

How Much of Economic Growth Trickles Down to the Population in Resource-Rich Countries?

Evidence from Papua New Guinea

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Abstract

There was substantial growth in the resource sector in Papua New Guinea during the last resource boom, increased revenue collection by the government associated with that growth, and significant increases in international assistance, all which might have translated into improved well-being outcomes across the country. For a better understanding of whether these changes improved household-level outcomes, this paper updates estimates of key well-being outcomes in the country. The analysis imputes monetary poverty status using nonmonetary indicators in the 2016–18 Demographic and Health Survey and estimates the World Bank’s

Multidimensional Poverty Measure. Despite the country’s significant growth since 2009, monetary poverty and access to several essential services hardly changed, which stands in stark contrast to the substantial improvement across the rest of the world and other comparison regions over the same period. Combined, the results illustrate that it is possible that very little of resource-led growth trickles down to the population and that the link between macroeconomic and microeconomic outcomes is more tenuous in Papua New Guinea than found in other resource-intensive settings.

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How Much of Economic Growth Trickles Down to the Population in Resource-Rich Countries? Evidence from Papua New Guinea*

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1. Introduction

Although there is an extensive literature illustrating the potential consequences of resource-intensity on economic growth and mechanisms through which growth in the resource sector might affect poverty and household-level well-being,¹ there is relatively little evidence of how much of resource-led growth might lead to household-level benefits in countries highly dependent on natural resources (e.g., Savoia and Sen 2021). Importantly, the quasi-experimental studies that have estimated the impacts of resource growth on poverty have found ambiguous results (e.g., Loayza and Rigolin 2016; Zabsonre et al. 2018; Bazillier and Girard 2020; etc.).

To investigate the degree to which growth in the resource sector might support the population, we analyze how well-being changed in Papua New Guinea following the end of its resource boom in 2014 (e.g., Fox and Shroder 2018). This is a period during which there was growth in the resource sector (e.g., World Bank 2023), an associated increase in the collection of government revenue (e.g., Howes et al. 2022), and also a substantial increase in foreign assistance as the country became increasingly important geopolitically (e.g., Hayward-Jones 2017).

This is also a critical public policy issue in PNG where there is significant debate regarding the extent of monetary poverty in the country (e.g., Pandey and Howes 2022). There has not been an official estimate of monetary poverty since 2009 given substantial challenges in collecting data in the country (e.g., DHS 2019). It is possible that the economic growth and other significant changes in the country noted above have substantially improved well-being since 39.7 percent of the population was estimated to be living below the World Bank's International Poverty Line of \$2.15 (2017 PPP) in 2009 (World Bank 2013).

But even aside from the significant changes that potentially improved well-being since the last official monetary poverty estimate, many viewed the high estimates in 2009 with skepticism. In particular, many found it difficult to reconcile the high level of economic activity in the country with such a high estimate of monetary poverty. For example,

¹See Ross (2015) for a survey of the historical context and of the many strands of the literature.

the average extreme poverty rate for countries with nominal GDP within 10 percent of PNG's was approximately one-half of that reported in PNG- 21.2 percent.² Furthermore, many question the suitability of global well-being measures in PNG, and often refer to the term "subsistence affluence" to describe how community-level support and subsistence agriculture provide basic needs (e.g., Bourke 2000; Cammack 2007; etc.).

Given the substantial ambiguity regarding the extent of deprivation in the country and the degree to which it has changed in the past decade and a half, we aim to update key well-being estimates using the 2016-2018 Demographic and Health Survey (DHS). Specifically, we estimate the prevalence of monetary poverty in the country by tracking the change in close correlates of monetary poverty and imputing the poverty level using the relationship between those variables and poverty in the last official estimate. And we estimate the World Bank's Multidimensional Poverty Measure (MPM), which is an index that combines information on access to critical and basic services and monetary poverty.

The data illustrate three clear patterns. First, despite growth in real per capita GDP of 29 percent and the other changes that have occurred between 2009 and 2016-2018, there was no change in the share estimated to be monetarily poor. The close correlates of poverty hardly changed over that time and the imputed share of the population living below the World Bank's international poverty line of \$2.15 (2017 PPP) in 2016-2018 was 39.3 percent, which is nearly identical to the estimate in 2009.³ Additionally, poor access to essential services also changed very little from their initial low base. The changes were precisely estimated, and a significant improvement (or worsening) in any individual well-being measure analyzed here can be rejected at conventional significance levels.

Second, this lack of change in several key well-being measures is in contrast to the substantial monetary and non-monetary gains made in much of the rest of the world over the same time period, even in places with little economic growth. The World Bank's global database illustrates that there were large improvements in four of the five indicators tracked here in countries with the most similar multidimensional poverty rates in the pre-

²Author's calculations using data from the World Development Indicators.

³The high estimate of monetary poverty is corroborated using a variety of approaches, including estimates of severe food insecurity and projections based on non-resource GDP growth.

period, and there were large improvements in all five of the indicators in the rest of the world. There were also large improvements in other resource-intensive countries over the same period, which also likely significantly benefitted from the high global commodity prices. Thus, the link between resource-led growth in PNG appears even more tenuous than in other resource-intensive countries.

And lastly, we are able to explore the link between economic activity and well-being in PNG to both non-resource and resource-intensive countries across the world. Not only did the share deprived not change between 2009 and 2016-2018, but also the well-being measures analyzed here are poor in PNG. Approximately 75 percent of the population is multidimensionally poor according to the MPM, which ranks 118 out of 122 countries for which the measure is estimated in the World Bank's Poverty and Inequality Platform (PIP); and the population faces significant deprivations in every dimension captured. Of the countries that have similar levels of deprivations across all the indicators captured here, PNG has the highest level of economic activity, and the disparity is larger than for other resource-intensive countries.

Given that very little of the population is employed in the resource sector in PNG (e.g., PNG NSO and UNFPA 2023), resource-led growth would either have to spur economic activity in other sectors or the government would have had to redistribute the gains in order for the population to significantly benefit. However, neither development is supported by the results presented here. There are several factors potentially behind the disconnect between economic growth and improvement in household well-being, including a difficult business environment (e.g., World Bank 2023; Howes et al. 2022; etc.), low levels of human capital among the population (e.g., World Bank 2018; Pandey and Howes 2018; etc.), and a high degree of clientelism (e.g., Walton and Dinnen 2022; World Bank 2023; etc.). However, many of these issues have been shown to actually be consequences of developing primarily through resource-led growth (e.g., Ross 2015), and the lack of any benefit to the population is surprising.

Combined, these results build on previous work in PNG and other resource-intensive settings and more concretely show how little of economic activity in resource-dependent

economies might trickle down and support the population. In particular, the results emphasize the ambiguous impacts that resource-led growth has had on poverty in other settings (e.g., Savoia and Sen 2021); these results build on the analysis in Pandey and Howes (2022) demonstrating how access to health has changed over the course of the resource boom in PNG, and extend the well-being indicators analyzed beyond health indicators over a portion of the resource boom; and the results comparing well-being in PNG to much of the rest of the world extend previous work that has shown similar disparities for either a subset of indicators or comparisons to a subset of the countries analyzed here (e.g., Howes and Mambon 2021; UNDP and OPHI 2022; Howes forthcoming; etc.).

The paper is structured as follows. Section 2 provides background information on the resource boom in PNG and some of the other significant changes that have occurred since the last official poverty estimate; Section 3 describes the data used in the analysis and the construction of the monetary and multidimensional poverty measures; Section 4 presents estimates of how well-being indicators have changed between 2009 and 2016-2018 for PNG and other comparison regions; Section 5 illustrates the disparity between economic activity and well-being in PNG relative to the rest of the world; and section 6 concludes.

Section 2. Background on Resource Growth and Welfare Measurement in Papua New Guinea

As discussed in the Introduction, the resource sector is one of the largest contributors to the PNG economy. Although many economic statistics are imprecisely measured given the severe data deprivation in the country,⁴ the biggest sectors of the economy have significant exports to other countries, and exports are much more precisely measured than many other economic statistics (e.g., Howes et al. 2022). Based on this information, the key contributors to overall economic activity include mining for gold, copper, cobalt, and zinc; drilling for natural gas and oil; and the production of timber from logging (e.g.,

⁴As mentioned in the Introduction, the last Household Income and Expenditure Survey was conducted in 2009. Economic statistics depend in a large part on the information from these surveys, and much of the basis for GDP estimates in the country are based on likely outdated information (e.g., World Bank 2023).

Howes et al. 2022; World Bank 2023).

Combined, the official contribution of the resource sector to overall GDP is high and has been growing over time. The figure was just above 10 percent in 1980, and steadily increased over time to nearly 30 percent of GDP by 2018 (e.g., Howes et al. 2022; World Bank 2023; etc.). The share of GDP contributed by agriculture is also high at approximately one-quarter of GDP, but the sector has grown at the same rate as overall GDP and agriculture's contribution to GDP has remained relatively stable between 1980 and 2018 (e.g., Howes et al. 2022). As described in the Introduction, the vast majority of employment in the country is in subsistence agriculture, with the most recent estimates illustrating that roughly one-half of households have at least one member primarily employed in agriculture (e.g., World Bank 2024). Thus, any gains that might accrue to the population from growth in the resource sector are likely either through spillovers from the sector or through government transfers redistributing some of the economic gains from the activity (e.g., World Bank 2023).

Economic growth and government revenues are strongly tied to global commodity prices given the country's resource intensity (e.g., World Bank 2023). The country has had several resource booms associated with spikes in commodity prices since independence that have led to high levels of growth and high levels of revenue collection. The most recent resource boom began in the early 2000s and continued to roughly 2014 (e.g., Fox and Shroder 2018; Howes et al. 2022; etc.).

As discussed in the Introduction, we estimate the change in well-being between two nationally representative surveys conducted during the last resource boom. Specifically, we estimate the change in monetary poverty and access to several essential services using the 2009 Household Income and Expenditure Survey (HIES) and the 2016-2018 DHS. Figure 1 reports both the GDP per capita in current US\$ over this time period and the real per capita GDP growth rates in each year.⁵ The figure illustrates that per capita GDP in constant US\$ increased by over 30 percent between 2010 and 2017 and that the average annual growth in real per capita GDP was 3.3 percentage points. And in a subset

⁵The GDP figures are obtained from the World Development Indicators; and the real per capita growth rates are obtained from the World Bank's 2023 Macroeconomic and Poverty Outlook.

of years, there were extremely high rates of real per capita growth (exceeding 10 percent in one year) associated with the boom in the resource sector.

But in addition to the economic growth that occurred over this time period, there was also a substantial amount of foreign assistance provided to the government of PNG that has been increasing over time. As mentioned in the Introduction, the country is becoming more geopolitically important and foreign assistance has potentially been increasing from a wide range of countries as a result (e.g., Hayward-Jones 2017). Figure 1 reports total assistance provided by Australia, as reported by the Australian government's Department of Foreign Affairs and Trade; the total assistance provided by the United States, as reported by the U.S. government's State Department; and total assistance provided by all OECD partners for a subset of years. The figure illustrates these patterns.

Section 3a. Data

The analysis focuses on the change in well-being indicators between the 2009 HIES and the 2016-2018 DHS. The 2009 HIES is a nationally and regionally representative survey of 4,104 households, and is also able to report statistics at the rural and urban levels. The survey includes detailed information on consumption that was used to construct estimates of the national poverty rate for 3,658 households from the entire sample. The extensive survey also captured access to several essential services.

The DHS was conducted in four waves between 2016 and 2018. The survey is nationally and provincially representative, and can report estimates at the rural and urban levels. Data collection was difficult and fieldwork could not be completed in 33 of the 800 census units originally selected in the sample design. Reasons for the delays and for not completing work in each census unit include difficulties in handling the terrain in the country, adverse weather, and security issues (e.g., DHS 2019).

The survey consisted of a household survey, and then separate surveys for eligible men and women in the household. In all households in the survey, all women who were aged 15-49 and who were either usual residents of the household or who spent the night before in the household were eligible to complete the women's questionnaire; and for every

second household in the survey, all men who were aged 15-49 and who were either usual residents of the household or who spent the night before in the household were eligible to complete the men’s questionnaire. In total, 16,021 households were surveyed with a common questionnaire; 15,198 women were administered the women’s questionnaire across 11,193 households;⁶ and 7,333 men were administered the men’s questionnaire across 5,374 households.⁷

Using these data sets, we update estimates of monetary poverty and the World Bank’s MPM, and then use these indicators to estimate the change in well-being following the end of the last resource boom in PNG. There are three reasons these particular indicators are the primary focus. First, the official well-being measure previously adopted by the government in 2009 is monetary poverty (e.g., World Bank 2013), and thus is a critical well-being measure by which we estimate how the population has been affected by growth in the resource sector. Second, poor delivery of essential services is a national crisis, and improvement in access is something that would be captured by the World Bank’s MPM and which would significantly improve well-being in the country (e.g., World Bank 2018b; Pandey and Howes 2022). And lastly, much of the rest of the world reports identical statistics to the World Bank, and thus well-being in PNG can be compared in each of the indicators analyzed here.⁸ This last advantage of the measures on which we focus helps us to better construct a counterfactual of how well-being changed in comparator countries that had either less economic growth or a different composition of growth.

Section 3b. Updating Key Well-Being Measures

We first update estimates of monetary poverty using the 2016-2018 DHS. As discussed above, there is no direct way to estimate the poverty status of individuals in the survey. In order to estimate monetary poverty using the 2016-2018 DHS, we impute poverty following the Survey of Well-Being via Instant and Frequent Tracking (SWIFT) framework (e.g., Yoshida et al. 2022). In this approach, we first find all the variables that are

⁶The number of women interviewed in each household varied between one and 10.

⁷The number of men interviewed in each household varied between one and eight.

⁸These statistics are publicly available to be downloaded on the World Bank’s Poverty and Inequality Platform (“<http://www.pip.worldbank.org>”).

common between the 2009 HIES and the 2016-18 DHS. Then we estimate the relationship between expenditure and each of those common variables in the 2009 HIES through many permutations based on the statistical significance of each of the common variables. Finally, we choose the empirical specification that has the highest predictive power of monetary poverty, as measured by the smallest absolute difference between actual and imputed poverty rates.^{9,10}

The model with the best predictive power included information on region, education, dwelling, and household size. Table 1 reports summary statistics using both the 2016-18 DHS and the 2009 HIES for all variables used to impute monetary poverty in the 2016-18 DHS.¹¹ The figures illustrate patterns consistent with a struggling population. But most importantly, key indicators that are common between the surveys are roughly similar, suggesting that the questions were interpreted similarly across surveys and that there were not large changes that occurred between the surveys that might also change the relationship between monetary poverty and other household variables.¹²

The poverty imputation results in a poverty rate of 39.3 percent at the World Bank's International Poverty Rate of US\$2.15 (2017 PPP).¹³ Figure 2 further illustrates that the imputed poverty rate is higher for groups expected to be poorer and thus the imputed household expenditure is likely capturing the share of the population that is poor. Specifically, Figure 2 illustrates that the severely food-insecure population according to the Food Insecurity Experience Scale (FIES) has a significantly higher imputed poverty rate than those with better food security outcomes; the share of the population that is imputed to be poor is decreasing for higher asset deciles in the DHS; and the share of the

⁹Details on the imputation procedure and for the results from the full regression models are available from the authors upon request.

¹⁰This is only one of many different ways to potentially impute estimates of monetary poverty. Some alternative methods were compared in the construction of these estimates, but the SWIFT methodology still had the highest predictive power. See Yoshida et al. (2022) for more details.

¹¹Summary statistics for all the remaining variables that are common between the two surveys are available from the authors upon request.

¹²The imputation module includes both variables that can adjust quickly and ones that adjust over time, and thus can flexibly capture changes in poverty over the time horizon under analysis (e.g., Yoshida et al. 2022).

¹³The model had a relatively high predictive power relative to other countries where the imputation models have proved to be precise estimates of poverty through subsequent household surveys (e.g., Yoshida et al. 2022).

imputed poor population is larger in the rest of the country than in the National Capital District.¹⁴

But in addition to imputing an estimate of monetary poverty, we also estimate the World Bank’s MPM. The MPM includes 6 different indicators across three welfare dimensions- monetary poverty, education, and access to basic services (World Bank 2018). The monetary poverty measure is the international poverty line using the \$2.15 (2017 PPP) per day poverty line; the indicators capturing access to education include indicators addressing the educational attainment of adults and the attendance of school-aged children; and access to basic services include indicators capturing access to proper sanitation, clean drinking water, and access to electricity.¹⁵ Although monetary poverty is an indicator in the World Bank’s MPM and is not directly able to be estimated from the 2016-18 DHS, we use the imputed poverty rate for each household described above. See Table 2 for a summary of the dimensions and the indicators captured in the standard World Bank MPM.

For each of these individual indicators, we report the share of the population that is deprived relative to the thresholds of the MPM. We also report the share of the population that is multidimensionally poor, which is a measure of the degree to which deprivations overlap in individual households.¹⁶ Specifically, the measure is defined as the share of people that fall short of the MPM threshold in at least one dimension, or a combination of indicators equivalent in weight to a full dimension.^{17,18}

¹⁴In results not reported, the difference is statistically significant at the 1 percent level.

¹⁵A detailed list of the indicators that were calculated for PNG from the 2016-2018 DHS are available from the authors upon request.

¹⁶This figure is referred to as the multidimensional poverty headcount ratio. We refer to this figure throughout the report as the World Bank’s MPM. Although we report the multidimensional poverty headcount ratio throughout, there are other multidimensional indicators that are able to be estimated. In particular, the multidimensional poverty index is defined as the product of the headcount ratio and the intensity of poverty. However, we focus on the headcount ratio for the ease in interpretation.

¹⁷All three dimensions are weighted equally, and within each dimension, all indicators are weighted equally. Given that both the education and access to basic services dimensions have more than one indicator, the weight given each of the indicators is less than the weight given the monetary poverty indicator, which is the only indicator in that dimension. Specifically, the monetary poverty indicator is given a weight of $\frac{1}{3}$; each education indicator is given a weight of $\frac{1}{6}$, which is obtained from the fact that the two indicators together have to add to the weight of each dimension ($\frac{1}{3}$); and, similar to the education dimension indicators adding to the weight of each dimension, the weight of each indicator in the access to basic services dimension is $\frac{1}{9}$.

¹⁸Examples of households who would be multidimensionally poor include a household that is monetarily poor but is not deprived in any other indicator; and a household that is deprived in one of the education

We have to make assumptions about how to treat households for which the indicator might not apply and for households with missing indicators. For example, the indicator on school attendance does not apply to households without school-aged children. When reporting on and ranking the indicator alone, we report the share only including the subset of households that have school-aged children. But when creating the multidimensional poverty indicator, we follow the World Bank’s PIP methodology, where ineligible households are assumed deprived if a sufficiently large share of households in the geographic region were deprived (e.g., World Bank 2018). Specifically, all households without school-aged children are assumed to be deprived in provinces that have a share deprived above the national median. And in provinces with below-median deprivation, all households without school-aged children are assumed to be not deprived.^{19,20}

However, we omit one indicator from the comparison between the 2009 HIES and the 2016-2018 DHS- the share of the population living in a household where not all school-aged children attend school. The 2009 HIES appears to be poorly capturing school attendance and does not appear to be comparable to the DHS or other nationally representative surveys.²¹ However, when including the indicator, the change would indicate a significant worsening (likely artificial) over the time period and would not contradict the main empirical findings demonstrating no improvement in well-being following a period of strong resource-led growth. And we continue to report the attendance indicator in the 2016-2018 MPM and summary statistics.

indicators and two of the access to basic services indicators. An example of a household that narrowly misses out on being multidimensionally poor includes a household that is deprived in one of the two education indicators and only one of the access to basic services indicators.

¹⁹The indicator based only on eligible households (41.8 percent) and the indicator with the above province-level assumptions (43.6 percent) are nearly identical at the national level.

²⁰Additionally, a subset of the other standard MPM indicators have a handful of missing observations in both surveys. For each individual indicator, we report and rank estimates using all non-missing observations. But for the multidimensional poverty indicator, we calculate the measure for only households with no missing observations in any of the indicators. However, this last restriction drops only a handful of households in each survey (e.g., 133 households out of 16,021 were dropped in the 2016-2018 DHS).

²¹There was a substantial worsening of school attendance between attendance indicators in the 2009 HIES and the 2016-2018 DHS. However, the 2009 estimates appear to be an outlier when compared to estimates reported from the 2011 Population Census and the 2022 Socio-Demographic and Economic Survey, and little could explain such a change over the time period. And this stands in stark contrast to the very little change in any other well-being indicator presented in Section 4. Details available from the authors upon request.

Section 3c. Summary Statistics- Updated Well-Being Measures

Table 3 presents estimates of these updated measures of well-being.²² All of the indicators captured in the MPM aside from the educational attainment of adults have a higher share of the population deprived than is estimated to be monetarily poor. Approximately 42 percent of the population lives in a household with poor school attendance; 61 percent of the population does not have access to improved drinking water; and above 80 percent of the population has poor access to electricity and poor access to improved sanitation. Combined, the population in PNG experiences extensive deprivations across all dimensions of well-being.

At odds with the level of economic activity in the country, PNG ranks near the bottom in each indicator captured and in the overall MPM. Aside from the educational attainment of adults, for no measure reported in Table 3 does PNG rank above the 13th percentile of countries reported in the World Bank's PIP. And in one of those indicators, access to improved drinking water, PNG ranks last out of 112 countries for which the indicator is estimated; and in two other indicators- access to improved sanitation, and access to electricity- PNG ranks between the second and sixth percentiles of countries.

Given the widespread deprivation in PNG across all indicators, there is a significant share of the population for which these indicators overlap. Table 3 illustrates that 74.5 percent of the population are deprived in indicators equivalent to at least one dimension of the MPM. Very few countries in the world either have as high a share of the population that is multidimensionally poor, or are as consistently one of the most deprived countries in the world across all indicators. PNG has the 118th highest share of the population that is multidimensionally deprived out of the 122 countries for which the measure was able to be constructed; and PNG respectively ranks 120th across the 122 countries measured in the median rank across all indicators and the MPM itself.

Figure 3 reports the share of total deprivations by source among the population ex-

²²For the household-level proxy of monetary poverty, we use the predicted expenditure level for each household using a regression of expenditure on all the household variables used to impute monetary poverty. Estimates of the regression model are available from the authors upon request.

periencing at least one deprivation.²³ Consistent with the much higher shares of the population that are deprived in non-monetary indicators, the majority of deprivations experienced by the population are due to lack of access to basic services. Figure 3a demonstrates that 63 percent of deprivations on average are contributed by the access to basic services dimension, 21 percent of deprivations are contributed by the education dimension, and only 16 percent of deprivations are contributed by the monetary poverty dimension.

Figure 4 investigates these patterns by reporting the share of the population deprived in each indicator in the World Bank's MPM by imputed expenditure deciles, where higher deciles are associated with higher expenditure. Further corroborating the validity of imputed expenditure, there is a decline in deprivations for higher levels of expenditure. However, the figures illustrate very significant deprivations even among the richest households in the population. The average deprivation among the highest expenditure decile is 33.1 percent, with the highest deprivations in access to basic services.

To better benchmark these levels of deprivation of the richest, Table 4 compares the average deprivation for the top expenditure decile in PNG to the average of the population in the rest of the world for each indicator in the basic MPM aside from monetary poverty. Strikingly, the deprivations among the top expenditure decile of the population are still often comparable to the average deprivations of the entire population in some of the poorest countries in the world. The education indicators compare the best, where the top income decile in PNG ranks in the 44th and 31st percentiles globally; and the rest of the MPM indicators range between the 21st and the 7th percentiles globally.

The deprivation extends to the entire country and the least deprived provinces in Papua New Guinea have deprivation levels similar to many of the most deprived countries in the world. Figure 5 reports the global ranking of each province in the share of the population that is multidimensionally poor. Even the National Capital District (NCD), with a substantially lower multidimensional poverty rate, still ranks only 85th out of the 122 countries. The countries that have the most similar international rank to the NCD

²³The share of the population that experiences at least one deprivation is 92.8 percent of the population.

are Sao Tome and Principe, the Comoros, Namibia, Djibouti, Senegal, and Ghana.

Combined, these estimates illustrate the magnitude of the challenges facing PNG. The fact that PNG faces significant monetary and non-monetary poverty challenges is not surprising (e.g., World Bank 2013; Pandey and Howes 2021; World Bank 2023; etc.), and PNG's status as the poorest ranking country in the East Asia and Pacific region is also not surprising (e.g., World Bank 2023). However, the depth of the challenges across all the indicators and the fact that PNG has some of the highest share of deprivations anywhere in the world is surprising given the relatively large level of resource-related economic activity occurring in the country (e.g., World Bank 2023).

Section 4. The Change in Well-Being Following the End of the Resource Boom

The new estimates of monetary poverty and access to essential services in 2016-2018 described above illustrate that the significant resource-related growth, the associated increase in resource revenue for the government, and substantial foreign assistance have resulted in little change in well-being since 2009. The lack of a change in any measure of well-being is consistent with there being little improvement in either the financial ability of households to afford goods and services and with there being no substantial improvement in the availability of essential services to be utilized.

Figure 6 reports the share of the population that was monetarily poor and deprived in each of the World Bank's MPM indicators in 2009 and in 2016-2018, and further reports the 95 percent confidence intervals.²⁴ The similarity in the indicators across the two surveys is striking. The magnitude of the differences are very small for all indicators, with the average change in deprivation across the indicators equal to 0.05 percentage

²⁴The indicators were made to be comparable across surveys, where the same categories that were defined as deprived in 2009 were used to define deprivation in 2016-2018. The 2009 estimates differ slightly from the figures reported in the World Bank's Poverty and Inequality Platform (PIP) because the figures in the PIP impute missing observations based on the prevalence in the nearest geographically representative boundary and because some of the figures are in the process of being revised. In particular, after an evaluation of how access to clean drinking water was defined by experts in the field, one source was identified as mistakenly being identified as unimproved (rainwater) and one source was mistakenly being identified as improved (other sources of water). After these revisions, the access indicator is as is reported in Figure 6- 57.8 percent of the population lacked access to improved drinking water in 2009. As is mentioned above, poor access to improved drinking water in 2016-2018 is defined to be identical to the categorization in 2009.

points; and in all cases, the 2016-2018 estimate of the share deprived is contained in the 95 percent confidence interval for the 2009 estimate.

Given the large sample sizes of each survey, the standard errors are precise and the estimates can rule out any large decline in deprivation at standard levels of significance. At the 5 percent confidence level, the estimates can rule out any poverty reduction greater than 2.4 percentage points, which would still be very low amounts of poverty reduction given the amount of resource-related growth that occurred relative to some of the other settings that have been analyzed (e.g., Savoia and Sen 2021). Furthermore, for access to basic services, the estimates can rule out declines in poor access to essential services greater than a threshold between 0.8 and 7.7 percentage points.

Further illustrating the extremely limited ability of economic growth to benefit the population in PNG, we show how poor this lack of improvement in well-being looks relative to comparison countries and the rest of the world. Although we cannot estimate standard errors given that we do not have access to the microdata in all countries, Figure 7 reports how the average of the share deprived changed for each comparison region. The figure reports the average number of the five indicators in comparison regions that improved by greater than 5 percent, which are likely to be statistically significant improvements given the large sample sizes of nationally representative surveys.

We compare PNG's performance to several different comparison regions. Specifically, we compare PNG to countries with the most similar share of the population that was multidimensionally poor in the pre-period, capturing the fact that countries with the most deprivations in the world might be improving at a faster rate than other countries; and we also compare PNG to the rest of the countries aside from the those with a similar MPI profile captured in the World Bank's global database.

Figures 7a-7b illustrate that there was broad improvement in each of these comparison regions across nearly all indicators, including in places that did not have nearly as much economic growth as PNG. The average figures across each comparison region demonstrate an improvement in four out of the five indicators in countries with a similar MPM profile, and an improvement in all five indicators in the rest of the world. The decline in the

share that were deprived was relatively large in each of the dimensions that improved, with an average decline of 8.8 percentage points in regions with a similar MPI profile (with the most room to improve) and 2.63 percentage points in the rest of the world.²⁵

There is also evidence that each individual country improved multiple indicators over this time period and that the averages are not driven by large declines in only a subset of countries. Specifically, Figure 7d reports the average number of the five indicators that improved by at least 5 percent in each comparison region. Countries with similar MPI profiles improved more than 5 percent in 3.3 out of the five indicators on average, and the rest of the countries improved in 2.6 indicators on average. This stands in stark contrast to PNG, in which no indicators improved at all, let alone by 5 percent. Aside from PNG, only five countries out of 94 tracked improved in zero of the five indicators, and they were all grouped as high-income countries by the World Bank with very limited scope to improve the already very small levels of deprivation in the pre-period.²⁶

However, Figures 7c and 7d demonstrate that PNG was an outlier even among countries that were similarly resource intensive and which likely similarly grew during the period of growing global commodity prices.²⁷ Resource-intensive countries improved in four out of the five captured indicators tracked on average; the average decline in deprivation for the improved indicators was 5.3 percentage points; and resource-intensive countries improved in 3.7 of the five indicators on average. Thus, the degree to which resource growth trickled down to the population in PNG was likely even lower than other resource-intensive economies over this period.

Section 5. Comparing the Relationship between Economic Activity and Deprivation in Papua New Guinea to the Rest of the World

Given the poor performance in PNG over the time period relative to all other comparison groups, we use the richness of the global data on well-being and economic activity

²⁵The 2.63 percentage points translates into a large percentage improvement given the share deprived in the rest of the world is small on average.

²⁶The countries were Estonia, France, Germany, Hungary, and Switzerland. For a list of High-Income Countries as categorized by the World Bank, see (accessed March 2024) "[https : //datahelpdesk.worldbank.org/knowledgebase/articles/906519 – world – bank – country – and – lending – groups.](https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups)"

²⁷Resource-intensive countries were identified by IMF (2012).

to compare the relationship between economic activity and well-being in PNG and other countries. Specifically, we illustrate that the deprivations evident in the 2016-18 DHS are significantly higher than would be expected by the level of economic activity in the country.

For each deprivation, we estimate the correlation between the share of the population deprived and per capita GDP in 2017. As expected, there is a strong negative correlation for each deprivation, where the decline in the share deprived varied between 0.36 and 0.95 percentage points in response to an increase in per capita GDP by US\$1,000.²⁸ We then project the expected deprivation levels using the point estimates of the simple correlation, and then we compare those projections to the actual deprivation levels in the country. We construct confidence intervals for the projections using the bounds of the 95 percent confidence intervals of the point estimates.

The difference between projections and actual deprivation levels for PNG are reported in Figure 8. The GDP-based projections are smaller than the actual level of deprivations for all six indicators in the standard MPM and for the MPM itself. The magnitude of the excess share experiencing deprivations is large, with the actual share deprived being 38.6 percentage points higher than expected on average based on economic activity alone. Additionally, the actual level of deprivation is still significantly higher than the projection using all the upper bounds of the 95 percent confidence intervals in the underlying regression as opposed to the point estimates for all indicators except for one.

The data can illustrate the degree to which economic activity is disconnected from the levels of deprivation in the country. The three countries with per capita GDP immediately above PNG in the World Development Indicators were Ukraine, Honduras, and the Lao People's Democratic Republic. The average level of monetary poverty in these countries as reported by the World Bank's PIP is 6.6 percent, as compared to the 39.3 percent imputed in PNG; and the average share of the population that was multidimensionally poor in the three countries is 8.9 percent, as compared to the 74.5 percent in PNG. Alternatively, the three countries with MPIs that are most similar to PNG- Malawi,

²⁸A table reporting each estimate is available from the authors upon request.

Chad, and Niger- have a per capita GDP of US \$500, which is 21.5 percent of the per capita GDP in PNG (US \$2,333).

The patterns are robust to concerns about the accuracy of reported GDP figures. For example, some have suggested that there is too much volatility in reported figures, even in years where there have been few observable changes (e.g., Howes et al. 2022). However, Figure 9a illustrates that the figures are qualitatively identical when using an additional source for per capita GDP aside from those reported in the World Development Indicators;²⁹ and Figure 9b illustrates that the figures are identical when using the five year average of GDPs in the underlying regression and the projection to reduce potential noise.

As described above, the inability of economic activity in the resource sector to spill over and benefit the majority of the population through public transfers, direct employment, or spillovers of increased economic activity in other sectors is possible in resource-dependent economies (e.g., IMF 2012). However, we illustrate that higher-than-expected deprivations in PNG are even extreme relative to other resource-dependent economies.

Figure 10 reports how much larger actual deprivations are than the level of deprivations projected by economic activity alone. The figure reports this difference separately for PNG and the average for all resource-dependent countries that are low- or middle-income, as defined by the IMF (e.g., IMF 2012).^{30,31} For the MPM itself and for each deprivation aside from the educational attainment of adults, the difference was larger in PNG than the average for all other resource-intensive low- and middle-income countries. The point estimate for the other resource-dependent economies was below the lowest projection in PNG for all indicators; and for four of the seven total indicators (6 deprivations and the MPM), the lowest projection in PNG is still higher than the highest average projection in other resource-dependent countries.

Although it is difficult to precisely interpret the difference between GDP-based pro-

²⁹Figure 9a uses GDP per capita obtained from the PNG Economic Database, available at (accessed March 2023): "<http://devpolicy.org/pngeconomic>".

³⁰A list of resource-dependent countries that are low- or middle-income, as defined by IMF (2012) is available from the authors upon request.

³¹The estimates are qualitatively identical when including other comparator countries to PNG, such as Peru, Malaysia, and Solomon Islands (e.g., World Bank 2023).

jections and actual deprivation levels, these results corroborate the results from Section 4 and further illustrate that the link between economic activity and well-being in PNG is likely one of the most tenuous among resource-intensive economies. One potential consequence of these findings is that additional growth in the resource sector alone will likely be insufficient to improve well-being in the country for the majority of the population. Other analyses have similarly come to that conclusion by demonstrating, to the degree that one is able to in such a data deprived environment, that there is little evidence that previous resource booms have benefitted the population (e.g., Pandey and Howes 2022; World Bank 2023).

Section 7. Conclusion

We update key well-being estimates in PNG and estimate the degree to which strong resource-led growth might have benefitted the overall population. We find that there was extremely little change in well-being in response to the growth that occurred, and that this performance was extremely poor even compared to several other comparison regions. We also utilize the richness of newly updated global databases to illustrate how the link between economic activity and well-being is more tenuous in PNG than in many other resource-intensive countries.

These findings raise important questions regarding the composition of growth and issues of governance in PNG. As discussed in the Introduction, the results more concretely illustrate that none of the economic activity seemed to have spurred demand for other goods and services that could have benefited the population. Even if the growth that occurred did not trickle down to the population, the outcomes illustrate that the government did not effectively redistribute the substantial government revenue from that activity to the population in the form of transfers or availability of essential services. The lack of effective government transfers is even more striking given the substantial total assistance received by the government that has potentially been growing. Combined, the stagnation of well-being outcomes above illustrates the urgent need to spur engines of growth that better benefit the population.

However, there are many issues that the analysis is unable to address more fully. First, given the lack of a detailed consumption and expenditure survey from which we could construct a new estimate of monetary poverty, we were forced to impute poverty using non-monetary indicators and the relationship between poverty and those indicators in the last survey from which poverty was measured. However, for a more complete estimate the change in monetary well-being, we would need to utilize an actual measure of poverty instead of a proxy.

Additionally, we are only able to measure and compare PNG to the rest of the world in a limited number of coarse indicators given data limitations. Thus, we are unable to delve more deeply into particular dimensions or to measure the quality of services used by the population. More analyses into each of these specific areas would help to unpack more fully the potential degree to which resource-growth leads to improvements in household and individual-level outcomes. For example, although Howes and Pandey (2022) find limited evidence that household health outcomes improved following the resource booms in the country, the evidence is more mixed when looking at many different health indicators over longer time periods.

Furthermore, we need to understand in more detail why PNG's experience is more extreme than other resource-intensive countries. The Introduction discussed some potential issues that likely helped to contribute to the lack of benefit from the economic growth that occurred, including a poorly developed private sector, aside from the resource-intensive activities, poor human capital outcomes that limit the ability of the population to take advantage of economic growth, and a host of governance issues. However, more work needs to be done to examine whether these issues are more extreme in PNG and what reforms might make the most meaningful improvement in household-level outcomes.

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Table 1. Summary Statistics of Variables Used in the Imputation of Monetary Poverty

Variable	2016-18 DHS	2009 HIES	Difference
Household Size	6.4463	6.4069	0.0395
	[.0728]	[.1013]	[.1254]
Household Size- Squared	50.0667	48.2781	1.7886
	[1.2697]	[1.6405]	[2.0739]
Dependency Ratio	0.4362	0.4247	0.0115*
	[.004]	[.0053]	[.0065]
Secondary School	0.3525	0.3832	-0.0307
	[.0101]	[.0184]	[.021]
Above Secondary School	0.119	0.0865	0.0326**
	[.0121]	[.0102]	[.0153]
Owens a Mosquito Net	0.7134	0.6524	0.061**
	[.016]	[.0255]	[.0308]
Owens a TV	0.1588	0.1561	0.0027
	[.0174]	[.0137]	[.0218]
Toilet- covered pit	0.5072	0.6152	-0.108
	[.0193]	[.0295]	[.036]
Water- Piped into Community	0.0785	0.1251	-0.0465*
	[.009]	[.0228]	[.0247]
Floor- Bamboo	0.4211	0.4788	-0.0577*
	[.0191]	[.0291]	[.0346]
Floor- Earth	0.1707	0.1523	0.0184
	[.0133]	[.0204]	[.0245]
Total Rooms	2.4182	2.5096	-0.0914
	[.0409]	[.0532]	[.0665]
Province- Western	0.0237	0.0187	0.005
	[.005]	[.0092]	[.0105]
Province- Central	0.0382	0.0378	0.0004
	[.0078]	[.0174]	[.019]
Province- National Capital District	0.0283	0.0544	-0.0261***
	[.0067]	[.0069]	[.0096]
Province- North (Oro)	0.0276	0.0314	-0.0038
	[.0056]	[.0143]	[.0157]
Province- Enga	0.0372	0.0394	-0.0022
	[.0078]	[.0169]	[.0189]
Province- Chimbu	0.0661	0.0682	-0.0021
	[.0172]	[.023]	[.029]
Province- Morobe	0.0982	0.1115	-0.0133
	[.0235]	[.0256]	[.0348]
Province- Madang	0.0693	0.066	0.0033
	[.0144]	[.0218]	[.0261]
Province- West Sepik	0.0376	0.0351	0.0025
	[.0078]	[.0161]	[.0178]
Province- Manus	0.0092	0.007	0.0022
	[.0018]	[.0061]	[.0063]
Province- New Ireland	0.0282	0.0211	0.007
	[.0057]	[.01]	[.0115]
Province- East New Britain	0.0358	0.0487	-0.0129
	[.007]	[.0164]	[.0179]
Province- West New Britain	0.0347	0.0398	-0.0051
	[.0074]	[.0145]	[.0163]

Notes: The table reports summary statistics for each variable that is common between the 2016-18 Demographic and Health Survey and the 2009 Household Income and Expenditure Survey and used in the model to impute total household expenditure. The last column further reports the difference in the mean values of the summary statistics, with standard errors obtained from pooling the samples from the two surveys and regressing the household outcome for each variable on an indicator equal to one if the observations was from the 2016-18 DHS. Standard errors clustered at the PSU level are reported in parentheses; and *** denotes statistical significance at the 1 percent level, ** denotes statistical significance at the 5 percent level, and * denotes statistical significance at the 10 percent level.

Table 2. Dimensions and Indicators Included in the World Bank’s Multidimensional Poverty Measure

Standard MPM		
Dimensions	Indicators	Description
Monetary Poverty	Poor	Daily consumption or income is less than US\$2.15 (2017 PPP) per person
Education	Enrolled	At least one school-age child up to the age of grade 8 is not enrolled in school.
	Attained	No adult in the household (age of grade 9 or above) has completed primary education
Access to Basic Infrastructure	Water	The household lacks access to limited-standard drinking water
	Sanitation	The household lacks access to limited-standard sanitation
	Electricity	The household has no access to electricity
Notes: The indicators and thresholds for the World Bank Multidimensional Poverty Measure are taken from Table 4.1 of the 2018 Poverty and Shared Prosperity Report.		

Table 3. Share of Households Deprived in Each Indicator in the World Bank’s Multidimensional Poverty Measure

	Monetary Poverty-Imputation	Educational Attainment	Educational Enrollment	Electricity	Sanitation	Drinking Water	Share of the Population that is Multidimensionally Poor	Median International Rank of Across All Indicators (including MPM)
Share Deprived	39.3	20.8	41.8	83.1	85.1	60.6	74.5	112
International Rank	113 Out of 122 Countries	89 Out of 122 Countries	84 Out of 88 Countries	118 Out of 120 Countries	93 Out of 99 Countries	112 Out of 112 Countries	118 Out of 122 Countries	120 Out of 122 Countries
Comparator Countries	Angola, Lesotho, Eswatini, Zimbabwe, Uganda, and Tanzania	Lesotho, Sao Tome and Principe, Tunisia, Timor-Leste, Pakistan, Bangladesh	Mozambique, Chad, The Gambia, Yemen, Burkina Faso, Liberia	Zambia, Niger, Liberia, Malawi, Chad	Ghana, Benin, Togo, Niger, Chad, Sierra Leone	Mozambique, Ethiopia, Sudan	Zambia, Ethiopia, Mozambique, Malawi, Chad, Niger	Chad, Mozambique, Ethiopia, Malawi, Niger
<p>Notes: All estimates aside from the imputation and projection of monetary poverty were constructed using the 2016-18 Demographic and Health Survey (DHS) alone; the imputation of monetary poverty was constructed with household-level variables from the 2016-18 DHS, using the average relationship between total household expenditure and these variables in the 2009 Household Income and Expenditure Survey (HIES). Multidimensionally poor is defined as the share of people that fall short of the World Bank’s Multidimensional Poverty Measure (MPM) threshold in at least one dimension, or a combination of indicators equivalent in weight to a full dimension. Rankings of the share deprived are relative to the figures reported in the World Bank’s Poverty and Inequality Platform, using data collected between 2014 and 2020. And the median rank reported in the last column is the median rank in all individual indicators reported in Columns 1-7. Comparator countries are the three countries with the closest shares deprived, both above and below (listed in order from least deprived to most deprived).</p>								

Table 4. Comparing the Households in the Top Decile of Expenditure in Papua New Guinea to the Average Population in the Rest of the World

	Educational Attainment	Educational Enrollment	Electricity	Sanitation	Drinking Water	Median International Rank of Across the 4 Indicators
Share Deprived	7.4	14.2	52.1	58.9	34.4	74
International Rank	68 Out of 122 Countries	61 Out of 88 Countries	105 Out of 120 Countries	74 Out of 99 Countries	104 Out of 112 Countries	86 Out of 122 Countries
Comparator Countries	Peru, Paraguay, Mauritius, Botswana, Egypt, Honduras	Uganda, Vanuatu, Togo, Cameroon, Timor-Leste, Djibouti	Burkina Faso, Togo, Sudan, Angola, Namibia, Mauritania	Angola, Bangladesh, Lesotho, Kiribati, Zambia, Liberia	Nigeria, Sierra Leone, Zambia, Chad, Niger, Mauritania	Eswatini, Namibia, Myanmar, Gabon, Nicaragua, Pakistan
Notes: All estimates were constructed using the 2016-18 Demographic and Health Survey (DHS). Rankings of the share deprived are relative to the figures reported in the World Bank's Poverty and Inequality Platform, using data collected between 2014 and 2020. Comparator countries are the three countries with the closest shares deprived, both above and below (listed in order from least deprived to most deprived).						

Figure 1. Changes in Macroeconomic Indicators in Papua New Guinea

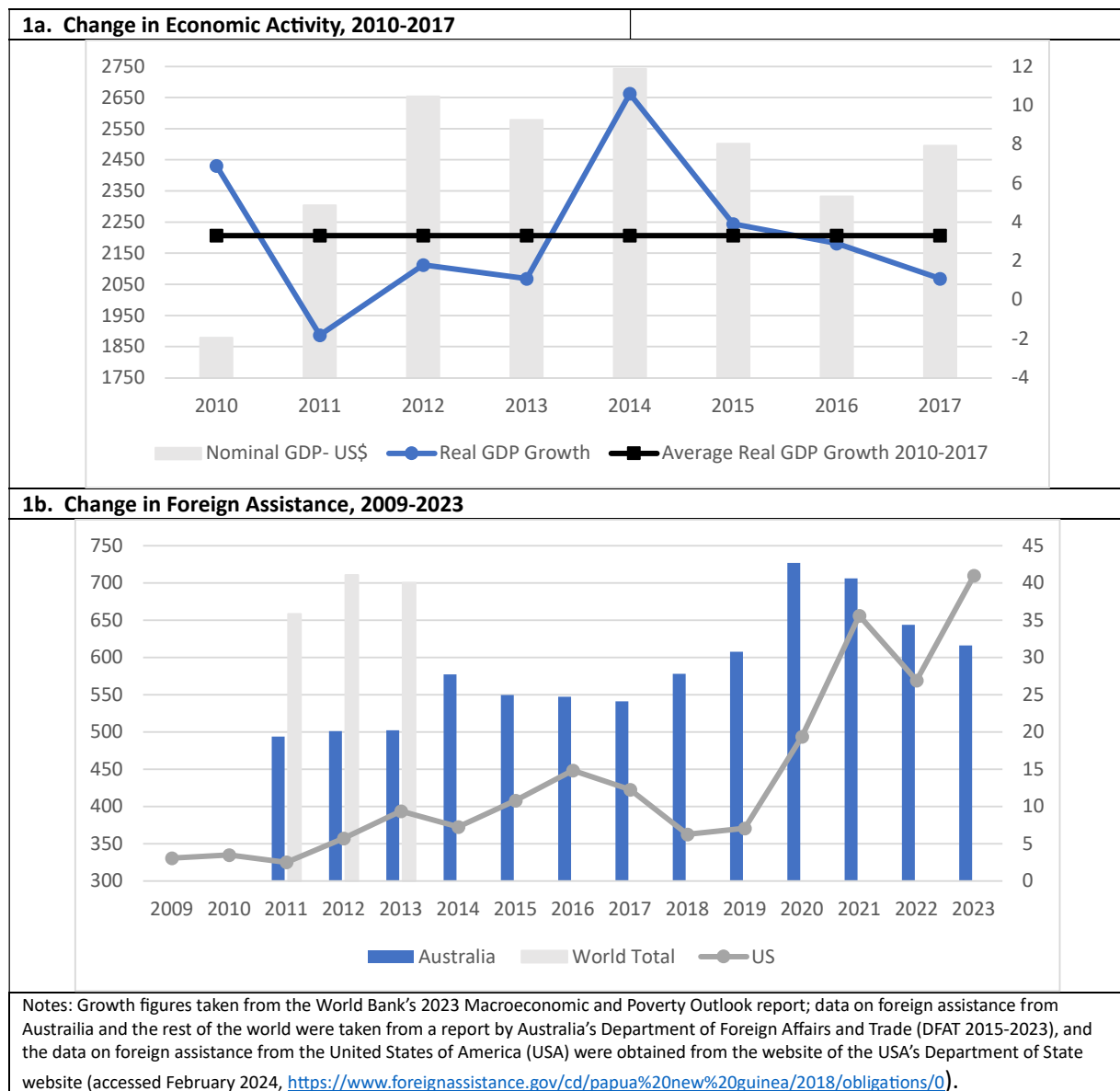


Figure 2. Relationship between Household Proxies for Monetary Poverty

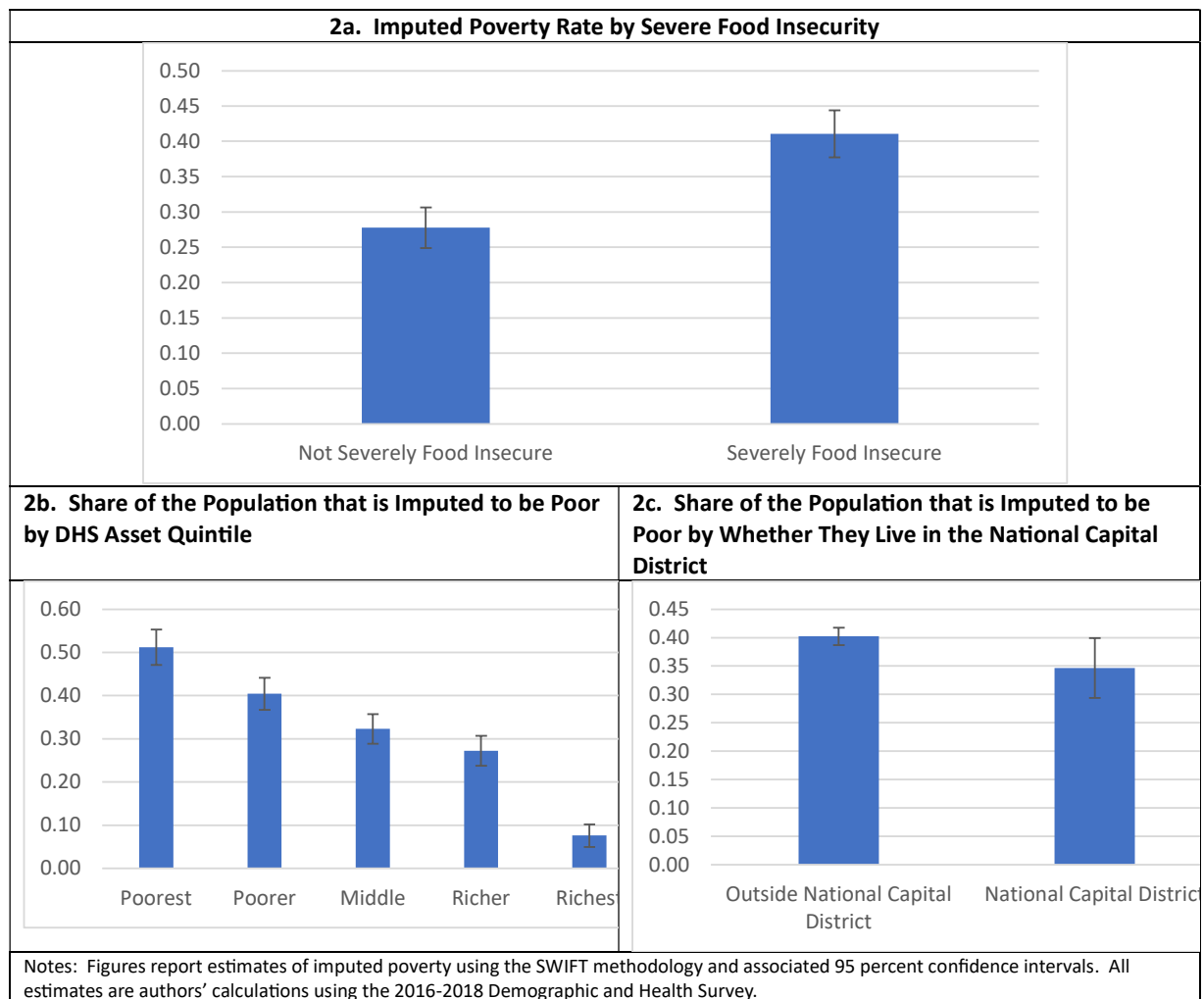


Figure 3. Contribution to Multidimensional Poverty by Dimension and Indicator

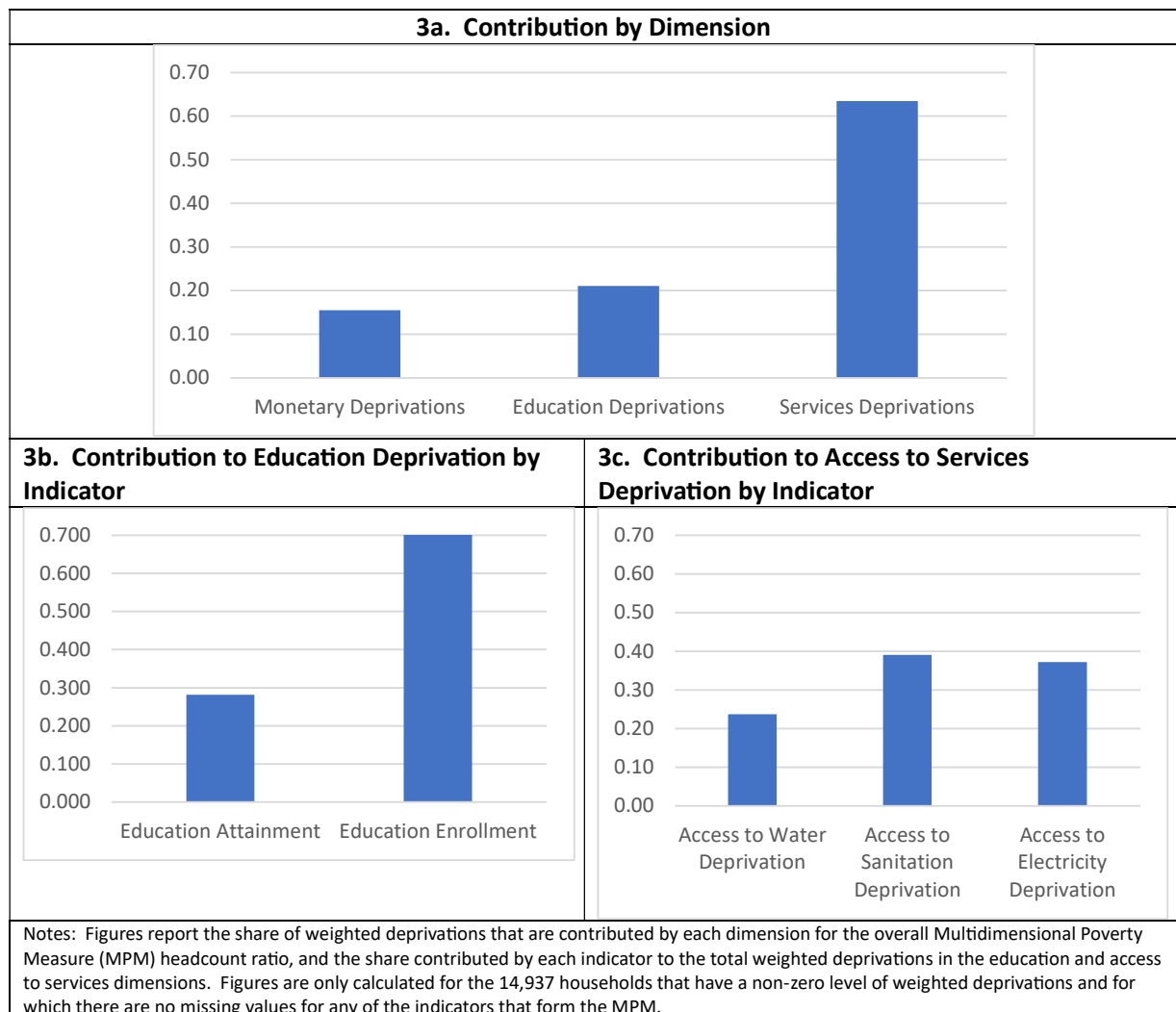


Figure 4. Share Deprived by Imputed Expenditure Decile (Higher Decile Associated with More Expenditure)

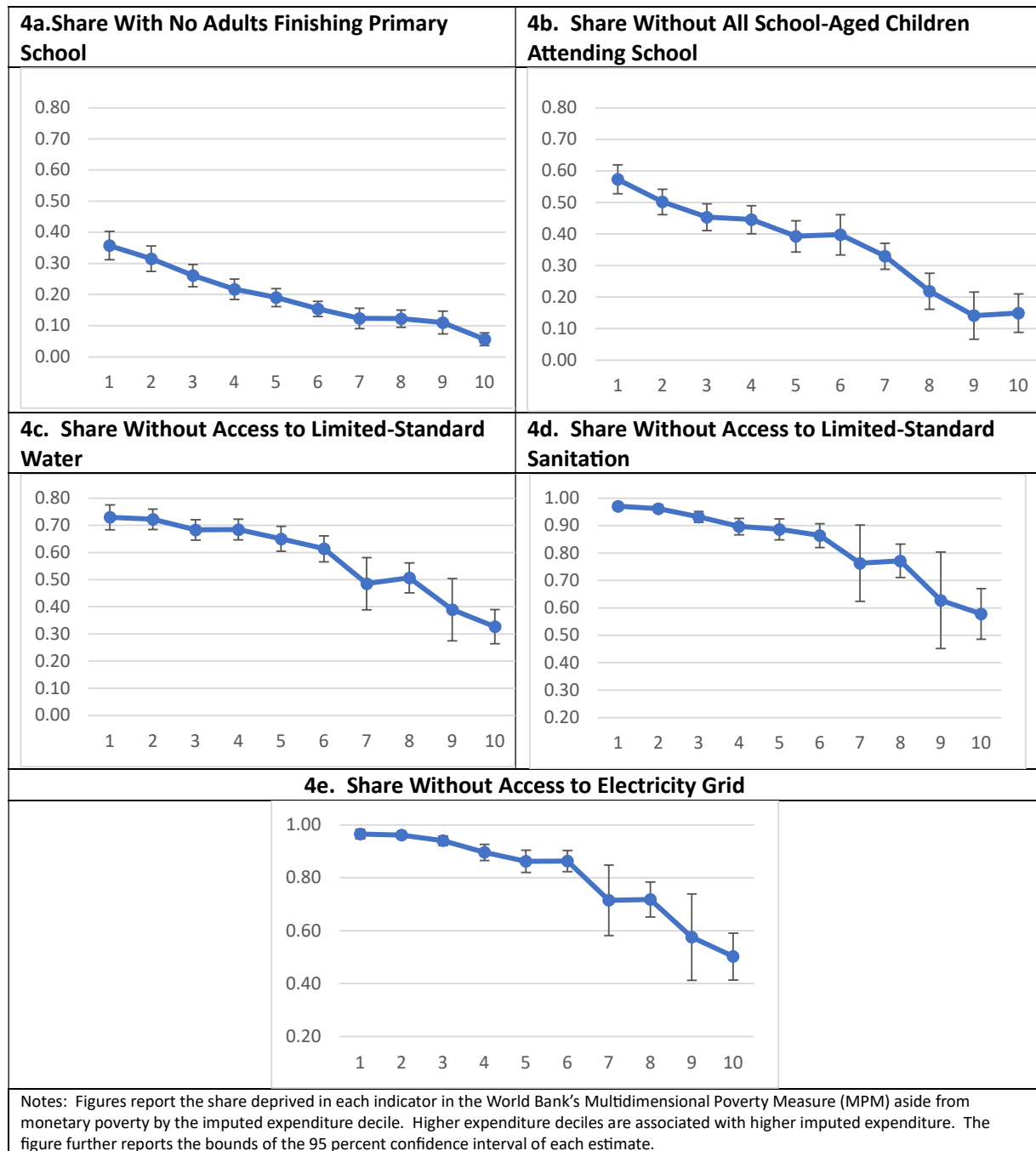
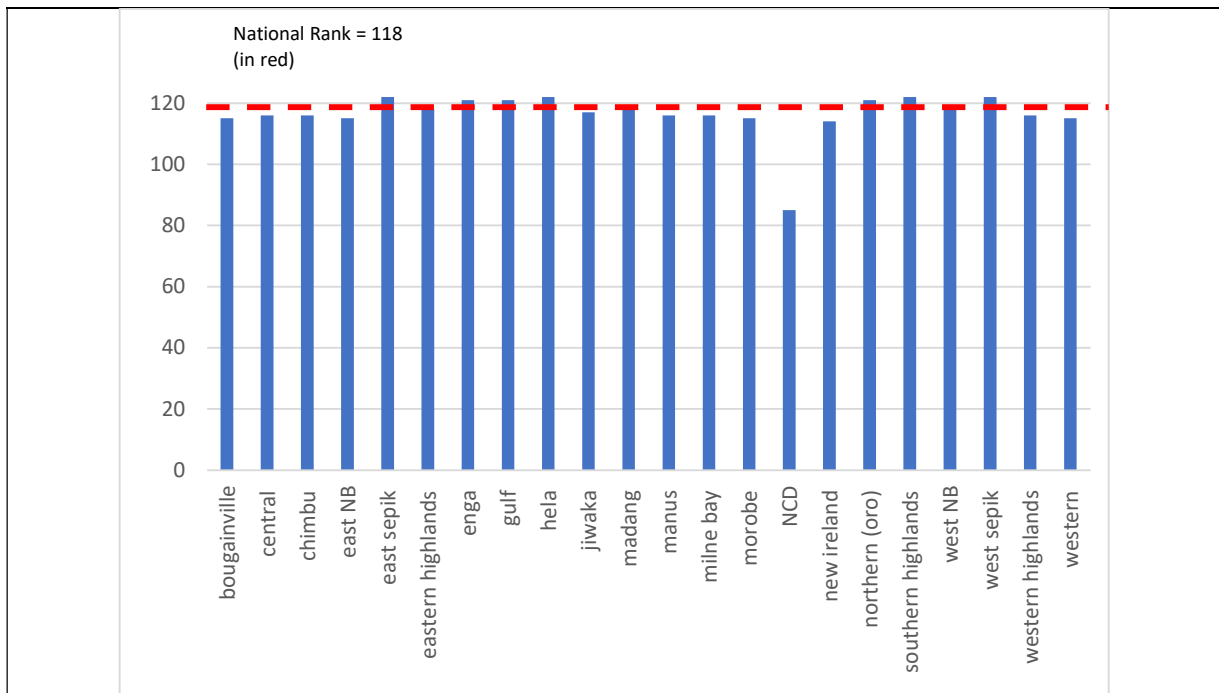


Figure 5. Ranking of the Share that is Multidimensionally Deprived (out of 122) by Province



Notes: Authors' calculations using the 2016-2018 Demographic and Health Survey. The figure reports the international ranking of the share of the population that is multidimensionally poor in each province relative to all the other countries reported in the World Bank's Poverty and Inequality Platform.

Figure 6. Change in Share Deprived in PNG between 2009 and 2016-2018

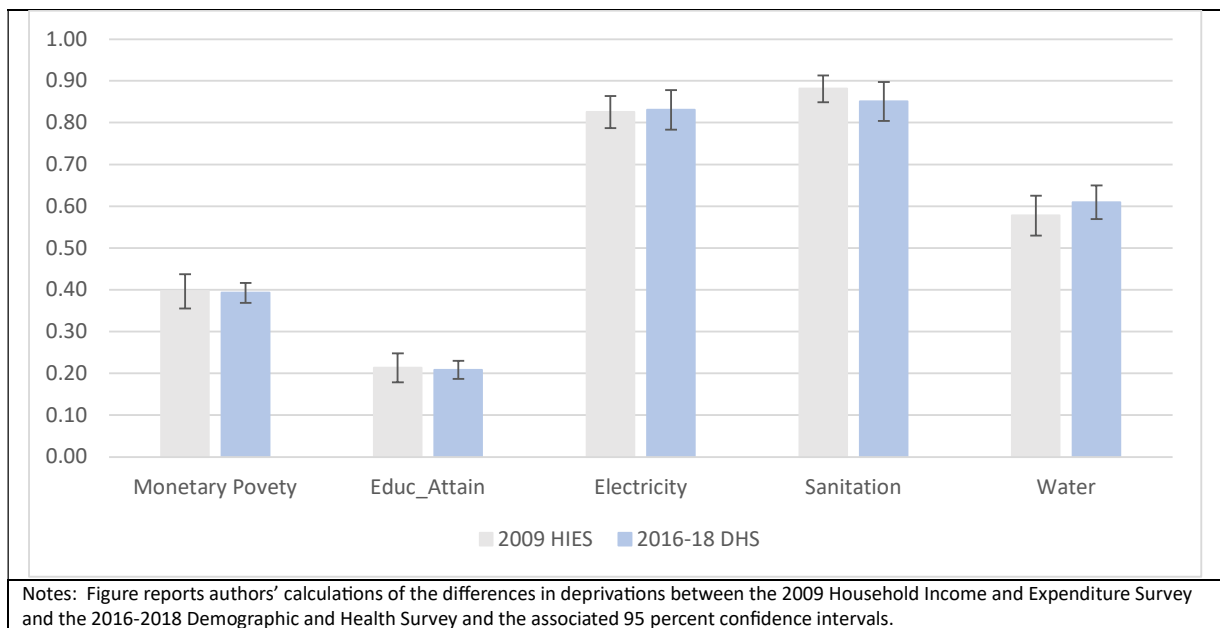


Figure 7. Comparing Changes in PNG to Comparison Regions

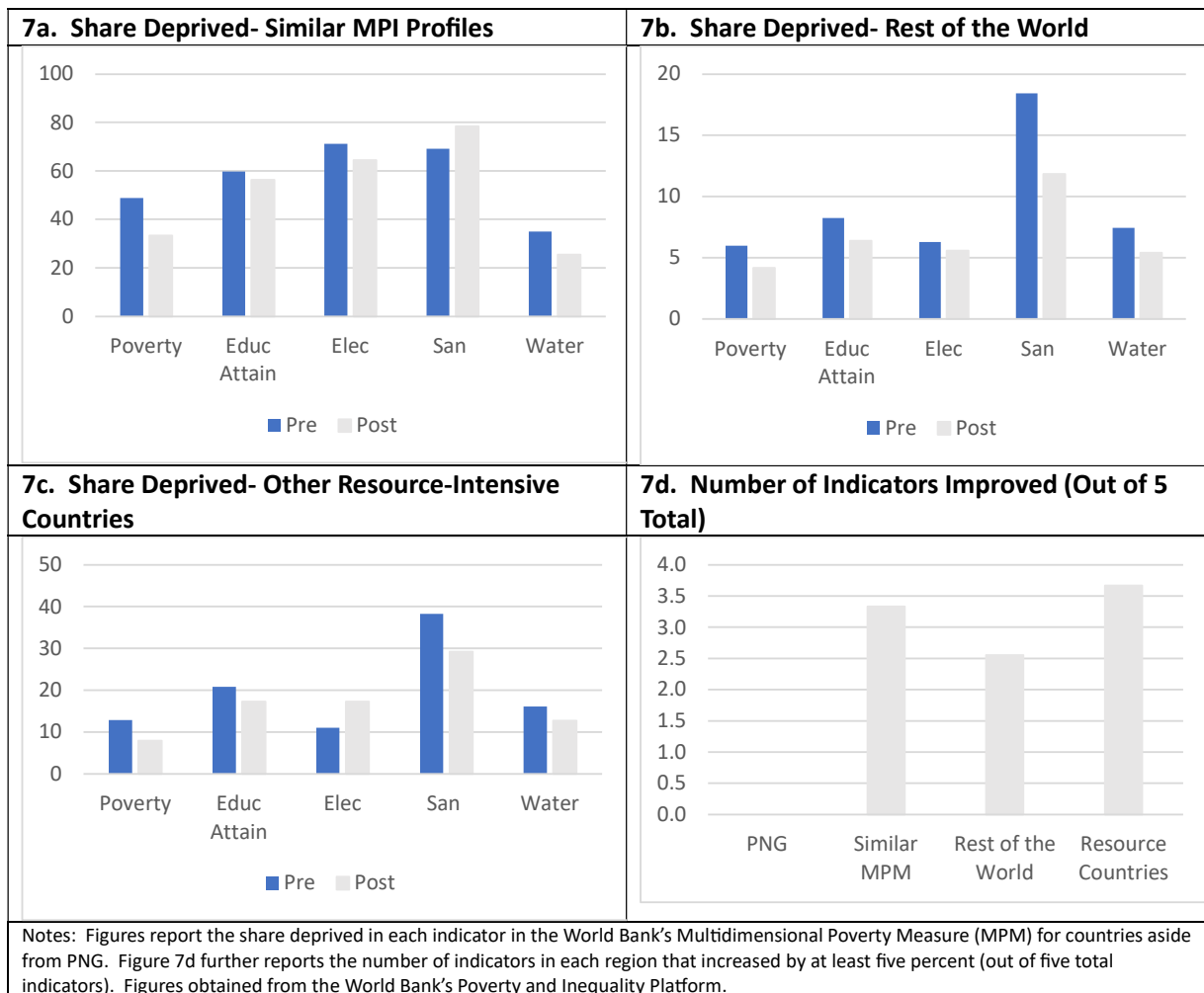
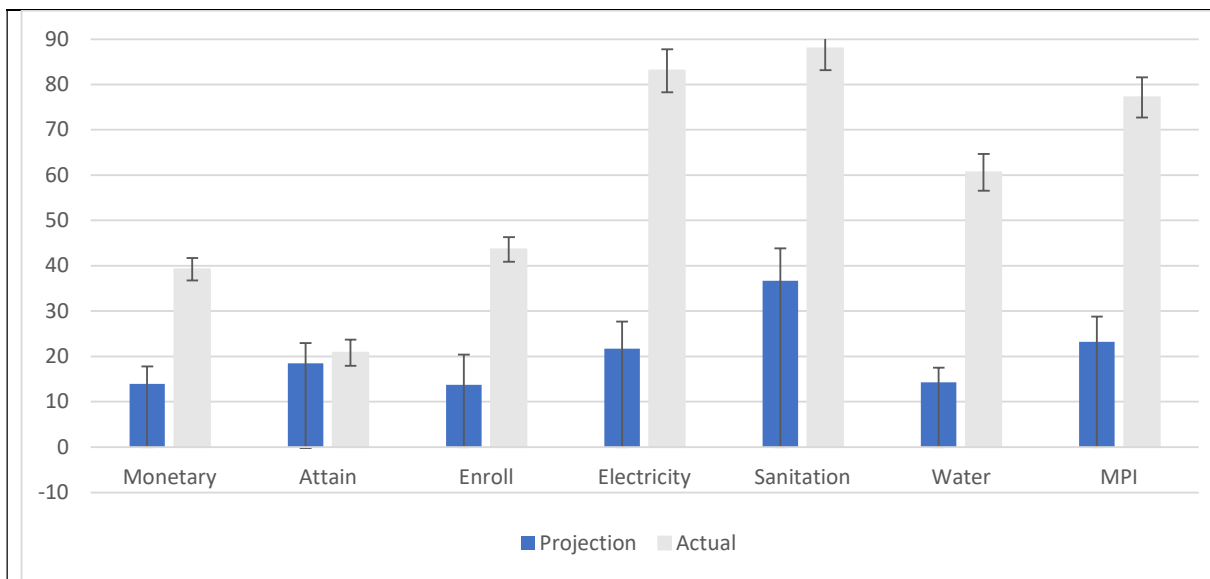


Figure 8. Differences between Actual and Projected Levels of Deprivation based on Economic Activity



Notes: Figure reports the differences between actual deprivations and projected deprivations based on a regression of deprivation on per capita GDP using all countries reported in the World Bank’s Poverty and Inequality Platform between 2014 and 2020. Confidence intervals on the projections are obtained by projecting the level of deprivation using the upper and the lower bounds of the 95 percent confidence intervals of all estimates in the regression.

Figure 9. The Actual Share Deprived Continues to be Significantly Larger than Projected Deprivations when Using Alternative Measures of Economic Activity

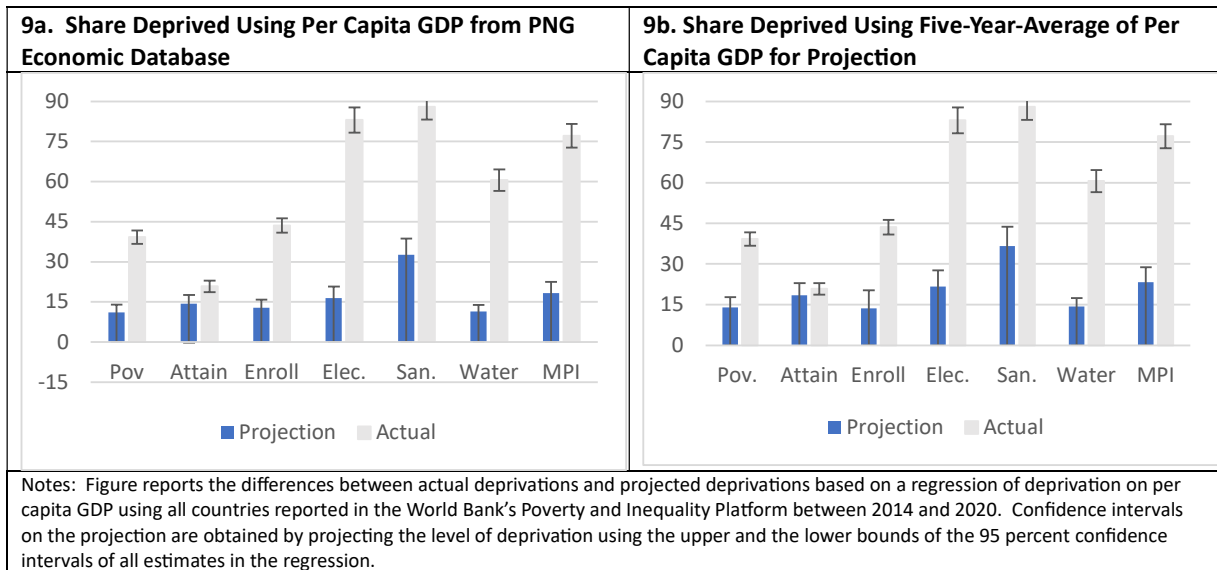
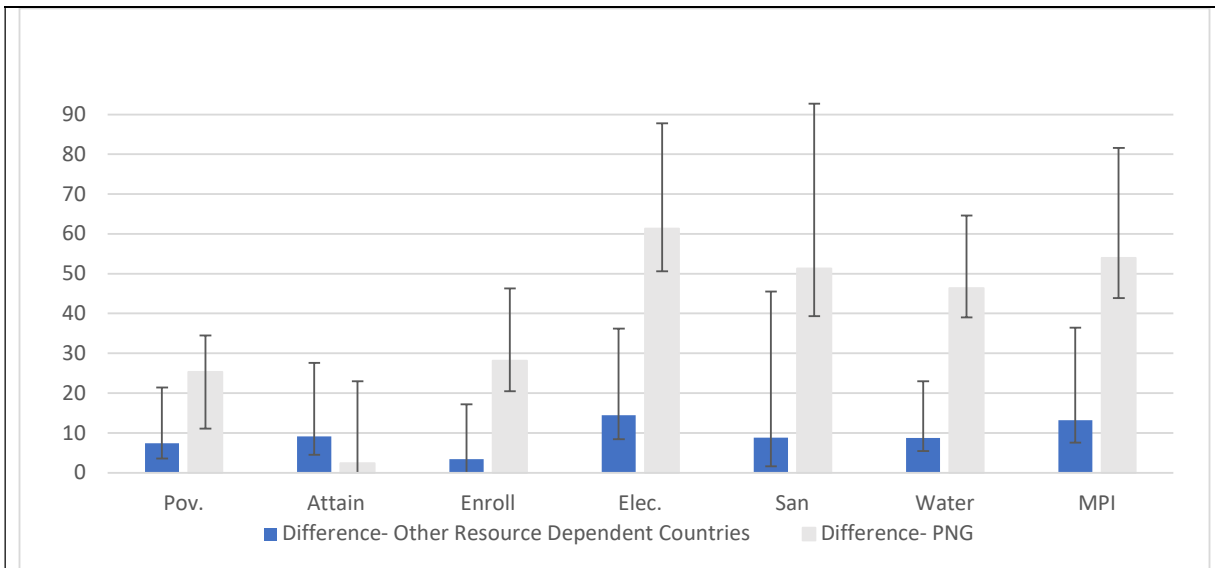


Figure 10. Difference between the Actual and Projected Share Deprived in PNG and Other Low- and Middle-Income Resource-Dependent Countries in the World



Notes: Figure reports the differences between actual deprivations and projected deprivations based on a regression of deprivation on per capita GDP using all countries reported in the World Bank's Poverty and Inequality Platform between 2014 and 2020. The list of resource-dependent countries are obtained from the IMF in their framework for resource-dependent country (IMF 2012). Confidence intervals on the projection are obtained by projecting the level of deprivation using the upper and the lower bounds of the 95 percent confidence intervals of all estimates in the regression.