

Empirical Paper

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Public–private partnerships and human development

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Abstract:

The restructuring of a state is crucial for promoting human development. For this reason, public–private partnerships (PPPs), the so-called “fourth revolution” in reinventing the state, have become a global strategy of choice. Yet, existing studies on PPPs mainly analyze their effect on growth or inequality, not human development. This article uses data from the human development index (HDI) database to investigate the impact of PPP projects on human development. With the increasing scale of public infrastructure investments and the need to improve public services, it is necessary to examine whether PPPs are justified in improving social welfare. We conducted the analysis for all low- and middle-income countries using propensity score matching (PSM) and multivariate analysis. Additionally, we present the HDI predictions. We believe that assessing the impact of public–private cooperation on increasing social welfare, reducing social exclusion, and implementing investments with a robust social impact is essential. Overall, we found a statistically significant effect of PPPs on human development, demonstrating that the growing scale of PPP investments in low- and middle-income countries enhances their HDI.

Keywords: growth, human development, human development index, inequality, PPP

JEL Classification: D60; I31; O55; L32

1 Introduction

On January 1, 2022, *The Economist* praised public–private partnerships (PPPs). “PPPs often make economic sense” [The Economist, 2022, p. 21]. But, like most economists, *The Economist* focused its analysis on economic growth. A few other economists [e.g., Banda and Jeke, 2022] concentrate on PPPs and inequality.

The study is relevant and timely because of the increase in the number, spread, and complexities of PPPs around the world [Loxley, 2013; Banda and Jeke, 2022; The Economist, 2022]. Contextualizing PPPs is a useful starting point. With the efflorescence of PPPs have come multiple evaluations. Even so, most have focused on growth or inequality, not human development broadly. Yet, since the 1990s, the United Nations Development Program (UNDP) has consistently published the human development index (HDI) that makes it possible to assess the broader human development impacts of PPPs. This HDI index evaluates countries at three levels: “long and healthy life,” “knowledge,” and “decent standard of living.” Three indicators are analyzed: gross domestic product per capita, expected life span, the average number of years at school for adults (aged 25 years and above), and the expected number of years of education for children starting school.

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In our research, the HDI (Human Development Index) serves as a proxy for human development and an indicator of social well-being due to its comprehensive approach to measuring long-term progress in three basic dimensions of human development: health, education, and standard of living. Utilizing the HDI as a measure in our research allows for an evaluation of the broader impacts of PPPs on societies, beyond mere economic growth, by assessing improvements in health, education, and income levels. This is particularly relevant in low- and middle-income countries, where PPPs often aim not just at infrastructure development or economic gains, but also at enhancing human development outcomes. The HDI's inclusive nature makes it an ideal indicator for analyzing the extent to which PPP initiatives contribute to advancing the overall social and economic well-being of nations, providing a holistic view of human progress and facilitating a deeper understanding of the societal impacts of PPPs. *A priori*, we should expect a connection between PPP and HDI. The increase in the scale of investments in the PPP formula implies a change in the role of the public entity in providing public services. Transferring this role to public-private entities forces the necessity to direct this form of delivering public goods not only for the profit of the private entity, but also to increase social welfare, which is the goal of the public partner. Hence, due to the growing scale of public-benefit infrastructure investments and increasing the availability and quality of public services through PPP projects, it is necessary to examine whether transferring public tasks to PPPs is reasonable for improving social welfare, as expressed here with this study by the HDI. The activities of a public entity tend to deliver public services and goods to all beneficiaries. Often such activities seek also to eliminate disparities in their accessibility. Arguably, the area where the theory of social welfare [Sen, 1970] overlaps with the theory of convergence [Brown and Harisson, 1978], and the New Public Governance trend should be reviewed in more detail.

This article examines the impact of PPP projects on social welfare in low- and middle-income countries. We analyzed whether such an impact exists and, if so, how it may influence human development worldwide in the future. We carry out those analyses for 56 low and middle-income countries in Europe and Central Asia (4 countries), North Africa and the Arabian Peninsula (4 countries), Sub-Saharan Africa (25 countries), Latin America and the Caribbean (22 countries).

We address the following hypothesis:

H1. The value of PPP projects impacts the human development index (HDI) in low- and middle-income countries.

The study aims to reduce possible errors in evaluating the impact of PPP on social development levels due to the impact of accompanying variables. Thus, we apply the propensity score matching (PSM) [Rosenbaum, 1987; Rosenbaum and Rubin, 1985]. This approach has not been used before for PPP research. Thanks to its application, we obtained two groups: control and experimental. We matched control groups with experimental groups to consist of countries with a similar value of the so-called disturbance variables (inputs). These inputs include the Gini index, number of PPP projects, GDP per capita, Worldwide Governance Indicators (WGI), private sector share in GDP, and geographical affiliation. As a result of macroeconomic analyses, we propose the predictions of HDI value for each country assuming the growing scale of PPP projects.

2 Literature review

“The Fourth Revolution” [Micklethwait and Wooldridge, 2014] is an account of “the global race to reinvent the state,” to make it incorporate the private sector. PPPs must be a key part of this restructuring. The emphasis is on combining the best elements of the state with the best spirit of privatization. This “fourth revolution” is supposed to combine the left and the right arms of the state. “There are three areas where Leviathan begs for unburdening: first, selling things that the state has no business owning by reviving privatization, an old cause of the Right; second, cutting the subsidies that flow to the rich and well-connected, an old cause of the Left; and third, forming entitlements to make sure that they are targeted to people who need them and sustainable in the long term, an old cause of everybody who

cares about the health of the state” [Micklethwait and Wooldridge, 2014, p. 234]. Not only are there Left/Right arguments to be reconciled in the case for PPPs, but there are also both macro and microeconomic arguments for this reinvention of the state, carefully discussed by Loxley [2013]. In macroeconomic terms, private sector finance helps the state to address to ameliorate any problems it may have with domestic shortage of resources and to reduce or remove its debt problems. Broader macroeconomic advantages include reduction in corruption, lessening of pressure to tax citizens even more, and the expansion of transparency. Microeconomic arguments for PPPs are even more audacious. Such claims range from the efficiencies of private sector firms to the total embrace of technology by private firm to revolutionize service delivery over time. Advocates [notably Micklethwait and Wooldridge, 2014, p. 208] stress that we should neither overestimate the short-term transformative power of technology nor understate the long-term cascading effects of relying on technology.

At the center of gravity of this tectonic revolution is risk sharing. No longer should the public bear all the risks, the private sector can be brought in to help spread the risk. “The main risks,” which PPPs help to address, “are project or construction risk, operating risk, market or demand risk, financing risk, environmental risk, regulatory risk, legal/political risk, foreign exchange risk, public policy risk, force *majeure* and residual value risk” [Loxley, 2013, p. 489; Roehrich et al., 2014]. Thus, there is a shift from government and governance to the development of New Public Governance (Osborne, 1993), associated with maintaining the security of the pillars of public economics, including the financial security of local administrative units (LAUs) and increased social development. The challenges of old management in the early 1990s [Hood, 1991] led to the transformation of the rules of public management and the abandonment of public administration in favor of effective public management [Osborne, 2006] or, in political-economic construction, (urban) governance. The most significant manifestation of this New Public Governance paradigm can be seen in social and political leadership in relations between public institutions, private entities, and civil society, both internally and internationally [Kooiman, 2003; Obeng-Odoom, 2013a]. Other authors define New Public Governance as “self-regulating networks” of stakeholders operating with or without the involvement of LAUs and governments for the provision of public goods [Bevir et al., 2003].

PPPs have become widely utilized. The reasons for this global interest vary. LAUs face the problem of obtaining financing for local communities’ necessary, non-decreasing needs, including infrastructure investments in the road engineering sector, education, transport, waterworks, wastewater treatment plants, water supply, waste disposal, and others. Securing sufficient funds to continuously provide public services becomes important in public management. The shrinking sources of the own income and public transfer necessitate the search for alternative sources of financing. PPP can obtain private capital for public investment. This is accompanied by the priority of continuous provision of services, delivering them at minimum cost but in satisfactory quality. Local government finance rules assume the obligation to deliver public services/goods at the lowest cost possible, matching the risk and quality control transferred to the financing party [Hart et al., 1997; Kociemska, 2019] to avoid limiting the availability of services to end beneficiaries.

Recently, investments have been significantly growing that positively impact the community and the environment. It has become a new trend among conventional forms of performance of investment projects by public entities and private ones. The Global Impact Investing Network [GIIN, 2019] estimates that the sector has grown from \$4.3 billion in 2011 to \$502 billion in 2018 and, at the upper end of the market, impact investing is estimated to reach as much as \$1 trillion in value by 2020 [De Amicis et al., 2020]. The background of this new trend comprises more and more research defining social finance theory and practice. GIIN [2016] defines impact financing as investments “made into companies, organizations, and funds to generate a measurable social and environmental impact alongside a financial return.” At present, studies focus mainly on assessing the impact and methods of measurement aimed at capturing environmental and social returns generated by investments [Esteves et al., 2012; Epstein and Yuthas, 2017; O’Connor and Labowitz, 2017; Findler, 2019; Hervieux and Voltan, 2019; Portales, 2019; Serafeim et al., 2020; Tsotsotso, 2020].

Other authors point to the development potential of social impact investments due to the accessibility of developing markets to private entrepreneurs [Daggers and Nicholls, 2016]. These economies often search for ways to reach numerous groups of the poorest people. Poor infrastructure development and goods and services distribution channels in such countries contribute to increasing transaction costs. Most PPPs are based on a red-tape, nontransparent contracting system. What could make private investors assume socially responsible attitudes? Rob et al. [2016] point to ensuring project profitability is satisfactory to owners who could share their profits. Therefore, it is valuable to search for such conditions of PPPs that are also oriented at the lowest levels of society while satisfying the expectations of all stakeholders, including financial intermediaries and civil society [Wilson, 2014; Kociemska, 2021]. The task of public financing guarantees would be to make private investors get involved in social impact investment projects.

With the spike in the number of PPPs globally, there has been a spiral of research on PPPs. Most of these studies, however, focus on the role of PPPs in driving economic growth [e.g., Banda and Jeke, 2022]. These studies stipulate, for instance, that income per capita was growing faster in poorer countries, which means that relative underdevelopment could facilitate economic growth, mainly based on the quantity of economic growth ratios. The most frequently examined macroeconomic factors stimulating PPP development are general government balance, population size, money supply, and the share of investments in GDP [Yurdakul and Kamasak, 2020]. Budget limitations, high levels of public debt, and insufficient funds are frequent reasons why countries (especially low-income and developing ones) search for alternative methods of financing their needs related to infrastructure [Arezki et al., 2017; Altung and Firat, 2018; Amos and Zanhoun, 2019]. As indicated before, in recent decades, PPP has been gaining popularity as an alternative source of financing and a mechanism for supporting the management of investments related to public infrastructure. Many studies refer to low-income and developing countries [Andrews and Entwistle, 2015; Boyer and Scheller, 2018; Yurdakul and Kamasak, 2020]. In developing economies, where the management risk and political risk are deemed high [Kamasak, 2017], it is sometimes difficult to decide on a long-term PPP arrangement. Macroeconomic stability is often mentioned as a material factor when implementing PPP projects [Hammami et al., 2006; Delmon, 2011; Boyer and Scheller, 2018]. However, apart from typical macroeconomic indicators, social development measures and their correlation to PPP development remain insufficiently explored. The PPP context emerges in social welfare studies, most often in creating sustainable development and cooperating with non-governmental organizations [Colverson and Perera, 2012].

But PPPs have their own problems. Critics point to how PPPs in practice drive inequalities, inefficiencies, and social stratification [see, for example, Loxley, 2013; Obeng-Odoom, 2013a,b, 2014, 2020]. These criticisms are sometimes accepted even by the advocates of PPPs [e.g., Micklethwait and Wooldridge, 2014; Banda and Jeke, 2022; *The Economist*, 2022]. Social inclusion is a multifaceted phenomenon, including the scale of poverty that is as limited as possible and measures for widespread social integration of people at risk of poverty and social exclusion for various reasons, such as unemployment, disability, and inaccessibility of public services. Thus, the processes of social inclusion should also be taken into account when assessing PPPs.

One of the challenges for public stakeholders is the holistic evaluation of PPP projects considering economic and social benefits. The choice of the “in-house” project performance approach or one using PPP in different forms, for example, service concession or collaborating as a special purpose vehicle, is normally made based on typical PPP project assessment methods. These often include “value for money” and/or cost-benefit analysis [Kwak et al., 2009]. They mostly rely on direct assessment of the impacts of an investment project, and mainly its financial return [Yescombe, 2007; Burger and Hawkesworth, 2011; Engel et al., 2013]. They center on growth. More critical work focuses on inequality. A broader assessment might incorporate growth and change, highlighting who gets/loses what, how, when, and where. The HDI is one way of achieving this outcome. Often prominently discussed in the assessment of the very meaning of development and change, the HDI, a composite measure of health (measured as life expectancy at birth), education (measured as the literacy rate), and standard of living (measured as economic growth), has been widely discussed, along with variants like the inequality-adjusted HDI [e.g., see a review by Obeng-Odoom, 2013b, p. 156, 160]. The UNDP certainly introduced the HDI as a much broader measure of progress [UNDP,

1990]. Yet, to date, we have seen little or no use of the HDI as a barometer of PPP performance, so this will be our contribution to the literature. Doing so is important to develop what the UNDP [1990, p. 1] called “a more genuine measure of socioeconomic progress.”

3 Methodology

To compare the low- and middle-income countries where PPP occurred with other countries with limited PPPs, we divide them into two groups: countries in which PPP investments were implemented and other countries where no such projects existed. The first group is the experimental test group, and the other is the control group. PSM matches the control group with the experimental group so that they consist of countries with a similar value to the so-called disturbance variables (inputs). We selected the disturbance variables out of the following indicators: the value of PPP investments, the number of PPP projects, the Gini Index, GDP per capita, WGI, and the share of the private sector in GDP. All data set are available on Data World Bank Org www.data.worldbank.org (free access entered from June 2022). In our study, we employ PSM to assess the impact of PPPs on the HDI across low- and middle-income countries, distinguishing between those with and without PPP initiatives. By matching countries based on disturbance variables such as PPP investment values, Gini Index, and GDP per capita – sourced from World Bank Data (World Bank, 2016) – we mitigate bias from nonrandom covariate distribution, enhancing the comparison’s validity. Our analytical strategy, leveraging a mixed-effects logistic regression model, systematically controls for these covariates, approximating randomized study conditions and offering a robust evaluation of PPPs’ effects on social development.

4 Data section

We conducted descriptive statistics on the selected variables used in this analysis. Here, each observation corresponds to one country. The two regions of the world dominated: Latin America and the Caribbean ($N = 22$, 39.3%) and Sub-Saharan Africa ($N = 24$, 44.6%). The number of PPP projects in a country (projects reaching final closure) was in the range between 1 and 123, with a mean equal to 8.77 and a standard deviation equal to 19.06. The mean level of total investments (in USD million) was equal to 1,290.77 with standard deviation equal to 3,851.43.

Further, we present the percentage share of the countries of consecutive regions in the study and control groups, respectively. According to Fisher’s exact test, there was statistically significant dependence between region and group ($p < 0.001$). Table 1 contains results for a comparison between region and type of group. A low p -value shows that there is a significant dependence between a region and a country belongs to.

We present descriptive statistics for selected variables in the study and control groups, respectively cross-sectionally in all countries and years. According to Mann–Whitney U test, there were for all variables statistically significant dependence between the study group and control group ($p < 0.001$); however, we note that sample sizes were quite large here (Table 2).

Table 1. Dependence between the existence of PPP projects and a region

Variable	Parameter	Study group (N = 28)	Control group (N = 28)	test	p-value
Localization	Europe and Central Asia	14.3% (N = 4)	0% (N = 0)	Fisher	<0.001
	Latin America and Caribbean	57.1% (N = 16)	21.4% (N = 6)		
	Middle East and North Africa	14.3% (N = 4)	0% (N = 0)		
	North America	3.6% (N = 1)	0% (N = 0)		
	Subsaharian Africa	10.7% (N = 3)	78.6% (N = 22)		

Source: Own computation.

PPPs, public-private partnerships.

Table 2. Dependence between HDI value along with other parameters and study groups

Variable	Parameter	Control group (N = 642)	Study group (N = 840)	test	p-value
HDI	N	309	675	Mann–Whitney <i>U</i>	<0.001
	Mean (SD)	0.73 (0.11)	0.51 (0.11)		
	Median (IQR)	0.76 (0.71–0.8)	0.51 (0.43–0.59)		
	Range	0.4–0.85	0.19–0.74		
GDP per capita	N	614	840	Mann–Whitney <i>U</i>	<0.001
	Mean (SD)	21,565.22 (22,320.62)	1,568.93 (1,612.61)		
	Median (IQR)	15,489.6 (6,921.05–27,530.41)	908.09 (463.77–2,034.86)		
	Range	209–117,098.45	121.26–8,810.93		
Gini index	N	42	185	Mann–Whitney <i>U</i>	<0.001
	Mean (SD)	51.68 (4.82)	49.98 (7.05)		
	Median (IQR)	51.75 (49.35–55.65)	49.8 (44.2–55.4)		
	Range	40.3–58.2	35.3–65.8		
Political stability	N	430	616	Mann–Whitney <i>U</i>	<0.001
	Mean (SD)	0.38 (0.84)	–0.25 (0.67)		
	Median (IQR)	0.48 (0.03–0.97)	–0.23 (–0.65 to 0.11)		
	Range	–2.65 to 1.97	–2.7 to 1.22		

Source: Own computation.

5 Results

In Table 3, the model results indicate that GDP, Gini index, Political stability, Projects reaching financial closure, and Year all had a significant positive impact on the HDI level at a significance level of 0.05, as shown in the fixed effects section of the model summary. Moreover, there was a significant difference for Sub-Saharan Africa region with respect to the region of Europe and Central Asia as in the case of an interaction between GDP and Year. On average, for an increase of 1 for Year, the HDI level increased by 0.475 ($p < 0.001$), for an increase of 1 for the Gini index, the HDI level increased by 0.069 ($p = 0.047$), for an increase of 1 for the Political stability index, HDI level increased by 0.178 ($p < 0.001$), for an increase of 1 for Projects reaching financial closure, HDI level increased by 0.244 ($p = 0.046$), finally HDI level decreased by –1.154 ($p = 0.001$) in comparison to Latin America region. In addition, an interaction effect between GDP and Year decreases HDI level by –0.122 ($p = 0.002$).

Table 3. Linear mixed-effects model explaining HDI with social inequalities variables

	Estimate	2.5%	97.5%	p-value
Intercept	0.879	0.378	1.381	0.003
GDP	0.084	–0.079	0.247	0.316
Year	0.475	0.394	0.555	<0.001
Gini	0.069	0.002	0.136	0.047
Political stability	0.178	0.096	0.259	<0.001
Projects reaching financial closure	0.244	0.020	0.469	0.046
Localisation Group: Subsaharian Africa	–1.154	–1.719	–0.589	0.001
GDP: Year	–0.122	–0.195	–0.049	0.002

Source: Own computation.

Table 4. The results of two-way repeated measures ANOVA for HDI with Year and PPP Group

	Sum Sq.	Mean Sq.	F value	p-value
Error: Country name				
Year	1.42	1.42	3.698	0.0567
PPP_Group2	46.21	46.21	119.96	<0.001
Year: PPP_Group2	2.48	2.48	6.44	0.012
Error: Within				
Year	6.433	6.433	1,582.7	<0.001
Year: PPP_Group2	0.05	0.05	123.7	<0.001

Source: Own computation.

PPPs, public-private partnerships.

To answer the question of whether the countries in which PPP occurs feature a higher level of social development, a two-way ANOVA was carried out. The new groups result from PSM: the experimental and control groups were compared regarding the value of the social welfare measure – HDI. The results of the two-way ANOVA model are shown in Table 4. Using Country (Name) as a random effect, we get a statistically significant random effect of PPP Group ($p < 0.001$) as well as an interaction term Year*PPP Group ($p = 0.012$). Specifying a random effect of the individual observations itself, we get a statistically significant random effect of both Year and an interaction term as well as an interaction term Year*PPP Group ($p < 0.001$).

Finally, the selected multivariate model was used to predict the HDI indicator value for each country for the next 10 years. The model assumes an increase in the number and value of PPP projects and that the other factors included in the model (except for the year) will maintain the value recorded in the last year taken into account when designing the model- see Table 5. The prediction quality of the presented models was evaluated using cross-validation, which is a variant of the “leave-one-out cross-validation” (LOOC). We can observe that the MAE result seems to be quite good – in most cases, its value is <0.1 . Further on we present the results of predicted values of HDI for the period of next 10 years (beginning from the last year for which HDI value was known) on the basis of the model:

$$\text{HDI} \sim \text{GDP per capita} * \text{Year} + \text{Gini index} + \text{Political stability} + \text{Projects reaching final closure} + \text{Localization group} + (1 + \text{Year} | \text{Country}).$$

6 Discussion and Conclusion

PPPs have become a commonly utilized way of restructuring the state for human development. Yet, research on PPPs is mainly about their ramifications for growth or inequality. Much less work has been done on the place of PPPs in driving human development. Yet, such a holistic approach is needed. Using the HDI as a proxy for human development, we have addressed whether there is any relationship between the value of PPP projects and the human development level and whether the increasing value of PPP projects will increase the human development level in the future.

Our research indicates that the value and number of PPP projects implemented worldwide are significantly increasing. The value of ongoing PPP projects is also increasing significantly. This may result from the increasingly shrinking sources of local government financing for necessary investments. At the same time, we indicated that developed PPP investments so far would give a clearly defined and reliable indicator of the impact of PPP implementation in the macroeconomic approach [Rob et al., 2016; Novat et al., 2018], apart from the study by Rouhani et al. [2016], where the authors propose a solution to this problem. Therefore, our research addresses the identified research gap. The results obtained are satisfactory. They indicate that for the growing number and value of PPP projects and the increasing social welfare of the 56 countries surveyed, there is a statistically significant relationship between the occurrence of PPP projects and their scale and the level of HDI (considered by us as an indicator of social well-being).

Table 5. Predicted values of HDI for next 10 years

Country name	Year	probs_1_year	probs_2_year	probs_3_year	probs_4_year	probs_5_year	probs_6_year	probs_7_year	probs_8_year	probs_9_year	probs_10_year
El Salvador	2019	0.69	0.695	0.7	0.704	0.709	0.714	0.718	0.723	0.728	0.732
Honduras	2019	0.654	0.66	0.667	0.673	0.679	0.685	0.691	0.698	0.704	0.71
Zimbabwe	2019	0.574	0.581	0.589	0.596	0.604	0.611	0.619	0.626	0.633	0.641
Lesotho	2017	0.535	0.543	0.551	0.558	0.566	0.574	0.581	0.589	0.596	0.604
Uganda	2016	0.544	0.552	0.56	0.568	0.576	0.583	0.591	0.599	0.607	0.615
Malawi	2016	0.473	0.481	0.49	0.498	0.506	0.515	0.523	0.531	0.54	0.548
Rwanda	2016	0.529	0.537	0.545	0.553	0.561	0.569	0.577	0.585	0.593	0.601
Zambia	2015	0.559	0.566	0.574	0.581	0.589	0.596	0.603	0.611	0.618	0.626
Benin	2015	0.531	0.538	0.546	0.554	0.561	0.569	0.577	0.584	0.592	0.6
Botswana	2015	0.664	0.667	0.669	0.672	0.675	0.677	0.68	0.682	0.685	0.688
Cabo Verde	2015	0.654	0.66	0.666	0.671	0.677	0.683	0.689	0.695	0.701	0.707
Kenya	2015	0.58	0.587	0.594	0.602	0.609	0.616	0.624	0.631	0.638	0.646
Namibia	2015	0.611	0.615	0.619	0.623	0.627	0.631	0.635	0.639	0.643	0.647
Togo	2015	0.515	0.523	0.531	0.539	0.547	0.555	0.563	0.571	0.58	0.588
Guatemala	2014	0.636	0.641	0.646	0.651	0.656	0.661	0.666	0.671	0.676	0.681
Mozambique	2014	0.418	0.426	0.434	0.442	0.45	0.458	0.466	0.474	0.482	0.49
Nicaragua	2014	0.666	0.673	0.679	0.686	0.693	0.7	0.707	0.714	0.72	0.727
South Africa	2014	0.676	0.678	0.68	0.682	0.684	0.686	0.688	0.69	0.692	0.694
Burkina Faso	2014	0.392	0.4	0.408	0.416	0.424	0.431	0.439	0.447	0.455	0.463
Comoros	2014	0.545	0.553	0.56	0.567	0.574	0.582	0.589	0.596	0.603	0.611
Madagascar	2012	0.533	0.541	0.549	0.558	0.566	0.574	0.582	0.591	0.599	0.607
Senegal	2011	0.48	0.488	0.495	0.502	0.51	0.517	0.525	0.532	0.539	0.547
Guinea-Bissau	2010	0.446	0.455	0.463	0.471	0.479	0.487	0.495	0.503	0.512	0.52
Central African Republic	2008	0.366	0.374	0.382	0.39	0.398	0.407	0.415	0.423	0.431	0.439
Belize	1998	0.635	0.641	0.646	0.652	0.658	0.664	0.67	0.676	0.681	0.687

Source: Own computation.

Table 6. Linear mixed-effects model explaining HDI with year and total investment

	Estimate	2.5%	97.5%	p-value
Intercept	−0.018	−0.355	0.325	0.933
Total investment	0.381	0.034	0.730	0.043
Year	0.417	0.398	0.437	<0.001

As the main finding, we proved that the total value of PPP projects, described by the total investment variable, was a statistically significant predictor for HDI variable (see Table 6). For each additional year, HDI level increased by 0.417 ($p < 0.001$) while total investment increased HDI by 0.381. There was also a significant connection between social inequalities variables and HDI. This implies that it is desirable for PPPs to be designed in such a way that they are inclusive. In specific studies, urban PPPs have sometimes been exclusionary, partly because the private sector is largely focused on serving the wealthiest in society, partly because the public sector is incapable of regulating the private sector, and partly because policies that do not take inequalities seriously cannot, by definition, systematically address such inequalities [Obeng-Odoom, 2013a,b, 2020]. Nevertheless, our results suggest that PPPs could be redesigned to also address inequalities, for example, by communing urban land, freeing urban workers from crippling taxation, and leaving capital to be the focus of competition [Obeng-Odoom, 2021]. That approach of applying different solutions to diverse urban resources is rather distinct from the approach of liberalism in which every urban resource, including land, must be subject to private control [see, for example, Micklethwait and Wooldridge, 2014, pp. 234–236]. Finally, by obtaining those results, we verified whether the increasing value of PPP projects can increase the future human development level (HDI)? The model investigates how HDI changes as a function of the Year and PPP Group. Significant differences between groups mean that HDI changes significantly compared to the Year and PPP Group. The relationship between HDI level and time-lapse is moderated by the type of PPP Group. Moreover, we can inspect the predicted values of HDI levels in the next 10 years (Table 7) to conclude that the increasing value of PPP projects consequently increases HDI value year by year.

Our studies have identified certain limitations that we aim to address in future research. Specifically, we encountered challenges with the sample period of available data for low – and middle-income countries and fragmented data sets. Moving forward, we plan to expand our research to include long-term factors that could impact the HDI, such as new business density, control of corruption, and government effectiveness.

According to the previous literature and methods, we implemented the PSM method, which helped us avoid comparing or confusing “apples for pears.” We analyzed potential dependencies in groups of countries that are very similar. Thus, our results highlight the problem of the possibility of a reliable assessment of the impact of private investors on the level of social welfare. This is a significant problem and is the subject of research by many authors, including Maduro et al. [2018], that developing a universal instrument to assess the social impact of PPP is necessary. Such a valiant attempt was made by Kociemska [2021], who proposes a permanent write-off of profit before tax methodologies adjusted to the needs of local communities. Such a cumulative write-off may cover the needs of, for example, the excluded. It is an effective measure and a quick way of assessing the additional welfare impact of PPPs. However, to our knowledge, it has not been implemented yet in practice. We are curious whether such an instrument is in the interest of the private entity/investor to adopt or *adapt*. Based on the results of our research, the scale of outsourcing public tasks to private entities is growing, not only in terms of number but also regarding the increase in social welfare, and human development. Thus, this evidence should inspire policy implications and private entrepreneurs to seek impact beyond profit, growth, and inclusion to broader social welfare and human development concerns. Suppose the research gap indicated by us, that is, on the one hand, chasing the profit of private entrepreneurs and, on the other hand, the necessity to provide public services, were linked systemically, each time with some instrument of real impact, in that case, such an impact of PPP on the HDI level could be achieved.

7 Geolocation information

Low- and middle-income countries: Belize, Bolivia, EL Salvador, Guatemala, Honduras, Nicaragua, Benin, Botswana, Burkina Faso, Cabo Verde, Central African Republic, Comoros, Eswatini, Gambia, Guinea-Bissau, Kenya, Lesotho, Madagascar, Malawi, Mozambique, Namibia, Rwanda, Senegal, South Africa, Togo, Uganda, Zambia, Zimbabwe, Aruba, Antigua, Bahamas, Barbados, British Virgin Islands, Cayman Islands, Chile, Curacao, Panama, Puerto Rico, Sint Maarten (Dutch part), St. Martin (French part), Suriname, Trinidad and Tobago, Turks and Caicos Islands, Virgin Islands, Bermuda, Equatorial Guinea, Eritrea, South Sudan, Bahrain, Libya, Oman, Qatar, Channel Islands, Gibraltar, Greenland, Turkmenistan.

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Conflicts of interest statement

The authors have stated that they do not have any competing interests to announce.

Data availability statement

Accessed free: The World Bank 2016 and on. “Private Participation in Infrastructure (PPI) Database.” <https://ppi.worldbank.org/en/ppi#>; and <https://databank.worldbank.org/source/africa-development-indicators/Series/UNDP.HDI.XD>.

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