6 The Feasibility of the Sustainable Development Goals

6.1 ON QUANTIFYING THE FEASIBILITY OF THE SDGS

In recent years numerous scholars and analysts have written about the difficulties of fulfilling the United Nations' 2030 Agenda in time. Some of these studies analyse specific SDGs and explore indicators forecasts across different micro-policy interventions (e.g., González-Pier et al., 2016; Boeren, 2019; Porciello et al., 2020; Mensi and Udenigwe, 2021; Sobczak et al., 2021). Other studies focus on identifying synergies and trade-offs between different SDGs (indicators or targets) (e.g., Fuso Nerini et al., 2019; Lusseau and Mancini, 2019; McGowan et al., 2019; Pedercini et al., 2019; Asadikia et al., 2021). This latter approach provides a more holistic evaluation of policy measures attempting to improve the performance of specific SDGs. A third variant of studies explores if the nature of the relationships between SDGs has changed over time and how likely it is that trade-offs can successfully transform into synergies in the coming years (e.g., Machingura and Lally, 2017; Fader et al., 2018; Kroll et al., 2019; Amos and Lydgate, 2020; Philippidis et al., 2020). Finally, a fourth set of studies uses expert advice or indicator trends to decipher the extent to which the SDGs might achieve the goals set for 2030 (e.g., Ionescu et al., 2020; Luken et al., 2020; Moyer and Hedden, 2020; Benedek et al., 2021; Pradhan et al., 2021).

Two major points stand out from analysing the previous literature: (1) that a systemic perspective – emphasising interactions among SDGs – is critical for policy evaluation and (2) that a comprehensive understanding of how budgetary allocations impact SDG performance is almost absent. This chapter focuses on the latter point and tries to fill this knowledge gap by applying our modelling framework to study policy prioritisation in the context of the SDGs. Akenroye et al.

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(2018) mention the importance of addressing the problem of how to prioritise policies and leverage the existing budget resources for meeting these goals. A quantitative framework is necessary to analyse pressing questions related to the effectiveness of public spending on existing government programmes, for example: Do changes in the size and distribution of the budget (on existing programmes) help to close development gaps effectively? What are the most and least sensitive SDGs to such budgetary rearrangements? Can the commitments to the 2030 Agenda be met with enough government spending? To what extent do structural factors hinder the effectiveness of existing programmes? From the perspective of governments, understanding how their expenditure actions translate, at a systemic level, into effective policies is critical to guaranteeing the success of any international development agenda.

In this chapter, we study the feasibility of the SDGs to improve our understanding of the empirical link between government expenditure and the performance of SDGs. We device counterfactual simulations to consider non-observed budgetary values. Thus, the reader should know that our results are not empirical assessments based on historical evidence (i.e., they are not derived from observed interventions and outcomes) but theoretical estimates (based on constructed counterfactuals) grounded on the countries' empirical underpinnings. This computational approach helps produce prospective evaluations when policymaking involves the usage of interventions that have not been applied before in the context of a specific country.

First, we explain the strategy to produce prospective (counterfactual or otherwise) analyses with the computational model and two metrics to evaluate advances in development gaps. These metrics quantify the expected distance between an indicator's level in a specific year and its goals set for 2030 and also the expected progress made during the period covered by the prospective analysis. Second, we present simulation results showing the development gaps by 2030 when the historical budget, in real terms, is preserved during the remaining years of the current decade. Third, we conduct sensitivity

analyses that involve changes in the overall budget size, in absolute and relative terms, that modify the value observed at the historical period used for calibration. Fourth, the chapter ends with some reflections on the results.

6.2 SIMULATION STRATEGY

With the model calibrated using the data from a given country (as explained in Chapter 5), the most straightforward exercise is to simulate the dynamics of the indicators forward in time; we call these the *baseline simulations*. More specifically, for a given parameterisation, we perform a set of Monte Carlo simulations,[1] starting with the conditions set by the indicators in 2020 and stopping in 2040. Notice that in the base case scenario, we extrapolate the public funding of the recent historical data in real terms. Then, using the artificial data generated by these simulations (for all countries), we provide a worldwide picture of which countries' SDGs will achieve their goals in the next 10 and 20 years. In a second exercise, we produce prospective simulations of a counterfactual nature by inducing budgetary increments or decrements. These estimations allow studying whether more or fewer goals are feasible (i.e., reachable by 2030 or before). Overall, these two types of simulations provide a rich picture of the potential evolution of the SDGs: (1) the countries' goals that can be achieved within a decade while keeping the same budget; (2) the sensitivity of the indicators' performance to changes in the budget sizes of governments around the world.

To assess the feasibility of the SDGs, we focus on two intuitive statistics measuring development gaps: (1) the expected gaps and (2) the gap closure. An expected gap consists of the distance between development goals and the levels predicted for the indicators at period T. We say that a gap is closed if a prediction surpasses its goal. Formally, the expected gap of indicator i is

[1] For the rest of the book, unless indicated otherwise, the number of Monte Carlo simulations is always 10,000.

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$$\text{gap}_i = \begin{cases} \frac{G_i - \bar{I}_{i,T}}{G_i} & \text{if} \quad G_i > \bar{I}_{i,T} \\ 0 & \text{otherwise} \end{cases}, \tag{6.1}$$

where $G_1, \ldots, G_N$ are the development goals obtained from the SDR, and $\bar{I}_{i,T}$ is the expected value of indicator i – across M independent Monte Carlo simulations – after T simulation periods. We express the gaps as a proportion of their goals and usually present them in percentage terms. Thus, we can read an SDG gap in the following way: "*by period T, indicator i will still need to close* x% *of its goal*". Note that, in the SDR dataset, the goals for a given indicator are the same across countries, which makes the expected gaps comparable. However, from our experience, governments don't necessarily follow these international agreements but have their particular objectives. In Chapter 10, we use more realistic development goals for a specific country. Here, we adhere to the SDR goals because no other datasets exist with indicator-level goals for so many countries.

A gap closure measures what fraction of the initial gap is covered after T periods. Let $I_{i,0}$ denote the initial level of indicator i in a prospective simulation. Then, the initial gap is given by $G_i - I_{i,0}$, while the expected gap is $G_i - I_{i,T}$. Thus, the gap closure is

$$\text{gc}_i = \begin{cases} \left(1 - \frac{G_i - \bar{I}_{i,T}}{G_i - I_{i,0}}\right) & \text{if} \quad G_i > \bar{I}_{i,T} \quad \text{and} \quad G_i > I_{i,0} \\ 1 & \text{otherwise.} \end{cases}, \tag{6.2}$$

In contrast to the expected gaps, the closure takes the initial conditions of a country into account. Thus, gap closures provide additional analytical insights, given that countries face different challenges due to their relative position in the development spectrum. Because of decreasing marginal returns in the improvement of indicators, it is possible that the same increase in the budget, in relative terms, could have a lesser impact on the SDGs in more advanced economies. Consequently, the development gaps at the start of the simulations tend to be extremely hard to close when they are already relatively small (something common in the real world). It is also possible that emerging economies fall into a middle-income trap when

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substantial advances for some indicators (e.g., those associated with public governance or environmental issues) become very difficult to produce, even if enough resources were available. Next, let us present and discuss our main findings.

6.3 EXPECTED GAPS

First, let us show the results concerning the expected gaps that, from our perspective, would remain open by 2030. It is already well known that the 2030 Agenda is too ambitious, as the historical experience around the world has shown that only a handful of countries have made significant improvements across the different dimensions of development. Furthermore, with the Covid-19 pandemic, even the most promising scenarios regarding the feasibility of reaching the development goals by 2030 had to be reconsidered. Nevertheless, it is still important to quantify how far the indicators might be, around the world, from the goals set for 2030 across countries, starting with the conditions prevailing in 2020. Here, we present an informative visualisation of the gap sizes expected in 2030 based on the baseline simulations of our prospective analysis.

The reader should recall that we perform these simulations for each country individually, so we do not need to pool cross-country data to produce our estimates. Yet presenting every indicator from every country poses an insurmountable challenge of communication and visualisation. Hence, we opt for showing aggregate results in the text across the six country groups (presented in Figure 3.3) and providing the individual estimates in the book's data repository. Therefore, for each country in a given group, we calculate the expected gap of each indicator according to Equation 6.1. Then, for each indicator, we compute the mean gap across all the countries in the selected group. The number of countries included in the averages may vary across groups and indicators. While, in Guerrero and Castañeda (2021a), we report measures of this variability, here we wish to focus on the expected gaps and provide a general view of the world in 2030 across regions and indicators.

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Figure 6.1 presents the expected gaps in 2030. Leaving aside the fact that Africa and MENA have fewer indicators available, the expected development gaps in 2030, on average, vary considerably across country groups. The countries in the West, as a whole, exhibit the smallest gaps (an 8.3% average gap), while the countries in Africa present the bleakest scenario (a 41.5% average gap). In terms of development indicators, there is also a wide dispersion in their performance, either within or across groups. For example, all indicators

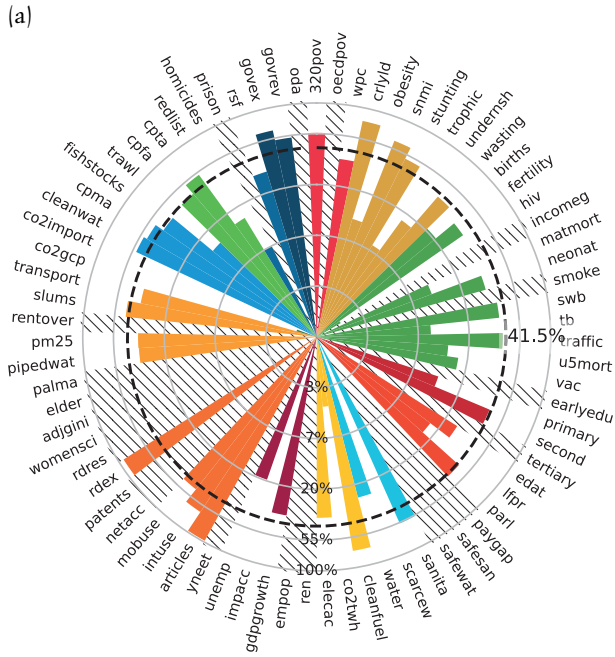

FIGURE 6.1 Expected gaps in 2030. (a) Africa, (b) Eastern Europe and Central Asia, (c) East and South Asia, (d) LAC, (e) MENA, and (f) West.
Notes: Each bar indicates the expected gap in a specific indicator in 2030, averaged across the countries in the same group. The striped areas indicate that such an indicator was not available for any country in the group. The dashed ring denotes the average expected gap, and we set its value on the right. The concentric circles and the bars are presented in logarithmic scale, so differences are larger in the outer circles. All metrics are presented in percentages.
Sources: Authors' calculations with data from the 2021 Sustainable Development Report.

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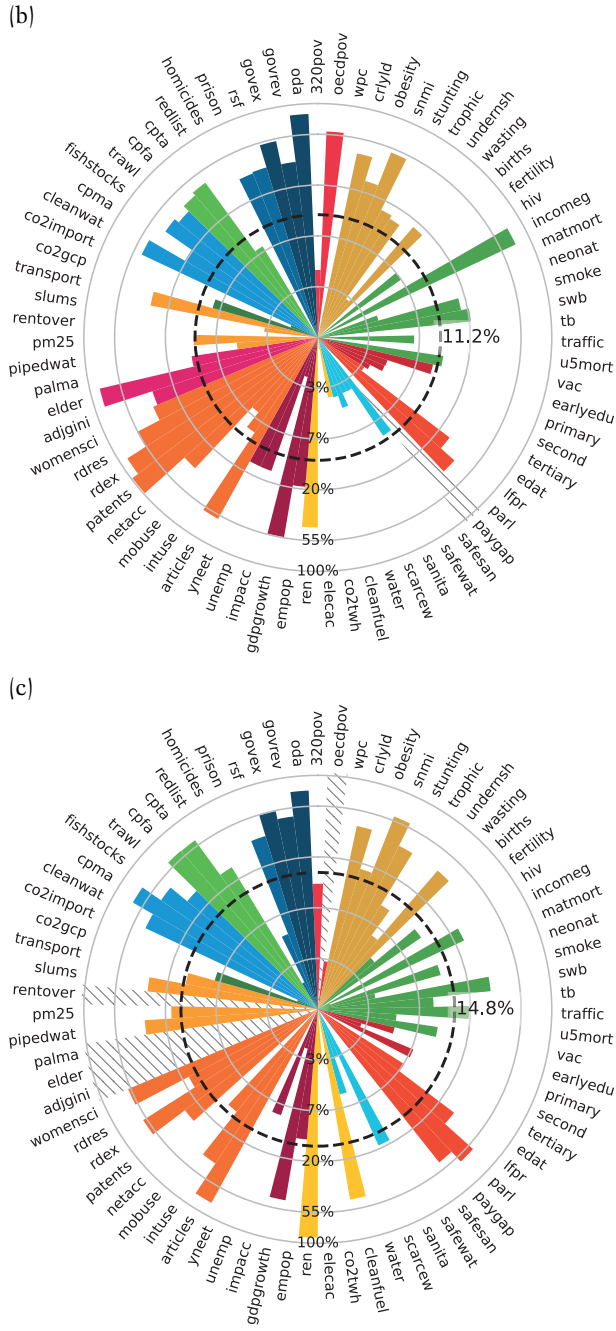

FIGURE 6.1 *(cont)*

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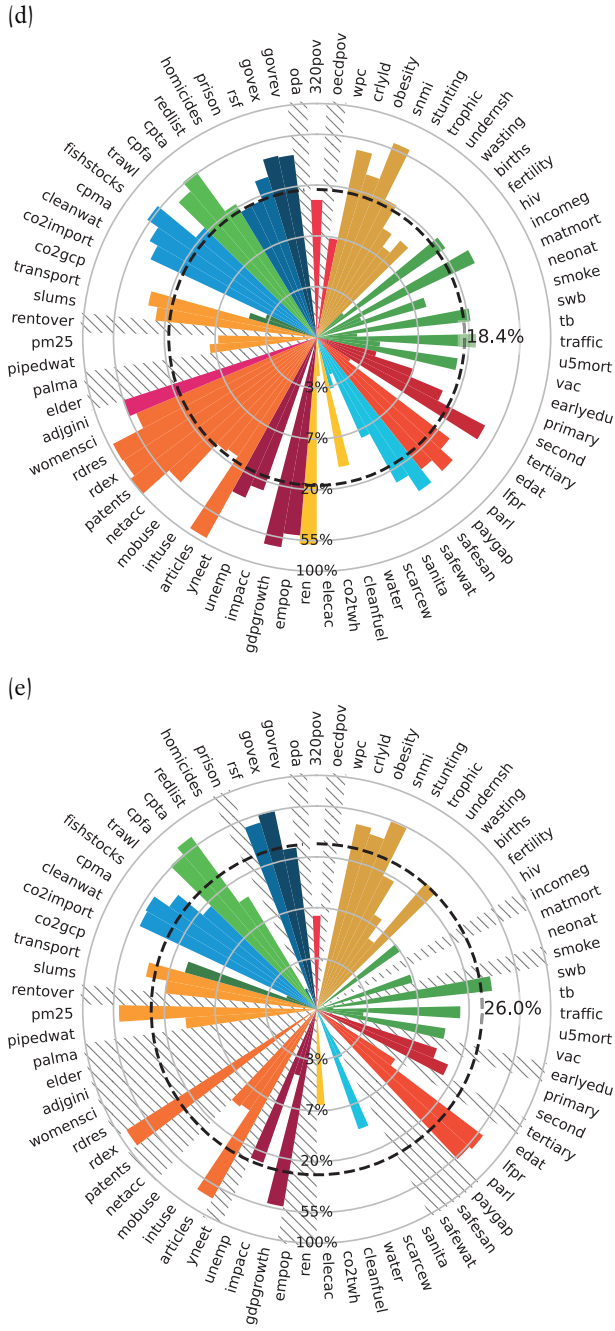

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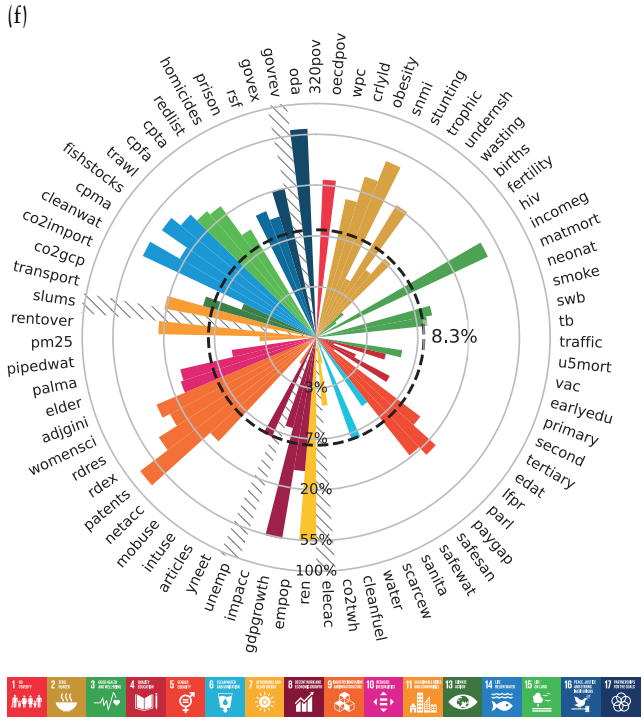

FIGURE 6.1 *(cont)*

belonging to SDG 4 in East and South Asia have expected gaps below the group average, whereas the indicators associated with SDG 15 present gaps above average. For the same indicators, the expected gaps of indicators in SDG 1 for East and South Asia are relatively small compared with for Africa.

When looking at specific SDGs, it stands out that most indicators of SDG 9 have a relatively bad performance worldwide, as their expected gaps are above the groups' averages. A similar pattern is prevalent in SDGs 14 and 15, related to environmental issues. On the contrary, the performance of indicators in SDGs 4 and 6 is relatively good, in general, across groups. The indicators of 'affordable and clean energy', identified in SDG 7, have very large expected gaps worldwide, except for countries grouped in MENA. Although most indicators

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related to health issues (SDG 3) present below-average gaps in all groups, their relative performance is not homogeneous within groups, inclusively, for countries in Eastern Europe and Central Asia, East and South Asia, and the West. For some indicators associated with poverty and hunger (SDGs 1 and 2), the expected gaps in 2030 are higher than 55% in Africa, Eastern Europe and Central Asia, East and South Asia, and LAC, suggesting that these problems are prevalent around the world. Altogether, these results show that, even without considering the additional downfall in the indicators caused by Covid-19 in 2021 and 2022, the United Nations 2030 Agenda seems to be unreachable with the current budgetary resources, government programmes, and public governance, especially in the least developed regions of the world.

6.3.1 Gap Closures

The analysis of development gaps, in general, provides an appealing picture of the potential state of the world by 2030, and it sheds new light on the progress expected with the current budget to achieve the established goals. Here, we employ the metric of gap closure to build another global perspective on sustainable development achievements. Through this metric, we can compare how different the world would look in 2030 with respect to the situation that prevailed in 2020 for each country. In other words, if we recall Equation 6.2, the gap closure tells us what percentage of the initial development gap will be closed by 2030, according to PPI (i.e., higher is better). In contrast to expected gaps, where lower is better, closures can help us quantify regional differences in terms of a dynamic portrait of specific groups' development potential in the remainder of this decade. In a similar fashion to the analysis of expected gaps, here we visualise the average gap closures of each indicator in terms of country groups.

Figure 6.2 presents these results. According to our simulations in most indicators and groups, we expect to observe relatively poor improvements in the next decade since gap closures are relatively small. Again there is a striking difference between countries grouped

in the West with those from Africa. Notice that, for countries in the West group, indicators of SDGs 3 and 4 exhibit a small expected gap for 2030 (Figure 6.1). This achievement is a consequence of the significant progress expected to be made in health and education-related issues, respectively, by the end of the decade, as indicated by the corresponding gap closures. However, in the same group of countries, a scenario characterised by small development gaps and

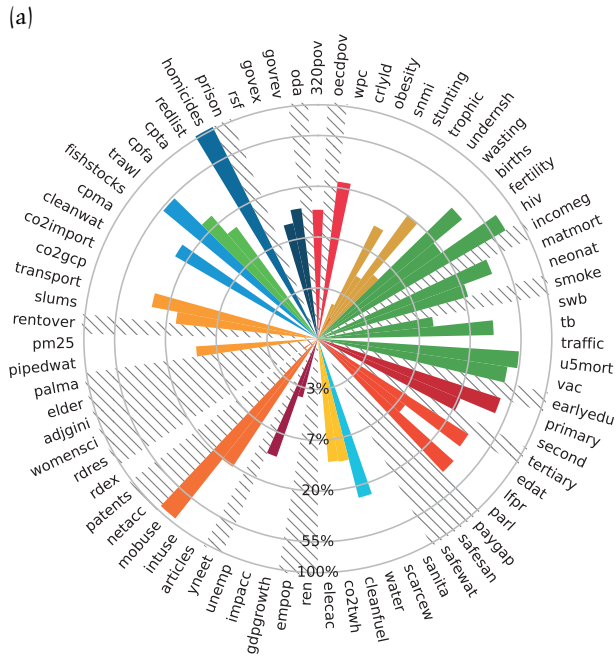

FIGURE 6.2 Gap closures. (a) Africa, (b) Eastern Europe and Central Asia, (c) East and South Asia, (d) LAC, (e) MENA, and (f) West.
Notes: Each bar indicates the expected gap closure in a specific indicator, averaged across the countries in the same group. The striped areas show that an indicator was not available for any country in the group. Since gaps can widen (in the case of negative indicator trends), an expected gap closure could also be negative. For clarity, this plot only shows those average gap closures that are positive while representing negative values as zeros. The concentric circles and the bars are presented in logarithmic scale, so differences are larger in the outer circles.
Sources: Authors' calculations with data from the 2021 Sustainable Development Report.

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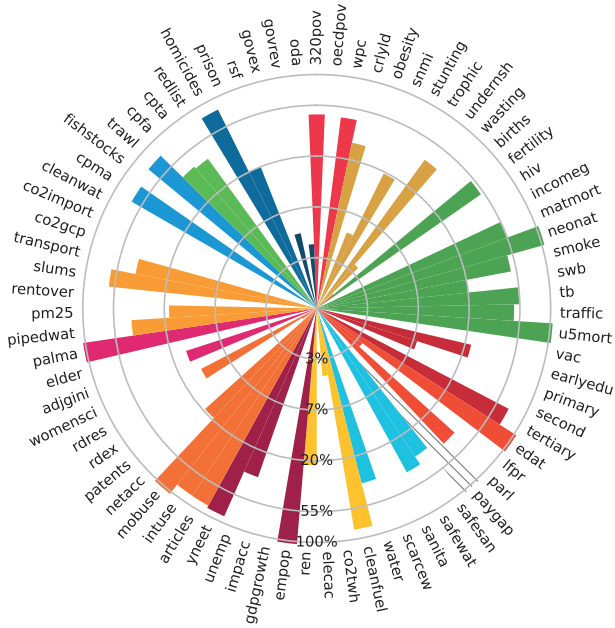
(b)



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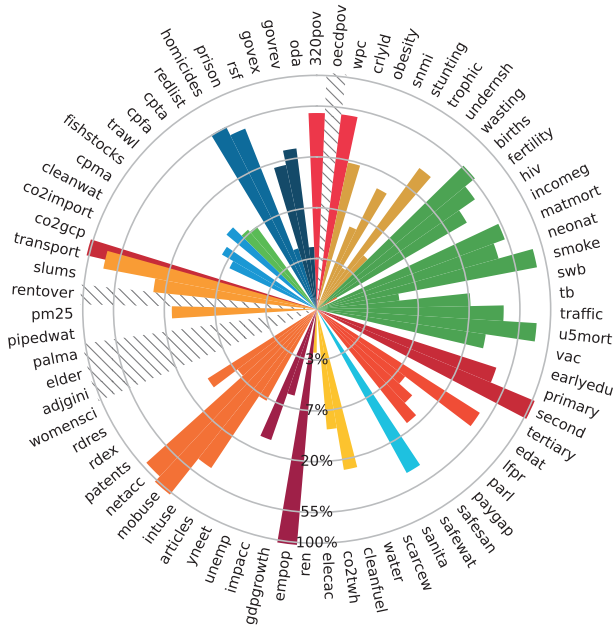

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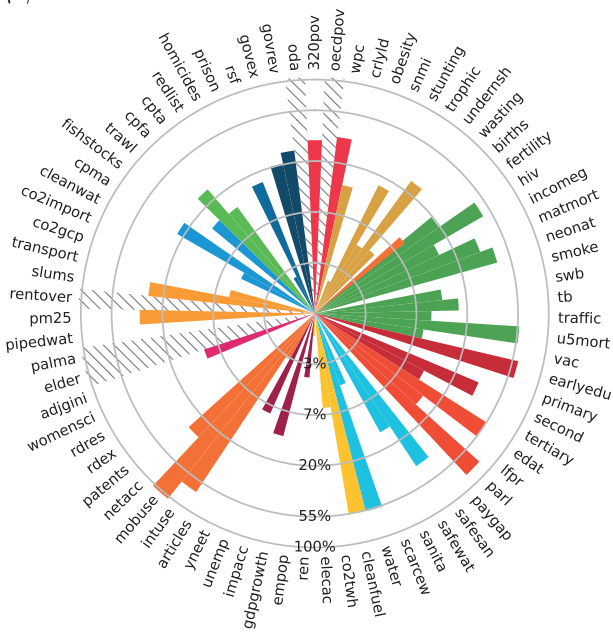

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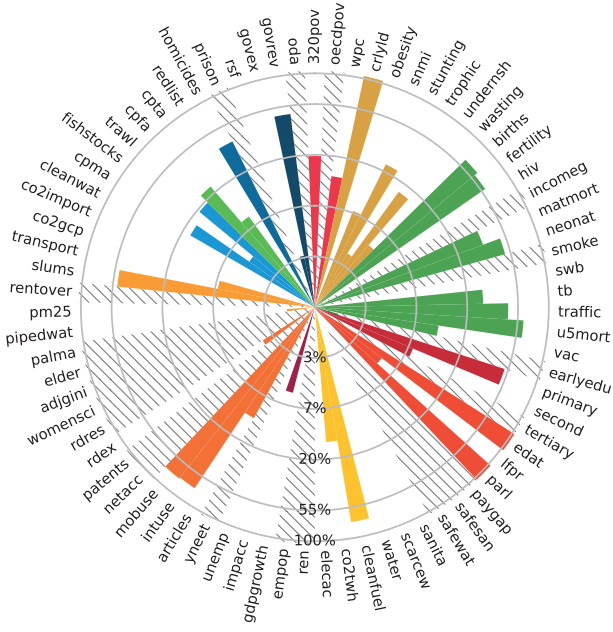

FIGURE 6.2 *(cont)*

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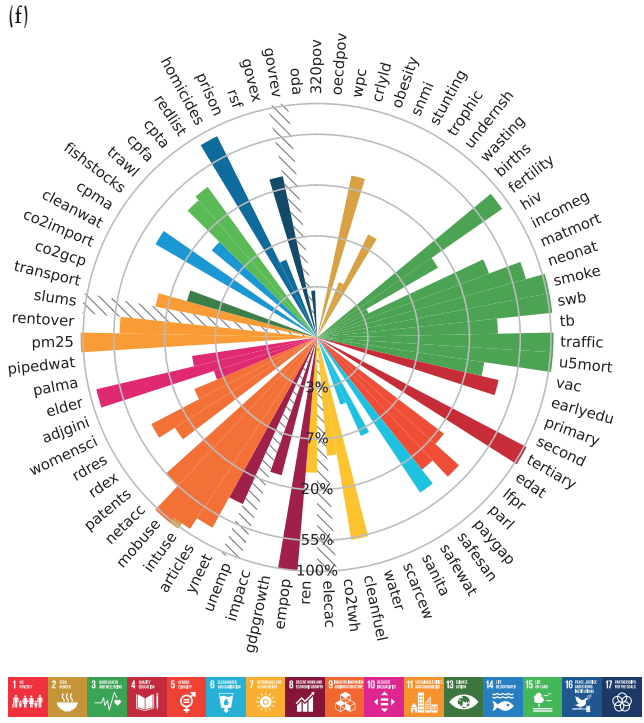

FIGURE 6.2 *(cont)*

relatively poor closures is expected for indicators of SDGs 1, 2, 6 and 13. This last result suggests that, for a set of development indicators, a decreasing marginal returns effect ensues when governments attempt to boost development only through budgetary resources.

In a large set of indicators across several SDGs, we expect substantive average progress in two other regional groups: Eastern Europe and Central Asia and East and South Asia. The dynamics of countries in LAC and MENA are, on average, relatively better than in Africa, yet it lags behind the remaining groups. For example, these two groups of countries show slow progress in terms of economic indicators (related to SDG 8). However, even between these two groups, there are remarkable differences in the expected performance of some indicators. In LAC, for example, there would be notorious advances in SDG 6 but not for MENA. Overall, we can expect a sharp

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divergence in development between the Global North and South in the coming decade. Possibly, such divergence reflects the dampened progress of the developing world, so it is essential to understand how governments could affect these dynamics through their available policy instruments and the resources fuelling them.

6.4 SENSITIVITY TO THE BUDGET SIZE

We have explained how PPI makes the expenditure–development relationship explicit and how we specify a series of vertical and horizontal mechanisms to formalise this connection through agent computing. Next, we would like to exploit this explicit link to study the response of indicators to changes in the overall budget size of a government. The funding of policies is an essential problem for both development scholars and policymakers, and the solution may yield valuable insights into the driving forces behind the evolution of the SDGs. Understanding the government-related drivers of the SDGs is as important as acknowledging their multidimensionality and complexity. Without an educated insight into how governments can accelerate or slow down performance across all these indicators, international agendas such as this one may become overambitious and poorly actionable. Thus, in this section, we investigate the role of one such government mechanism: public spending.

In practical terms, we aim to assess the sensitivity of the indicators to changes in the total size of the government's budget. We conduct this investigation through two types of simulated interventions (or counterfactuals). In the first, we increase the per capita annual expenditure of every country by $100 USD. In the second, we vary the budget size of each country in relative terms; that is, between −50% to +50% of their current government expenditures. Let us initially focus on the first type of simulated intervention, where, by increasing all the budgets by the same amount, we infer differentiated impacts across countries, irrespective of the observed variability in public expenditure. Figure 6.3 shows several charts with the results of this counterfactual analysis. In Figure 6.3a, we estimate

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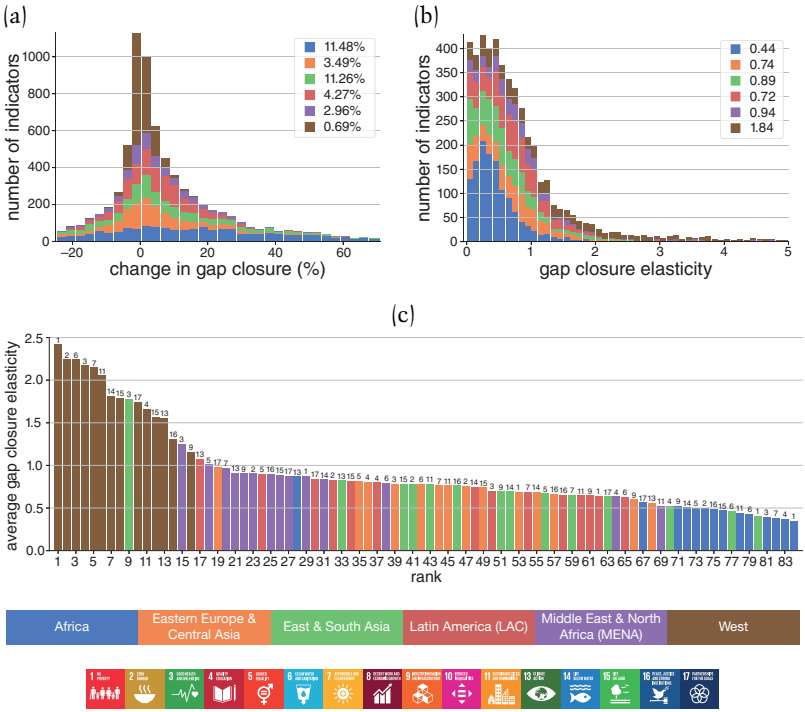

FIGURE 6.3 Potential impacts of increasing government annual expenditure in $100 USD per capita. (a) Distribution of changes in gap closures, (b) distribution of positive gap closure elasticities, and (c) ranking of SDGs at the regional level by their average positive gap closure elasticity.

Notes: Figures 6.3a and 6.3b omit outliers. The inset legends show the average calculation for the variable on the horizontal axis. The numbers on top of each bar in Figure 6.3c correspond to the SDGs.

Sources: Authors' calculations with data from the 2021 Sustainable Development Report.

potential impacts as the percentage change in the gap closure of each indicator in each country. In other words, we measure how much the gap closure can improve for a given indicator and country if its government were to increase the annual budget size by $100 USD. The histogram shows the frequency of the simulations producing a change of a specific magnitude. Notice that we colour these counts by country group.

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The first thing to highlight is that there are positive and negative changes in the gap closure, which indicates that more budget can speed up progress or slow it down. At first sight, the latter result seems paradoxical, yet slower advances are likely to happen due to spillovers with negative side effects. Overall, the number of cases presenting positive impacts is much larger. Therefore, the average change is positive for all country groups, being the smallest in countries in the West, MENA, and LAC groups. As expected, countries in the West tend to show a small sensitivity in gap closures since the absolute increase in their budget is minuscule relative to their current expenditure size. In contrast, the same budget enlargement for African countries produces a wide disparity of outcomes. In summary, progress is more speedy for some countries and indicators, while others become sluggish even though many require a swifter response across the board.

To rephrase these changes in terms of returns over expenditure, we compute the elasticity of the indicator-specific gap closures. That is, we divide the per cent change in the gap closure by the per cent change in the budget generated by an increment of $100 USD. This metric is common in economics, because it aims to form an idea of how responsive a target variable is to changes in an intervention. In this case, we study the responsiveness of indicators to changes in total expenditure.[2] We focus on the positive elasticities because these are the most common and intuitive. They represent 'opportunities' to improve indicators through budgetary changes. The histogram in Figure 6.3b indicates the number of times that a certain elasticity appears. The plot colours each count based on the group membership of each country. Notice that now, in relative terms, the modest increase in the budget for a country in the West generates significant improvement in the gap closure; nevertheless, this intervention might not exert a meaningful impact on the indicators. In contrast, African countries present the smallest positive average elasticities.

[2] When the elasticity is greater than 1, we say that the indicator is very sensitive, as its response is more than proportional to the intervention.

In Figure 6.3c, we rank the indicators of SDGs according to the average gap closure elasticity (among those that are positive). Since there is substantial variability in potential impacts across country groups, we present the average elasticities for all indicators within the same SDG and region. In general, elasticities from Africa's indicators come last, and those from the West come first, as suggested above. Whereas most elasticities from countries in MENA indicate relatively enhanced progress, those for LAC countries are spread across the mid-level rank. In summary, due to modest elasticities, limited increases in the overall budget will not promote the desired development, for the average country, in Africa, East and South Asia, Eastern Europe and Central Asia, and LAC. Meanwhile, in the West and MENA, the high elasticity might not be enough to produce meaningful changes when the increase in the budget is rather small.

6.4.1 *Proportional Changes in the Budget*

Now, let us discuss the second type of simulated intervention: proportional changes to the budget size. The idea behind this exercise is to generate more realistic scenarios for the growth or shrinkage of the budget. Since public expenditure tends to depend on its historical level, simulating proportional changes is a natural way to model spending dynamics. Using the budget of a specific country, we perform simulations by changing it by $-50\%, -40\%, \ldots, 0, 10\%, 20\%, \ldots, 50\%$. To evaluate how sensitive an indicator is to budgetary changes, we switch to a more intuitive measure: *years saved to reach the goals*.

Specifically, we run the simulations for a given country and its empirical budget until all indicators reach their goals. Then, by repeating this exercise with different levels of public expenditure, we can calculate how many additional (or fewer) years it would take to reach the goal of each indicator.[3] For these many countries and indicators, simulating until converging to the goals may be too expensive

[3] Of course, this only works for indicators that exhibit positive trends; thus, for this exercise, we remove those with negative trends. We will return to them in Chapter 7 when analysing idiosyncratic bottlenecks.

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in computational terms, as some indicators may exhibit very slow dynamics. Hence, we approximate convergence time by running the equivalent of 20 years forward and then extrapolate these dynamics via linear regression for those indicators that do not converge in this period. With this information, we obtain the number of years it would take, for each country indicator, to reach its respective goal under the empirical and the modified budgets.

We present these results in Figure 6.4, where we aggregate the outcomes into country groups and SDGs. In general, the simulated functions present a concave shape which implies decreasing marginal returns to government expenditure. Likewise, a drop in public funding comes with a sharp reduction in convergence time (i.e., time saving becomes negative). The slope of these curves varies depending on SDG and country group. For instance, for East and South Asia countries, the highest slope corresponds to SDG 15, while it corresponds to SDG 13 for Africa. Savings of more than 10 years are rare and only occur with increases to the budget above 20%. For moderate expenditure expansions (below 10%), time savings are limited (below five years). This result indicates that converging, in the next decade, for the average country within a group would require substantially more funding. Finally, within-group disparities in convergence time are more widespread when the budget falls that when the budget rises.

6.5 SUMMARY AND CONCLUSIONS

This chapter presents the first application of PPI in the book. We calibrate the model to a large set of countries and indicators to produce prospective simulations on the dynamics of sustainable development for the next decade. Three main conclusions stem from this study. First, context matters in the budget–performance link. Second, the 2030 Agenda does not seem to be reachable with the current level of government funding. Third, budget cuts exhibit, in general, severe negative impacts on the SDGs, while increased budgetary resources tend to present low elasticities, especially in countries that need to progress the most. This exercise is also an example of how ABMs can be reliable tools for producing counterfactual simulations through

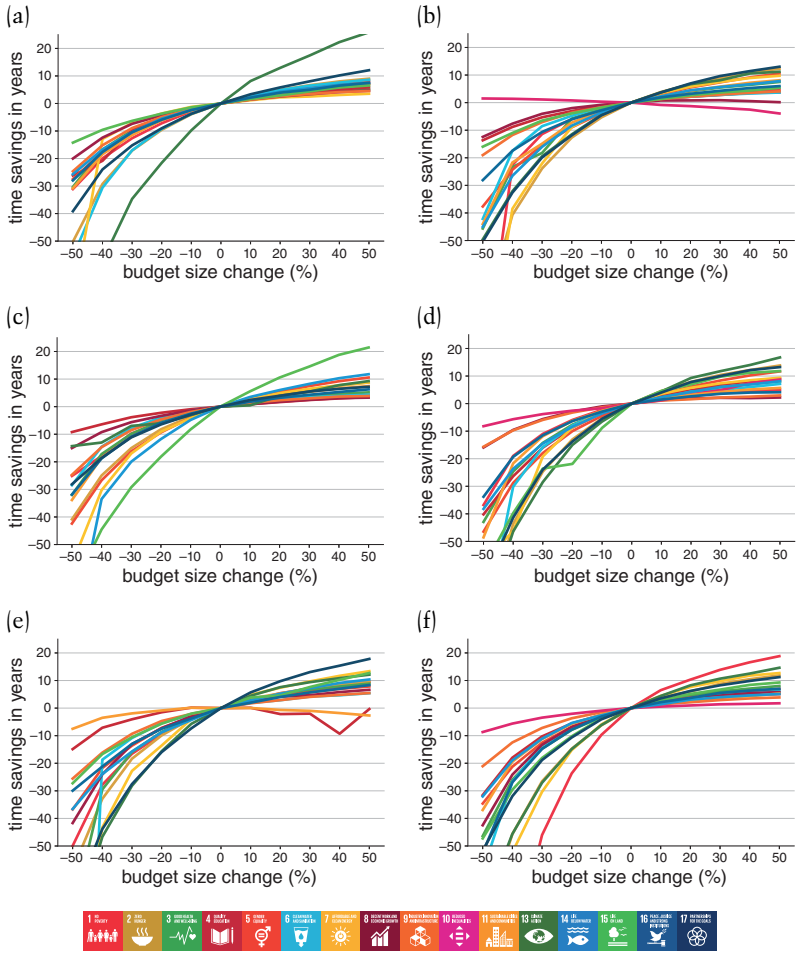

FIGURE 6.4 Change in convergence time to the goals by country group and SDG. (a) Africa, (b) Eastern Europe and Central Asia, (c) East and South Asia, (d) LAC, (e) MENA, and (f) West.

Notes: We measure time savings as the difference between the expected convergence time to the goals under the actual budget and the expected one under a counterfactual budget: *years_saved* = *baseline_years* − *counterfactual_years*. These calculations only consider indicators that exhibit positive trends. Time savings are an aggregate estimation for country groups and SDGs. One can interpret negative time savings as the years of delayed convergence.

Sources: Authors' calculations with data from the 2021 Sustainable Development Report.

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which analysts can study the outcomes of policies not applied before in specific countries.

Concerning the importance of each country's empirical context (reflected in their current indicators' levels, public governance, and spillover network), the results show significant disparities among countries (or groups) in terms of their future performance and quickness in closing their development gaps. Unfortunately, according to PPI's results, we expect the least developed countries to exhibit more pronounced gaps in 2030. In addition, progress in these countries in the next decade seems slow in comparison to that of more advanced nations. These results suggest a future scenario of development divergence between the Global North and South, precisely the opposite outcome that the SDG agenda aims at achieving when using the slogan "*leave no one behind*".

Prospective simulations make clear that the goals set by the 2030 Agenda will not be reached on time, irrespective of the Covid-19 adverse effects on poverty, health, education, and economic growth observed in recent years. According to our results, substantial development gaps will remain open, even in advanced economies. In some cases, this is due to the decreasing marginal returns of government spending. In others, it is because of low sensitivity in the indicators' performance to budgetary expenses.

In all regions of the world, a reduction of 20% or more in the budget is likely to cause a sharp fall in development. Yet, an equivalent increase does not produce a meaningful improvement in these indicators. However, the deterioration of development is not homogeneous across SDGs and countries, which indicates that the amount of public funding needed to avoid a collapse in their performance varies substantially. In contrast, the indicator performance in a scenario of higher budgets is more homogeneous across SDGs and country groups. Nonetheless, in such a setting, the elasticities of budgets are extremely low in African countries. In the following chapters, we attempt to identify the policy issues responsible for such progress latency through the perspective of structural bottlenecks.