estimations control for year FE and gradually include commune FE (model 2), climate variables including precipitation and temperature at the time of observation (model 3) and Abadie (1995)'s inverse PS reweighting (model 4). Robust standard errors in parentheses, clustered at commune level. Significance level: *** p<0.01, ** p<0.05, * p<0.1

Parallel trends. We provide a series of estimates using different bandwidths and cutoffs, reported in Appendix **Table 9**. The upper panel is based on the whole sample while the lower one shows estimations excluding the hub communes, which violate the parallel trends assumption and are likely to have their own economic development dynamics, as seen before. The first two columns correspond to the period 1992–1995 with placebo cutoffs in 1993 or 1994. Both yield insignificant DD estimates, meaning that the parallel trend assumption is verified. The rest of the table uses the cutoff of 1995, corresponding to the beginning of the decentralisation process,

and extends the end period from 1996 to 1999. The reform does not materialise right away: the estimate in the third column is small (it is significant at the 10% level but the lower part of the table shows that it is driven by the hubs). In the next columns, point estimates gradually converge towards the baseline result obtained when focusing on the early period 1992–1995. As discussed, parallel trend verifications – especially with a short time window 1992–1995 – are not conclusive evidence that the early decentralised communes would follow the same pattern as the other communes post-1995 in the absence of decentralisation, but nonetheless provide a minimal falsification test.

Inverse PS reweighting. Despite common trends between early- and late- decentralised communes, there may be unobserved characteristics of the early decentralised communes that drive specific economic dynamics post-1995 and make the comparison with other communes unreliable. If these time-varying confounding factors are associated with observed demographic, geographic or economic trends, controlling for the latter may reduce the bias. A well-known approach would consist of matching early-decentralised communes with other communes on the basis of these factors. To address the multi-dimensionality issue, we rely on a PS version of the matching strategy in the context of DD. As discussed before, we consider treated and untreated communes that are more similar to each other by reweighting observations using the inverse PS, as suggested by Abadie (2005) for the DD approach. The PS, denoted *p*, is obtained as the prediction of a first-stage estimation of the 1995-decentralised dummy on demographic, geographic and economic variables. As seen in Appendix **Figure 10**, the PS distributions are fairly different between early decentralised communes and the other communes, but there is broad common support. We also enforce common support at the observation level by trimming the sample of communes appropriately.[23] The inverse PS reweighting gives more weight to the late (early) decentralised communes that are most similar to the early (late) decentralised communes. Results are presented in column (4) of **Table 2**. It turns out that making treated and control more similar through the weighting strategy does not fundamentally affect the estimates. The early decentralisation effect relative to pre-treatment average control outcome now ranges from around 13.6% (using 1992–2000) to 17.7% (using 1992–2005).

23 Deleting observations for which PS is below 0.01 or above 0.99 (12% of the 1992–2000 sample and 5.4% of the 1992–2010 sample) is enough to guarantee commune-level common support for the PS.

Table 3 Robustness checks (cont.)

	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Using observations from 1992 to 2000								
Decentralised 1995 ×POST 1995	0.228***	0.199***	0.187**	0.207**	0.222**	0.194**	0.223**	0.220*
	(0.066)	(0.065)	(0.083)	(0.083)	(0.092)	(0.083)	(0.092)	(0.121)
Relative to pre-1995 control mean outcome	**14.2%**	**12.1%**	**9.7%**	**10.6%**	**11.3%**	**10.7%**	**11.3%**	**11.3%**
Observations	2,664	2,962	2,863	2,998	2,998	2,511	2,998	288
R-squared	0.905	0.902	0.902	0.900	0.902	0.906	0.900	0.911
Using observations from 1992 to 2005								
Decentralised 1995 × POST 1995	0.279***	0.238***	0.237**	0.262**	0.267**	0.245**	0.267**	0.299**
	(0.087)	(0.086)	(0.110)	(0.109)	(0.118)	(0.110)	(0.118)	(0.136)
Relative to pre-1995 control mean outcome	**17.8%**	**15.1%**	**12.3%**	**13.8%**	**13.8%**	**12.9%**	**13.8%**	**15.2%**
Observations	4,138	4,599	4,445	4,655	4,655	3,900	4,655	448
R-squared	0.900	0.897	0.899	0.895	0.897	0.903	0.895	0.899
Year FE	YES	YES	YES	YES	YES	YES	YES	YES
Commune FE	YES	YES	YES	YES	YES	YES	YES	YES
Climatic controls	YES	YES	YES	YES	YES	YES	YES	YES
Inverse PS reweighting	YES	YES	YES	YES	YES	YES	YES	YES
Restriction on commune type	pop.>10,000	excl. Hubs	excl. Regional capitals and Hubs	NO	NO	excl. Regional capitals, Hubs and pop.>10,000 or <70,000	NO	Province capital only
Adding *Zi* × *POST 1995*	NO	NO	NO	with Regional capitals × POST and Hubs x POST	with Regional capitals × Year FE, Hubs × Year FE	NO	with Regional capitals × POST, Hubs × POST, Pop. Size × POST	NO

Estimation of nightlight intensity on a dummy for being decentralised in 1995 and observed post-1995, using different end years. All estimations control for year FE, commune FE, climate variables (precipitation, temperature) at the time of observation and, all except model 12, Abadie (1995)'s inverse PS reweighting. Population cutoffs of 10,000 correspond to the population criterion for 1995 decentralisation. Robust standard errors in parentheses, clustered at commune level. Significance level: *** p<0.01, ** p<0.05, * p<0.1

Increasing comparability and accounting for specific dynamics. Another way to restrict our DD to communes that are more comparable is to focus on some subgroups that may be less prone to the selection bias associated with the early decentralisation group. A minor check consists in restricting the sample to communes above the population threshold announced as a decentralisation criterion. As discussed, this criterion was weakly binding and we lose only 11% of the sample (all are non-decentralised communes). **Table 3** (column 5) shows that the results do not change much in this case. It is likely that the coefficients are inflated by the presence of hubs, the very economically active border communes. When excluding them (column 6), estimates indeed fall slightly but remain significant. Most importantly, the central characteristic influencing the participation in the early decentralisation process, and possibly associated with specific political and economic dynamics, is the status as regional province. We replicate our estimations without these communes (column 7). Relative effects slightly decrease and, with the sample size reduction, estimates are now significant at the 5% level only. An alternative way to control for specific dynamics associated with regional capitals or hubs is to interact dummies for these communes with the POST variable. Results are in the same order of magnitude in this case (column 8) or when using a more flexible specification where the regional capital and hub dummies are interacted with all the year FE (column 9).

Overall, there seems to be some evidence of a gain from decentralisation: the effect remains when excluding regional capitals and hubs (or when accounting for their potentially specific dynamics), i.e. when focusing on a decentralisation effect driven by provincial capitals. This is reassuring given that the latter communes have much less specific administrative/economic advantages and are largely similar to (or with a common support with) other communes before reform, notably in terms of fiscal capacity (**Figure 1**) or nightlight intensity (**Figure 5**). Admittedly, province capitals tend to be larger than simple communes. If we now exclude regional capitals and hubs while also restricting to a population size between 10,000 and 70,000 inhabitants – i.e. a segment for which there is much overlap between the early decentralised province capitals and other communes (cf. **Figure 2**) – we still find a moderately significant decentralisation effect (column 10). We can also extend the interaction terms $z'_i \times \text{POST}_{it}$ (as used in column 8) and include population size among the z_i. Estimates are very similar (column 11).

Despite these numerous checks, it might be that the provincial capitals that were decentralised first – even if they have similar characteristics to the other communes – experience unobservable dynamics that bias our conclusions. An ultimate check then consists in reducing our DD to the group of provincial capitals, i.e. to compare provincial capitals decentralised in 1995 to those decentralised later (a similar type of check was presented in Appendix **Figure 9**). Note that these two groups have similar characteristics, as shown in Appendix **Table 10**, except population size. Nonetheless, estimations are still adjusted with an inverse PS that depends, among other things, on communes' population size. Despite the very small sample (due to the restriction to provincial capitals), we still find a mildly significant effect for those decentralised first (column 12 in **Table 3**). We cannot rule out that these communes have specific unobservable characteristics that are not accounted for in the model, so our results remain suggestive. But it should be noted that the

PS also includes all the observed sources of heterogeneity across communes (demographics, geographic variables and economic resources, as described in Appendix **Table 10**), which brings some confidence to the results.

Magnitude. Note that it is difficult to compare the magnitude of these effects to those of the related literature. Indeed, as discussed, the studies using quasi-experimental approaches tend to focus on specific outcomes rather than on a general development measure. Nonetheless, we can report some of the previous estimates. For Indonesia, Kis-Katos and Sjahrir (2017) show that the 2001 decentralisation process had moderate or large effects depending on the outcome, for instance +7% in education and +14% in health care, among localities that had low public infrastructure in the first place. Galiani et al. (2008) find an effect of 4% to 7% of school decentralisation on test scores in Argentina. Malesky et al. (2014) find a contribution of 8%–10% of decentralised public services on the access to public transports. Khanna (2015) finds an impact of increased local responsibilities for educational programmes of 4% to 11% on the literacy rate. Thus, the magnitude of our most conservative estimates, i.e. a short-term relative effect of 9%–11% on nightlight intensity, is large but of a comparable order.

4.4 Heterogeneity and discussion

Heterogeneity among treated: administratively or economically specific communes. The above results address the internal validity issues as best we can. They also provide elements of an answer to the concerns regarding external validity. Indeed, the fact that province capitals seem to experience a positive effect of decentralisation means that this effect was not confined to regional capitals, which were seen as having more political leverage and greater ability to collect own-source revenues due to pre-existing administrative support (e.g. the presence of the Ministry of Finance). That said, it is likely that decentralisation effects were heterogeneous, at least in the group of early decentralised communes. We check this by interacting the Decentralised × Post 1995 variable with the three types of decentralised communes: regional capitals, hubs and provincial capitals. Results are reported in panel (a) of **Table 4**. As expected, the effect specific to provincial capitals is the smallest in the short run. Yet it is not significantly smaller than for regional capitals. The coefficients for hubs are huge and – even if unprecisely estimated – may confirm specific development trends for these communes more than decentralisation effects.

Heterogeneity among treated: types of resources. We complete this analysis with other heterogeneous effects, which may give some further indication of the communes' characteristics associated with larger decentralisation gains. We exclude hubs from the analysis for the reason discussed above (but results are similar when hubs are included). We exploit information on communes' fiscal capacity data, which is available for the early-decentralised communes, and the source of it, either from own-source revenues or from transfers. We use per capita measures of these resources and choose the median of all communes to define high or low levels of resources. Results in panel (b) first show that in the short-run (1992–2000), decentralisation effects are significant only for communes with high, above-median fiscal capacity. Panels (c)

and (d) indicate that the important factor for decentralisation gains in terms of local economic development, as proxied by nightlight intensity, is the access to *own-source revenues* more than the amount of *state transfers*.[24]

Table 4 Heterogeneous effects

Heterogenous effects		**Using observations:**	
		1992 to 2000	**1992 to 2005**
(a) Decentralised 1995 × POST 1995	× Regional capital	0.226**	0.241*
		(0.090)	(0.125)
	× Hub	0.463*	0.616**
		(0.238)	(0.295)
	× Provincial capital	0.189**	0.240**
		(0.083)	(0.110)
	p-value of equality test (*Region=Province*)	0.752	0.994
(b) Decentralised 1995 × POST 1995	× Above-median total resources	0.226**	0.322***
		(0.085)	(0.106)
	× Below-median total resources	0.145	0.211
		(0.134)	(0.166)
	p-value of equality test	0.570	0.545
(c) Decentralised 1995 × POST 1995	× Above-median own resources	0.255***	0.361***
		(0.095)	(0.118)
	× Below-median own resources	0.086	0.130
		(0.091)	(0.112)
	p-value of equality test	0.128	0.117
(d) Decentralised 1995 × POST 1995	× Above-median transfers	0.179*	0.258**
		(0.090)	(0.113)
	× Below median transfers	0.248*	0.350**
		(0.131)	(0.153)
	p-value of equality test	0.627	0.603
Year FE		YES	YES
Commune FE		YES	YES
Climatic controls		YES	YES
Inverse PS reweighting		YES	YES

Estimation of nightlight intensity on a dummy for being decentralised in 1995 and observed post-1995. All estimations control for year FE, commune FE, climate variables (precipitation and temperature at the time of observation) and Abadie (1995)'s inverse PS reweighting. Robust standard errors in parentheses, clustered at commune level. Significance level: *** p<0.01, ** p<0.05, * p<0.1

24 Not surprisingly, the coefficient for above-median own-source revenues becomes significantly larger than for below-median when hubs are included (unreported estimations).

Discussion. These results find some echo in the limited literature on the unequal effects of decentralisation in poor countries. Caldeira et al. (2012) show that decentralisation has contributed to poverty reduction by improving household access to essential public services in Benin, although the reform appeared to increase intra- and inter-jurisdictional inequalities in access to such services. Empirical results from Lessman (2012) also indicate that decentralisation might lead to higher regional disparities in developing and emerging economies more broadly. Some studies show that decentralisation may contribute to a permanent increase in inequalities by benefiting already advantaged populations, widening the gap with the poorest (Prud'homme, 1995; Manor, 1999). This is precisely the case if jurisdictions finance their activities from their own resources, which leads only the richest among them to make significant progress in terms of public services, for example in access to education and health (see West and Wong, 1995, for China, or Galiani et al., 2008, in Argentina, and Bardhan and Mookherjee, 2006, for West Bengal). Our results tend to show that the ability to generate and collect sufficient resources at the local level is a precondition for effective decentralisation, which also contributes to such inequality between territories.

Conclusions

We have used nightlight intensity as a proxy for local development – which is homogeneously measured and hence comparable across time and space – to study the implications of gradual decentralisation reform in Burkina Faso. Given the phase-in of the reform, with 33 communes decentralised in 1995, 16 others in 2000 and the rest of the country in 2005, we adopt a panel DD approach (i.e. TWFE, controlling for time and commune FE).

Results suggest a relative increase in nightlight intensity among the early decentralised communes compared to other communes, contrasting with the parallel trends of the two groups before the decentralisation process started. Multiple robustness checks and the use of inverse PS reweighting reduce the risk of unobserved confounders that would explain the choice of certain communes in the early decentralised group and would also influence their trend in the post-1995 period differently from the trend of other communes. We provide alternative robustness checks while controlling for the specific time trends of hubs or communes with political leverage (regional capitals). Results tend to hold and indicate a positive return on decentralisation.

However, decentralisation did not lift all boats. In terms of economic dividend measured by nightlight density, there is little we can say about the virtues of decentralisation for the bulk of communes decentralised later – which are actually used as a control group – but we can capture differences among the early-decentralised communes. We show that the gains from decentralisation tend to be effective only for those communes with a solid economic basis and the ability to generate their own fiscal revenues.[25] The capacity to attract state transfers seems to matter less. *A fortiori*, given that the bulk of communes that joined the decentralisation process later had low capacities, it is likely that decentralisation did not pay off for them.

25 Having poor own-source revenues per inhabitant probably renders local policy-making and the effectiveness of decentralisation difficult. Englebert and Sangaré (2010) state that there might be a threshold of income below which decentralisation is practically unfeasible. If there is insufficient income generation in the villages to offer some basis for taxation, communes remain underfinanced and dependent on the national government. Moreover, the local community might not develop a sense of ownership of their commune if they do not participate significantly in its financing.

References

Abadie, A. (2005) 'Semiparametric Difference-in-Differences Estimators' *Review of Economic Studies* 72(1): 1–19.

Alatas, V., Banerjee, A., Hanna, R. et al. (2012) 'Targeting the poor: evidence from a field experiment in Indonesia' *Am. Econ. Rev.* 102: 1,206–40.

Alderman, H. (2002) 'Do local officials know something we don't? Decentralisation of targeted transfers in Albania' *Journal of Public Economics* 83(3): 375–404.

Alesina, A., Michalopoulos, S. and Papaioannou, E. (2016) 'Ethnic inequality' *Journal of Political Economy* 124(2): 428–488.

Assemblée Nationale du Burkina Faso (1998) LOI N°041/98/AN portant organisation de l'administration du territoire au Burkina Faso.

Arse del Granado, F., Martines-Vasques, J. and Simatupang, R.R. (2008) 'Local government fiscal competition in developing countries: the case of Indonesia' *Urban Public Economic Review* 13–45.

Bardhan, P. and Mookherjee, D. (2005) 'Decentralising antipoverty program delivery in developing countries' Journal of Public Economics 89(4): 675–704.

Bardhan, P. and Mookherjee, D. (2006) 'Pro-poor targeting and accountability of local governments in West Bengal' *Journal of Development Economics* 79(2): 303–327.

Bardhan, P. (2002) 'Decentralisation of governance and development' *Journal of Economic Perspectives* 16(4): 185–205.

Besley, T. and Case, A. (1995) 'Incumbent behavior: vote-seeking, tax-setting, and yardstick competition' *American Economic Review* 85(1): 25–45.

Bird, R. and Rodriguez, E.R. (1999) 'Decentralisation and poverty alleviation. International experience and the case of the Philippines' *Public Administration and Development* 299–319.

Bo, S., Wu, Y. and Shong, L. (2020) 'Flattening of government hierarchies and misuse of public funds: evidence from audit programs in China' *Journal of Economic Behavior & Organisation* 179: 141–151.

Borusyak, K. and Jaravel, X. (2018) 'Revisiting event study designs'. Available at SSRN 2826228.

Brosio, G. (2002) 'Decentralisation in Africa' in E. Ahmad and V. Tansi (eds) *Managing fiscal decentralisation.* London: Routledge.

Bruederle, A. and Hodler, R. (2018) 'Night-time lights as a proxy for human development at the local level' *PloS one* 13(9) e0202231.

Caldeira, E. (2012) 'Yardstick competition in a federation: theory and evidence from China' *China Economic Review* 23(4): 878–897.

Caldeira, E., Foucault, M. and Rota-Graziosi, G. (2012) *Does decentralisation facilitate access to poverty-related services? Evidence from Benin.*

Caldeira, E. and Rota-Graziosi, G. (2014) 'La décentralisation dans les pays en développement: une revue de la littérature' *Revue d'économie du développement* 22(4) : 5–37.

Caldeira, E., Foucault, M. and Rota-Graziosi, G. (2015) 'Decentralisation in Africa and the nature of local governments' competition: evidence from Benin' *International Tax and Public Finance* 22(6): 1,048–1,076.

Callaway, B. and Sant'Anna, P.H.C. (2021) 'Difference-in-differences with multiple time periods' *Journal of Econometrics* 225(2): 200–230.

de Chaisemartin, C. and d'Haultfoeuille, X. (2020) 'Two-way fixed effects estimators with heterogeneous treatment effects' *American Economic Review* 110(9): 2,964–2,996.

Champagne, E. and Ouedraogo, b.M. (2008) *Decentralisation in Burkina Faso: a policy reform process in slow motion.* Working Paper 08-2008. Andrew Young School of Public Policy.

Channa, A. and Faguet, J.-P. (2016) Decentralisation of health and education in developing countries: a quality-adjusted review of the empirical literature' *World Bank Research Observer* 10.1093/wbro/lkw001 (31)2: 199–241.

Cortes, D. F. (2010) *Do more decentralized local governments do better? An evaluation of the 2001 decentralization reform in Colombia.* Universidad del Rosario Faculty of Economics Working Paper No. 84 (http://dx.doi.org/10.2139/ssrn.1703543).

Crawford, G. and Hartmann, C. (eds.) (2008) *Decentralisation in Africa: a pathway out of poverty and conflict?.* Amsterdam University Press.

Dafflon, B. and Madiès, T. (2013) *The political economy of decentralisation in sub-Saharan Africa: a new implementation model in Burkina Faso, Ghana, Kenya, and Senegal.* Washington DC: World Bank.

del Granado, F.J.A., Martinez-Vazquez, J. and McNab, R.M. (2018) 'Decentralised governance, expenditure composition, and preferences for public goods' *Public Finance Review* 46(3): 359–388.

Diaz-Serrano, L. and Rodríguez-Pose, A. (2015) 'Decentralisation and the welfare state: what do citizens perceive?' *Soc. Indic. Res.* 120(2): 411–435.

Dickovick, J.T. and Wunsch, J.S. (eds) (2014) *Decentralisation in Africa: the paradox of state strength.* Boulder, CO: Lynne Rienner Publishers.

Donaldson D. and A. Storeygard (2016) 'The view from above: applications of satellite data in economics' *Journal of Economic Perspectives* 30(4): 171–198.

Elvidge, C.D., Baugh, K.E., Anderson, S.J. et al. (2012) 'The Night Light Development Index (NLDI): a spatially explicit measure of human development from satellite data' *Soc. Geogr.* 7(1): 23–35.

Elvidge, C. D., Baugh, K. E., Kim, E. A. et al. (1997) 'Relation between satellite observed visible-near infrared emissions, population, economic activity and electric power consumption' *International Journal of Remote Sensing* 18(6): 1,373–1,379.

Englebert, P. and Sangare, N. (2010) *Comparative assessment of decentralisation in Africa: Burkina Faso desk study.* Washington DC: United States Agency for International Development.

Englebert, P. and Sangare, N. (2014) Burkina Faso: limited decentralisation under tight oversight' in J. T. Dickovick and J. Wunsch (eds) *Decentralisation in Africa.* Boulder, CO: Lynne Rienner.

Enikolopov, R. and Zhuravskaya, E. (2007) 'Decentralisation and political institutions' *Journal of Public Economics* 91: 2,261–2,290.

Faguet, J.-P. (2004) 'Does decentralisation increase government responsiveness to local needs?' *Journal of Public Economics* 88 (3–4): 867–893.

Faguet, J.-P. and Sánchez, F. (2014) 'Decentralisation and access to social services in Colombia' *Public Choice* 160/1/2: 227–249.

Faguet, J.-P. and Pöschl, C. (eds) (2015) *Is decentralisation good for development?: perspectives from academics and policy makers.* Oxford: Oxford University Press.

Ferraz, C. and Finan, F. (2008) 'Exposing corrupt politicians: the effects of Brazil's publicly released audits on electoral outcomes' *Quarterly Journal of Economics* 123: 703–745.

Flèche, S. (2021) 'The welfare consequences of centralisation: evidence from a quasi-natural experiment in Switzerland' *Journal of African Economies* 103(4): 621–635.

Gadenne, L. and Singhal, M. (2014) *Decentralisation in developing economies.* NBER Working Paper No. 19402.

Galasso, E. and Ravallion, M. (2005) 'Decentralised targeting of an antipoverty program' *Journal of Public Economics* 89(4): 705–727.

Galiani, S., Gertler, P. and Schargrodsky, E. (2008) 'School decentralisation: helping the good get better, but leaving the poor behind' *Journal of Public Economics* 92(10–11): 2,106–2,120.

Gibson, J., Olivia, S. and Boe-Gibson, G. (2020) 'Nightlights in economics: sources and uses' *Journal of Economic Surveys* 34: 955–980.

Goodman-Bacon, A. (2021) 'Difference-in-differences with variation in treatment timing' *Journal of Econometrics* 225(2): 254–277.

Grimm, M. and Günther, I. (2007) 'Growth and poverty in Burkina Faso: a reassessment of the paradox' *Journal of African Economies* 16(1): 70–101.

Grossman, G. and Lewis, J. I. (2014) 'Administrative Unit Proliferation' *American Political Science Review* 108 (1): 196–217.

Guerrero, V. M. and Mendoza, J.A. (2019) 'On measuring economic growth from outer space: a single country approach' *Empirical Economics.*

Habibi, N., Huang, C., Miranda, D. et al. (2003) 'Decentralisation and human development in Argentina' *Journal of Human Development* 4(1): 73–101.

Harsch, E. (2017) *Burkina Faso: a history of power, protest, and revolution.* London: Zed Books.

Hazard, B. (2004) 'Entre le pays et l'outre-pays'. africanistes (74–1/2) : 249–274.

Henderson, J.V., Storeygard, A. and Weil, D.N. (2012) Measuring economic growth from outer space' *American Economic Review* 102(2): 994–1,028.

Hirano, K., Imbens, G. and Ridder, G. (2002) 'Efficient estimation of average treatment effects using the estimated propensity score' *Econometrica.*

Hodler, R. and Raschky, P.A. (2014) 'Regional favoritism' *Quarterly Journal of Economics* 129(2): 995–1,033.

Horizons Solidaires La Décentralisation au Burkina Faso.

Iddawela, Y., Lee, N. and Rodríguez-Pose, A. (2021) 'Quality of sub-national government and regional development in Africa' *Journal of Development Studies* 57(8): 1,282–1,302.

Jia, J., Ding, S. and Liu, Y. (2020) 'Decentralisation, incentives, and local tax enforcement' *Journal of Urban Economics* 115.

Jin, H., Qian, Y. and Weingast, B.R. (2005) 'Regional decentralisation and fiscal incentives: federalism, Chinese style' *Journal of Public Economics* 89(9–10): 1,719–1,742.

Keola, S., Andersson, M. and Hall, O. (2015) 'Monitoring economic development from space: using nighttime light and land cover data to measure economic growth' *World Development* 66(1): 322–334.

Khanna, G. (2023) 'Large-Scale Education Reform in General Equilibrium: Regression Discontinuity Evidence from India' *Journal of Political Economy 131* (1) (https://doi.org/10.1086/721619).

Kis-Katos, K. and Sjahrir, B. S. (2017) 'The impact of fiscal and political decentralisation on local public investment in Indonesia, *Journal of Comparative Economics*, 45, 2.

Lessman, C. (2012) 'Regional inequality and decentralisation: an empirical analysis' *Environment and Planning A: Economy and Space* 44(6): 1,363–1,388.

Li, P., Lu, Y. and Wang, J. (2016) 'Does flattening government improve economic performance? Evidence from China' *Journal of Development Economics* 123: 18–37.

Ligthart, J.E. and van Oudheusden, P. (2015) 'In government we trust: the role of fiscal decentralisation' *European Journal of Political Economy* 37: 116–128.

Livingston, J.A. and Azfar, O. (2010) *Federalist disciplines or local capture?: an empirical analysis of decentralisation in Uganda.*

Mahieu, S. and Yilmaz, S. (2010) Local government discretion and accountability in Burkina Faso' *Public Administration and Development* 30(5): 329–344.

Malesky, E.J., Nguyen, C.V. and Tran, A. (2014) 'The impact of recentralisation on public services: a difference-in-differences analysis of the abolition of elected councils in Vietnam' *American Political Science Review* 108(1): 144–168.

Mamo, N., Arezki, R., Bhattacharyya, S. and Moradi, A. (2016) *Economic consequences of mineral discovery and extraction in sub-Saharan Africa: is there a curse?* University of Sussex.

Manor, J. (ed.) (1999) *The political economy of democratic decentralisation.* Washington DC: World Bank.

Martinez-Vazquez, J., Lago-Peñas, S. and Sacchi, A. (2017) 'The impact of fiscal decentralisation: a survey' *Journal of Economic Surveys* 31(4): 1,095–1,129.

Martinez-Vazquez, J. and Vaillancourt, F. (2011) (eds) *Decentralisation in developing countries: global perspectives on the obstacles to fiscal devolution.* Cheltenham: Edward Elgar.

Mellander, C., Lobo, J., Stolarick, K. and Matheson, S. (2015) 'Night-time light data: a good proxy measure for economic activity?' *PloS one* 10(10) e0139779.

Montinola, G., Qian, Y. and Weingast, B.R. (1995) 'Federalism, Chinese style: the political basis for economic success in China' *World Pol.* 48(01): 50–81.

Myck, M. and Najsstub, M. (2020) 'Implications of the Polish 1999 administrative reform for regional socio-economic development' *Economics of Transition and Institutional Change* 28(4): 559–579.

Oates, W.E. (2005) 'Toward a second-generation theory of fiscal federalism' *International Tax and Public Finance* 12(4): 349–373.

OECD and UCLG (2019) 2019 *Report on the World Observatory on Subnational Government Finance and Investment: Key Findings.* Paris: OECD, UCLG.

Ouédraogo, M. (2010) 'Electricity consumption and economic growth in Burkina Faso: A cointegration analysis' *Energy Economics* 32 (3): 524–531.

Ouédraogo, M., Millogo, E., Guiré, M. and Kaboré, M.T. (2009) *Les capacités des communes rurales au Burkina Faso: Naviguer entre l'apprentissage et le pré-requis.*

Pitt, M.M. and Khandker, S.R. (1998) 'The impact of group-based credit programs on poor households in Bangladesh: does the gender of participants matter?' *Journal of Political Economy* 106 (5): 958–996.

Prud'homme, R. (1995) 'The dangers of decentralisation' *World Bank Research Observer* 10(2): 201–220.

Reinikka, R. and Svensson, J. (2011) 'The power of information in public services: evidence from education in Uganda' *J. Public Econ.* 95: 956–966.

Riedl, R.B. and Dickovick, J.T. (2014) 'Party systems and decentralisation in Africa' *Studies in Comparative International Development* 49(3): 321–342.

Robalino, D., Picazo, O.F. and Voetberg, A. (2001) Does fiscal decentralisation improve health outcomes?: evidence from a cross-country analysis' *Policy Research Working Paper* WPS 2565. Washington DC: World Bank Group.

Sanogo, T. (2019) 'Does fiscal decentralisation enhance citizens' access to public services and reduce poverty?: evidence from Côte d'Ivoire communes in a conflict setting' *World Development* 113: 204–221.

Seabright, P. (1996) 'Accountability and decentralisation in government: an incomplete contracts model' *European Economic Review* 40(1): 61–89.

Smith, J.A. and Todd, P.E. (2001) 'Reconciling conflicting evidence on the performance of propensity-score matching methods' *American Economic Review, Papers and Proceedings* 91: 112–118.

Smoke, P. (2001) *Fiscal decentralisation in developing countries: a review of current concepts and practice.* Geneva: United Nations Research Institute for Social Development.

Sun, L. and Abraham, S. (2021) 'Estimating dynamic treatment effects in event studies with heterogeneous treatment effects' *Journal of Econometrics* 225(2): 175–199.

Sutton, P.C. and Costanza, R. (2002) 'Global estimates of market and non-market values derived nighttime satellite imagery, landcover and ecosystem service valuation' *Ecological Economics* 41: 509–527.

Tiebout, C.M. (1961) 'An economic theory of fiscal decentralisation' in National Bureau for Economic Research (NBER) (ed.) *Public finances: needs, sources, and utilisation.* Princeton, NJ: Princeton University Press.

Traore, S. and Owiyo, T. (2013) 'Dirty droughts causing loss and damage in Northern Burkina Faso' *International Journal of Global Warming* 5(4): 16.

UNDP (2005) *Fiscal decentralisation and poverty reduction*. UNDP Primer. New York: United Nations Development Programme.

UN Public Administration Network La décentralisation au Burkina Faso.

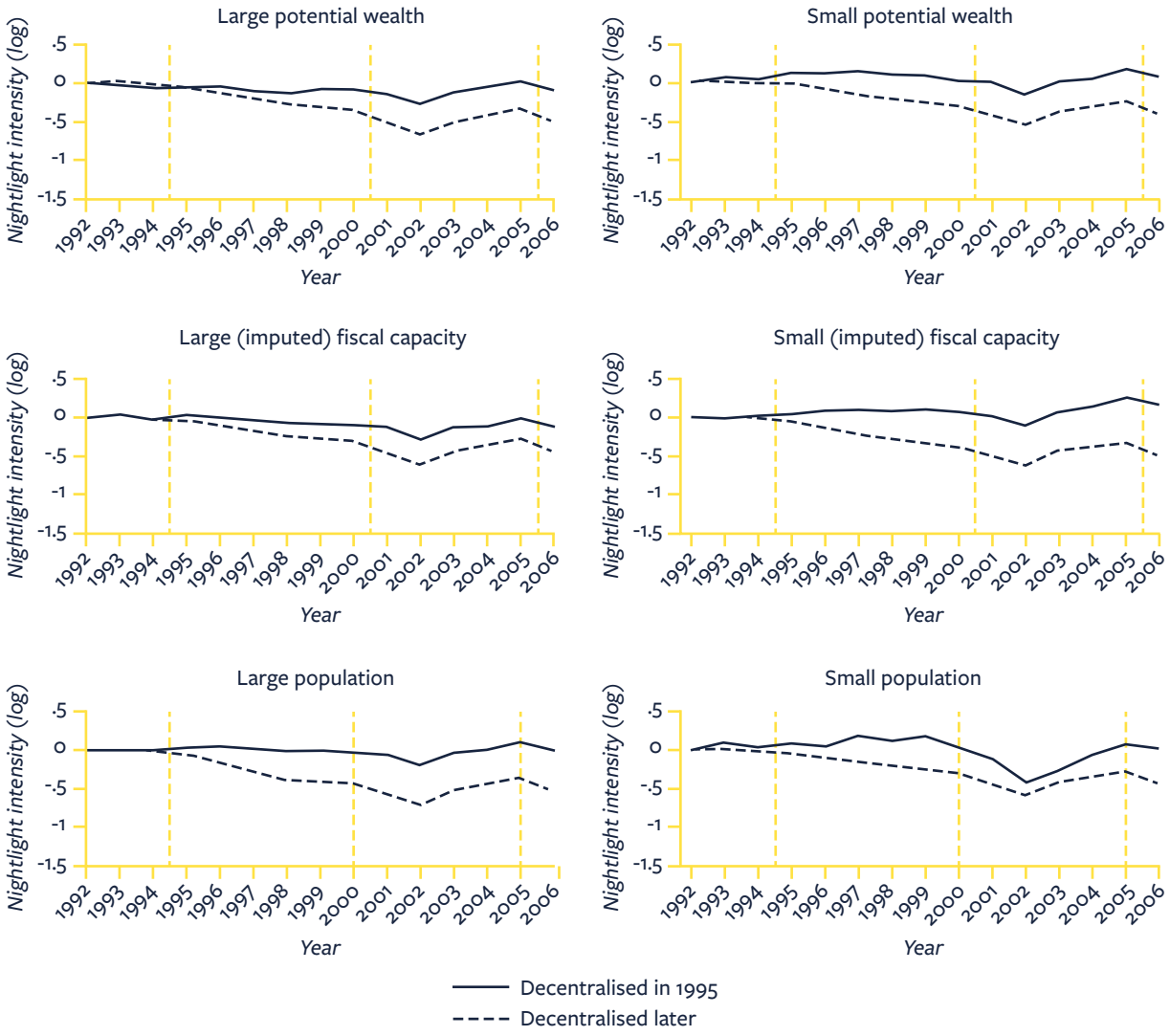
Vaillancourt, F. and Bird, R.M. (eds) (1999) *Fiscal decentralisation in developing countries*. Cambridge: Cambridge University Press.

Wang, W., Sheng, X. and Zhao, Z. (2012) 'Fiscal reform and public education spending: a quasi-natural experiment of fiscal decentralisation in China' *Oxf Rev Econ Policy* 42(2): 334–356.

West, L.A. and Wong, C.P.W. (1995) 'Fiscal decentralisation and growing regional disparities in rural China: some evidence in the provision of social services' *Oxford Review of Economic Policy* 11(4): 70–84.

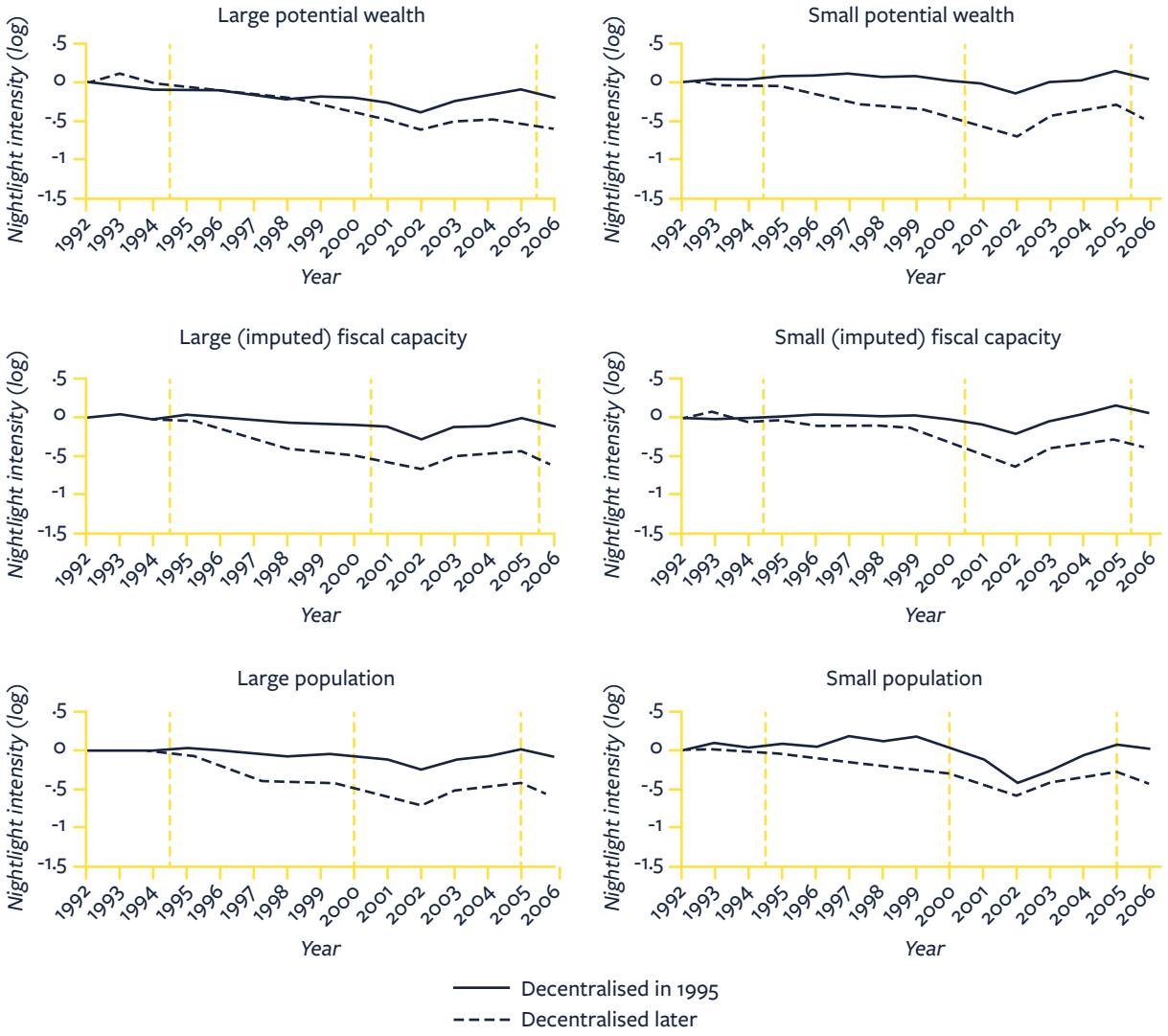
Appendix

Figure 8 Trends by decentralised status, heterogeneity by potential resource level and population size



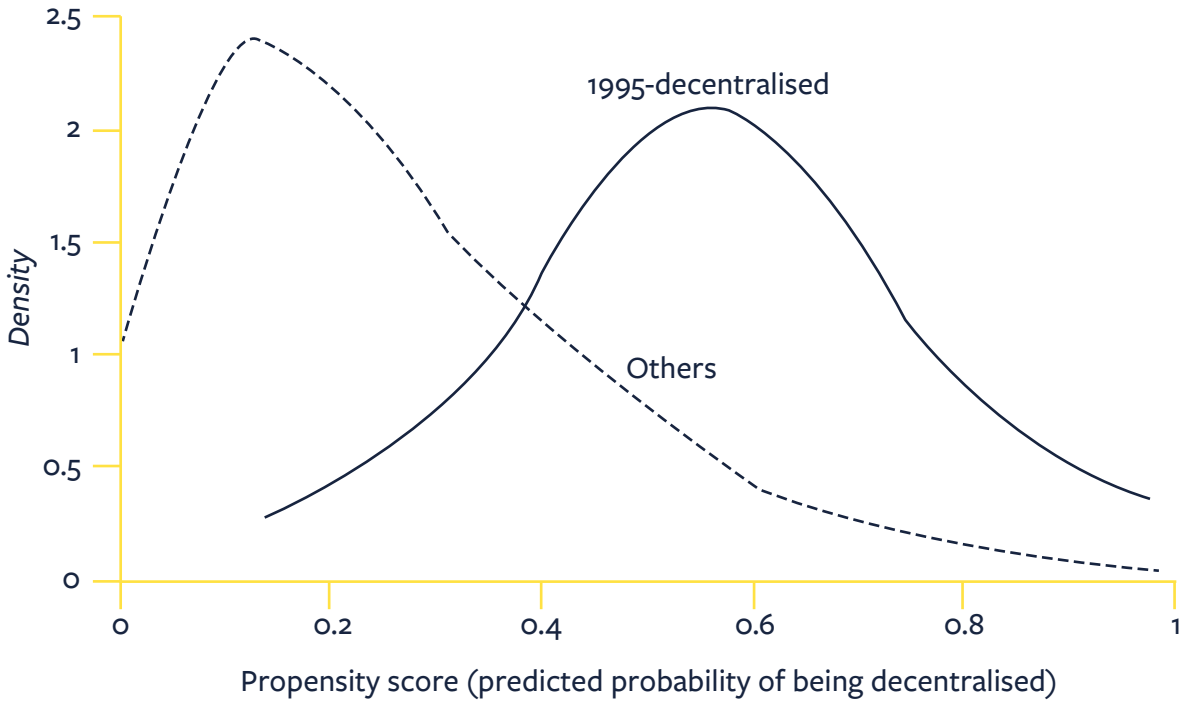
Moving average nightlight intensity. Large/small potential wealth: below/above median distance to resources (water, gold, gem, drug, oil, coast). Imputed fiscal capacity: prediction from an estimation of fiscal capacity on the same resources variables (using the early decentralised communes, for whom fiscal capacity is oberserved every year).

Figure 9 Trends by decentralised status, heterogeneity by potential resource level and population size (provincial capitals only)



Moving average nightlight intensity. Large/small potential wealth: below/above median distance to resources (water, gold, gem, drug, oil, coast). Imputed fiscal capacity: prediction from an estimation of fiscal capacity on the same resources variables (using the early decentralised communes, for whom fiscal capacity is oberserved every year).

Figure 10 Distribution of 'being decentralised' propensity score by decentralisation status



Propensity score (PS) obtained by alinear probability model estimation of the dummy 'being decentralised in 1995' on population size, distance to large cities, evaluation, distance to natural resources (gold, gem, diamond, water, coast, onshore petrol), distance to main road and to nearest border, and climate conditions. We delete observations for which PS is below 0.01 or above 0.99 (5% of the sample).

Table 5 Timeline of the decentralisation reform in Burkina Faso

1991	The 1991 Constitution instituted the multi-tier governance system and set the legal basis of the reform (articles 143, 144, 145 and beyond)	
1993	Adoption of the first series of legal provisions on decentralisation and local governance	
1995	1st wave of effective decentralisation – 33 municipalities	Municipal elections are held in 33 municipalities
1998	Adoption of four major legislation pieces on the decentralisation reform (*textes d'orientation de la décentralisation*)	
2000	2nd wave of effective decentralisation – 49 municipalities	Municipal elections are held in 49 municipalities
2004	Adoption of the General Code of Local and Regional Authorities (*Code général des Collectivités territoriales*)	
2005–2006	3rd wave of effective decentralisation	General municipal elections are held in 321 municipalities

Source: information from the National Parliament (*Assemblée Nationale*) of Burkina Faso (1998), Horizons Solidaires, Ouédraogo et al. (2009), UN Public Administration Network.

Table 6 Data description and sources

Variable	Description	Data Source
Outcome Variable		
Night-time light density	Proxy for local development. DMSP-OLS night-time light density corrected for ephemeral events	DMSP
Budget Data		
Fiscal capacity	Local government budget	DGTCP
Transfers	Transfers from central government	DGTCP
Own-source revenues	Local government own-source revenues	Authors with data from DGTCP
Climatic Data		
Precipitation	Yearly mean precipitation from Climate Research Unit in millimetres, obtained aggregating (mean) monthly precipitation data	AidData
Temperature	Yearly mean temperature from Climate Research Unit in degrees Celsius, obtained aggregating (mean) monthly mean daily temperature data	AidData
Geographic and Economic Data		
Population	Population size of a municipality	DGTCP
Distance to coast	Distance to coast (on land only), measured in meters and derived using World Vector Shorelines	AidData
Distance to diamond	Average distance to known diamond deposits, calculated with data from the Peace Research Institute Oslo	AidData
Distance to gold	Average distance to nearest lootable or surface gold deposit. Derived from GOLDATA dataset which consists of 2969 entries for gold occurrences in 108 countries	AidData
Distance to gemstones	Average distance to gemstone deposits, measured in meters, calculated with data from the Peace Research Institute Oslo	AidData
Distance to oil (onshore petroleum)	Distance to onshore petroleum, measured in meters, and derived from PRIO global onshore petroleum dataset	AidData

DMSP: U.S. Air Forces Defence Meterological Satellite Program. DGTCP: Treasury and Public Accountancy Directorate (*Direction générale du Trésor et de la Comptabilité publique*).

Table 7 Correlates of nightlight density

	(1)	(2)	(3)
Per capita fiscal capacity #	0.001***	0.001***	0.001***
	(0.000)	(0.000)	(0.000)
Precipitation		0.049***	0.028***
		(0.007)	(0.003)
Temperature		-1.026***	-0.709***
		(0.146)	(0.065)
Elevation		-0.001	-0.004***
		(0.001)	(0.001)
Observations	33	349	4,882
R-squared	0.347	0.471	0.408
Sample	1995	2005	1992–2005

Estimation of nightlight intensity on a set of covariates. # Fiscal capacity is the actual capacity for early decentralised communes and the predicted one for other communes. Significance level: *** p<0.01, ** p<0.05, * p<0.1

Table 8 Nightlight estimations with both 1995 and 2000 decentralisation effects

Sample from 1992 to:	**2000**	**2005**	**2005**
Specification	excluding 2000-decentralised		with both treatments
	(I)	(II)	(III)
Decentralised 1995 × POST 1995	0.219***	0.289***	0.292***
	(0.064)	(0.079)	(0.078)
Relative to pre-1995 control groupe mean outcome:	**13.6%**	**18.2%**	**18.6%**
Decentralised 2000 × POST 2000	-	-	-0.081
			(0.067)
Observations	2,976	4,630	6,588
R-squared	0.900	0.896	0.888
Year FE	YES	YES	YES
Commune FE	YES	YES	YES
Climatic controls	YES	YES	YES

Estimation of nightlight intensity on dummies for being decentralised in 1995 or 2000, and observed post-1995, using different end years. Estimations control for year FE, commune FE and climate variables (precipitation and temperature at the time of observation). Robust standard errors in parentheses, clustered at commune level. Significance level: *** p<0.01, ** p<0.05, * p<0.1

Table 9 Placebo estimations and first year effects

Sample from 1992 to:	**1995**	**1995**	**1996**	**1997**	**1998**	**1999**
Cutoff:	1993	1994	1995	1995	1995	1995
All sample						
Decentralised 1995 × POST Cutoff	0.028	0.030	0.116*	0.148***	0.188***	0.195***
	(0.080)	(0.053)	(0.064)	(0.051)	(0.058)	(0.064)
Observations	1,386	1,386	1,733	2,080	2,426	2,773
R-squared	0.917	0.917	0.917	0.892	0.893	0.895
Excluding hubs						
Decentralised 1995 × POST Cutoff	0.004	0.017	0.099	0.124**	0.162***	0.168***
	(0.082)	(0.055)	(0.065)	(0.050)	(0.057)	(0.063)
Observations	1,370	1,370	1,713	2,056	2,398	2,741
R-squared	0.918	0.918	0.917	0.892	0.894	0.895
Year FE	YES	YES	YES	YES	YES	YES
Commune FE	YES	YES	YES	YES	YES	YES
Climatic controls	YES	YES	YES	YES	YES	YES

Estimation of nightlight intensity on a dummy for being decentralised in 1995 and observed post-1995, using different end years. Estimations control for year FE, commune FE and climate variables (precipitation and temperature at the time of observation). Robust standard errors in parentheses, clustered at commune level. Significance level: *** p<0.01, ** p<0.05, * p<0.1

Table 10 Mean characteristics of provincial capitals

Decentralised in year:	1995	2000	Diff.
Demographics and geography			
Population size	57,521	34,397	23,123
	(23,157)	(21,903)	(31,874)
Distance to cities > 50,000 inhabitants	249	321	-72
	(144)	(197)	(244)
Elevation	309	299	10
	(47)	(46)	(66)
Distance to coast*	13.5	13.5	0.0
	(0.15)	(0.16)	(0)
Distance to border*	11.1	10.7	0.4
	(0.70)	(0.67)	(0.96)
Economics: distance to resources*			
Gold	11.5	11.7	-0.2
	(0.47)	(0.46)	(0.66)
Diamond	11.8	12.0	-0.2
	(0.64)	(0.49)	(0.81)
Gems	13.3	13.3	0.0
	(0.23)	(0.26)	(0.35)
Onshore petrol	13.8	13.8	0.0
	(0.13)	(0.15)	(0.20)

Standard deviation in brackets.
*Log of normalised distance in metres.