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POLICY BRIEF

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Can Energy Consumption Reveal the True Size of Bangladesh's Economy? An Empirical Investigation Using Panel Data

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Abstract: Estimation of Bangladesh's GDP has come under scrutiny, especially after the political transition in August 2024, amid concerns of exaggerated growth figures. Using the cross-country relationship between energy consumption and economic growth and leveraging a panel dataset of 196 countries from 1990 to 2023, this paper estimates the 2023 GDP as $314 billion, with a 95% confidence interval ranging from $238 billion to $416 billion. While the upper bound suggests a 5% overestimation, the point estimate implies a 40% discrepancy from official figures. These estimates are, however, subject to various caveats as indirect estimates can in no way substitute formal GDP measurement.

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I. Introduction

Estimation of the gross domestic product (GDP) in Bangladesh has come under intense scrutiny in recent times, especially after the change of the political regime in the country since early-August 2024. While many economists and analysts were sceptical about the consistently high GDP growth claimed by then government in the face of many unfavourable developments such as weaknesses in export earnings and remittances, and subdued private domestic investment activities which remained stagnant at around 22-23 per cent of GDP, the call for looking into GDP data has become more pronounced after the regime change. The White Paper Committee, which was formed by the Interim Government, to undertake a diagnostic of the economy strongly indicated the possibility of GDP overestimation by the previous government. Like in most other countries, GDP calculations stem from the official sources only with the Bangladesh Bureau of Statistics (BBS) being only agency in the country controlling the elaborate architecture of estimation exercises that rely on numerous parameters whose values are regularly assumed or assessed through inconsistent mechanisms and reasonings making it extremely difficult to identity sources of manipulation. Notwithstanding the fact that the measurement of GDP is an imprecise science, the critical underlying concern is any potential manipulation for political gains.

Several studies have documented the issue of GDP overestimation by various governments, particularly in autocratic settings, where regimes often have incentives to manipulate economic data to claim political legitimacy, mask inefficiencies, or influence electoral outcomes. One well-documented strategy is the use of political budgetary cycles, wherein regimes artificially inflate GDP growth—a phenomenon observed in multiple cases examined by Han (2021). Studies leveraging night-time lights data have identified significant discrepancies between reported and actual economic activities, with Martínez (2022) estimating that yearly GDP growth rates in authoritarian regimes are exaggerated by a factor of 1.15 to 1.3. Similarly, the stronger-than-expected correlation between electricity consumption and GDP in autocratic economies suggests systematic overstatement of economic performance (Michalski & Stoltz, 2013; Coutu & Muharremi, 2024). Overestimation may also serve to obscure the inefficiencies associated with large government size, as studies indicate that strong states—particularly those with centralized economic control—are more likely to inflate GDP figures to justify extensive state intervention (Aydin et al., 2016; Ding, 2014).

Growth estimates in the world's two largest emerging economies—China and India—have also been argued to be overstated. In the case of India, Subramaniam (2019) finds that while official estimates place annual average GDP growth between 2011–12 and 2016–17 at approximately 7 per cent, the actual growth may have been closer to 4.5 per cent, with a 95 per cent confidence interval ranging

between 3.5 and 5.5 per cent. For China, Henderson et al. (2012) estimate that its GDP could be overestimated by up to 65 per cent cumulatively, with alternative methodologies—including night-time luminosity data, energy consumption patterns, and indexed GDP proxies—suggesting a significant gap between reported and actual economic performance (Owyang and Shell, 2017).

For Bangladesh, the White Paper Committee (2024) refers to a World Bank analysis of cross-country panel data using nightlight intensity as an alternative measure of economic activity, from which it is inferred that actual GDP growth between FY13 and FY19 was approximately 3.5 percentage points lower annually than officially claimed. The Committee argues that inflated GDP figures were strategically used to reinforce narratives of exceptional "development" under the previous administration. In line with these claims, a City Bank Capital report (2025) projects Bangladesh's actual GDP at $300 billion for FY24, using electricity consumption as a benchmark in comparison with regional peers. However, no detailed empirical exercises were conducted either in White Paper or City Bank Capital analyses.

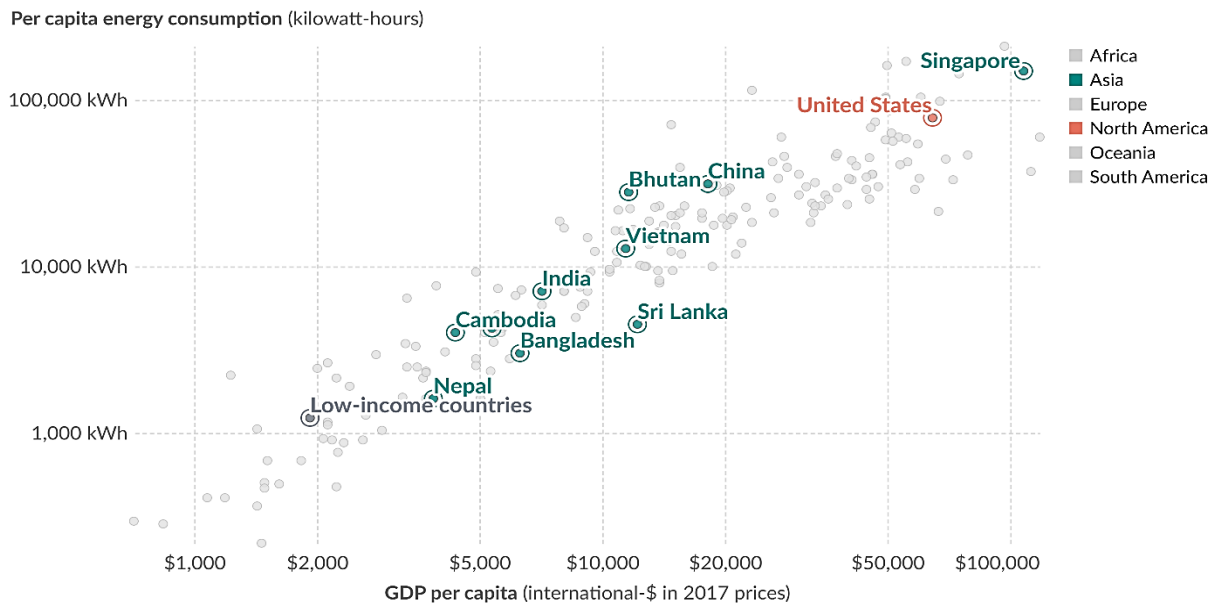
Against this backdrop, this paper seeks to estimate the cross-country relationship between energy consumption and economic growth, leveraging this framework to predict Bangladesh's GDP based on its energy consumption. Cross-country empirical evidence indicates a strong correlation between energy use and economic output, reinforcing the validity of this approach. Given that energy serves as a fundamental driver of economic activity, GDP growth estimates can, to a reasonable extent, be approximated using this method. Additionally, this study accounts for the observed anomaly that Bangladesh, despite its current level of energy consumption, exports a higher volume of merchandise than predicted. The econometric analysis employs panel data fixed-effects estimation, to control for country-specific characteristics in assessing the energy-growth relationship.

II. Energy Consumption to GDP: Stylized Features

Figure 1 depicts the cross-country relationship between per capita energy consumption (measured in kilowatt-hours) and GDP per capita (expressed in international dollars at 2017 prices) across various countries, reflecting a strong positive correlation, where higher GDP per capita is generally associated with greater energy consumption per person. This relationship seems to suggest energy consumption in a cross-country setting can be a good determinant of GDP for an individual country. Figure 2 provides the relationship between two different samples of developing and developed countries including energy consumption and GDP data over the time period of 1990-2023. It is found that, energy consumption is more strongly related to GDP in developing countries.

Figure 1: Energy use per capita vs GDP per capita, 2022

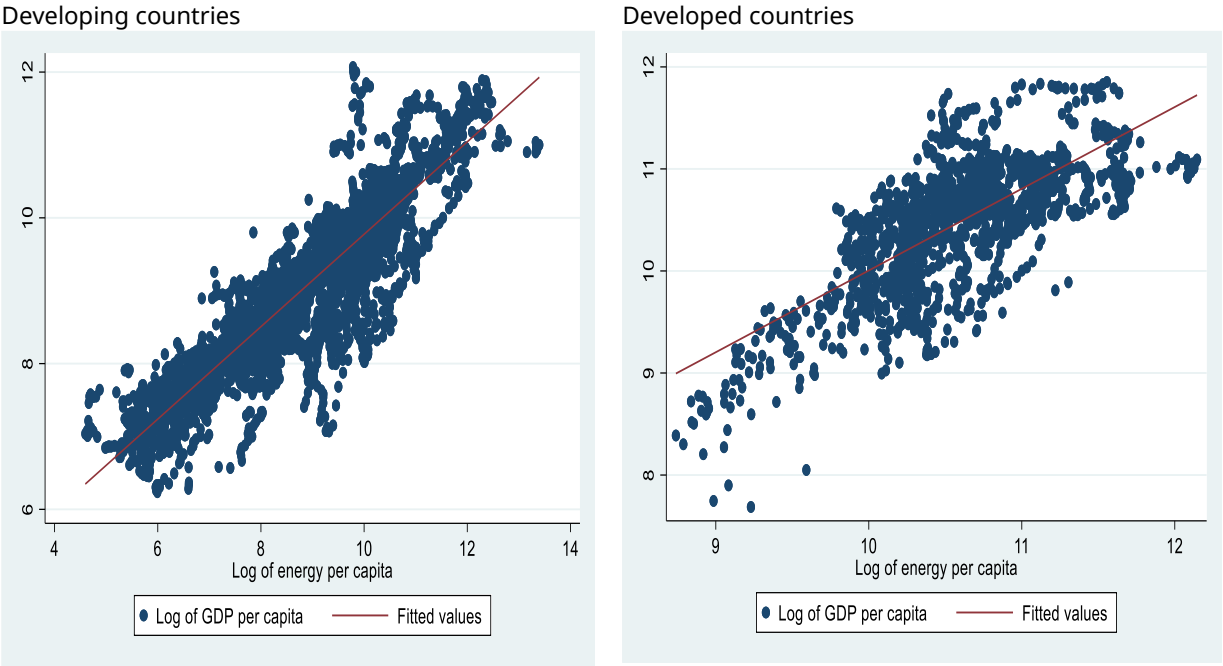
Energy refers to primary energy, measured in kilowatt-hours per person, using the substitution method. Gross domestic product (GDP) is adjusted for inflation and differences in the cost of living between countries.



Data source: U.S. Energy Information Administration (2023) and other sources
Note: GDP data is expressed in international-$ at 2017 prices.

OurWorldinData.org/energy | CC BY

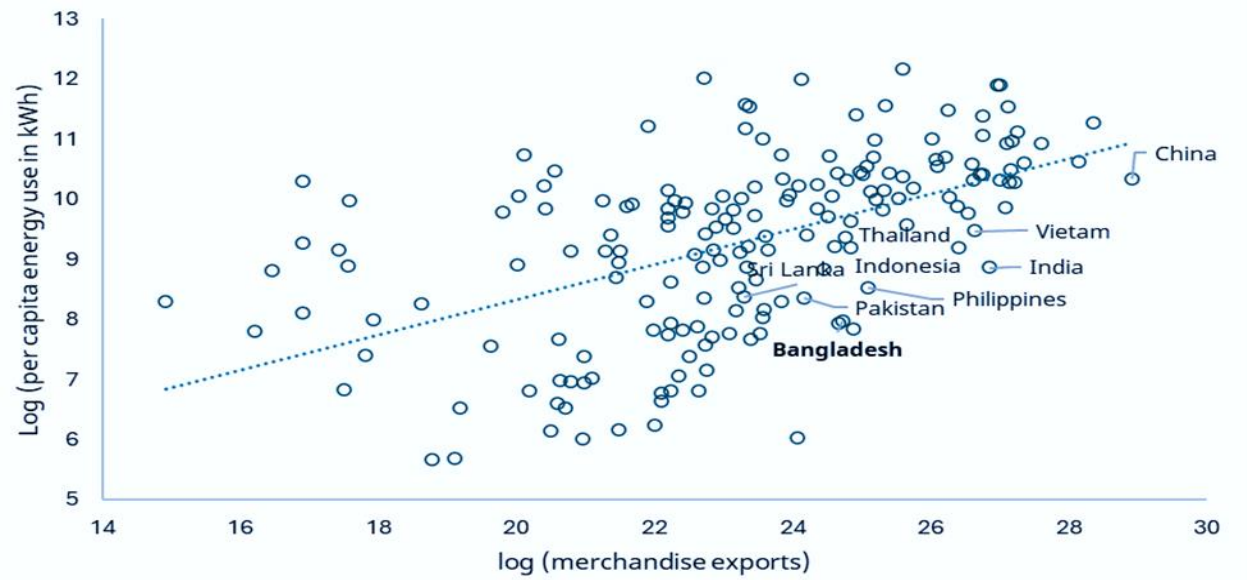
Figure 2: The strength of correlation varies from developed to developing countries (1990-2023)



Source: Authors' representation using the statistical software STATA 17.

Before, going into the estimation of the relationship between, it is important to acknowledge that there is some suggestion of Bangladesh's producing significantly higher level of exports given the level of energy consumption in the country, as shown in Figure 3. There can be various reasons for this including energy use being heavily concentrated in the manufacturing or export sector. One could also argue the country's being more efficient in energy use. Given the evidence in Figure 3, this issue will be taken into consideration in our empirical assessment.

Figure 3: Energy use and exports by global economies



Source: Authors' representation using the data from World Development Indicators (WDI), World Bank

III. Results

A panel dataset of 196 countries for the period 1990-2023 have been estimated with and without country and year fixed effects. These results are summarised in Table 1, which shows a strong positive and significant relationship between energy consumption per capita and GDP per capita, even after controlling for country—and year-specific factors. The results are robust, as coefficients in every model remain statistically significant. The elasticity of energy consumption to GDP is much less than unity and decreases when fixed effects are included, suggesting that some of the observed correlation is due to unobserved heterogeneity across countries or time. When the year fixed effect is included in the model, the elasticity is significantly reduced, meaning that global trends and shocks of energy consumption significantly impact. For simplicity of our analysis, we are only interested in country year fixed effect, which captures time-invariant differences across countries (e.g., geography, culture, or institutions).

Table 1: Energy consumption and GDP relationship in developing countries (1990-2023)

Variables	Log of Per capita GDP	Log of Per capita GDP	Log of Per capita GDP	Log of Per capita GDP
Log of energy per capita	0.56***	0.55***	0.40***	0.36***
	[0.54,0.58]	[0.53,0.56]	[0.39,0.42]	[0.34,0.38]
Constant	4.1***	4.21***	5.72***	5.40***
	[3.93,4.26]	[4.05,4.37]	[5.54,5.90]	[5.22,5.58]
Country FE	No	Yes	No	Yes
Year FE	No	No	Yes	Yes
Observations	4498	4498	4498	4498
95% confidence intervals in brackets * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$				

Source: Authors' analysis using the statistical software STATA 17

Regression analysis in Table 2 shows that globally, a 1 per cent increase in per capita energy consumption results in, on average, a 1.39 per cent rise in merchandise exports. That is, energy consumption has a much stronger impact on exports than GDP. For Bangladesh, it is estimated that at equivalent energy consumption levels, its merchandise export volume is 20.5 per cent higher than the global average. Readymade garments—accounting for over 80 per cent of total merchandise export earnings—have a cometic value addition of around 60 per cent (Razzaque et al., 2024). Estimation of value addition in non-garment export is challenging but is likely to be higher than that of garments and is conservatively assumed at 80 per cent. Utilizing this information on export production, Bangladesh's GDP projections based on per capita energy consumption require recalibration, which is, on average, 13.6 per cent higher than our prediction in Table 1.[1]

Table 2: Relationship between energy consumption and merchandise export (Panel fixed effect model) (1990-2023)

Log of merchandise export	Coef.	Std. error	t-value	p-value	[95% Conf	Interval]
Log of per capita energy	1.39***	0.089	15.62	0	1.22	1.57
Constant	9.41***	0.817	11.52	0	7.80	11.03

Mean dependent var	22.18	SD dependent var	2.81
R-squared	0.28	Number of obs.	5943
F-test	244.04	Prob > F	.
Akaike crit. (AIC)	12639.94	Bayesian crit. (BIC)	12646.63

Source: Authors' analysis using the statistical software STATA 17

Figure 4 presents Bangladesh's predicted GDP (red line) using the elasticity of energy consumption to the GDP of developing countries (column 2 of Table 1) and its energy efficiency in manufacturing exports. The green line plots Bangladesh's actual GDP size. The dotted blue line represents the 95

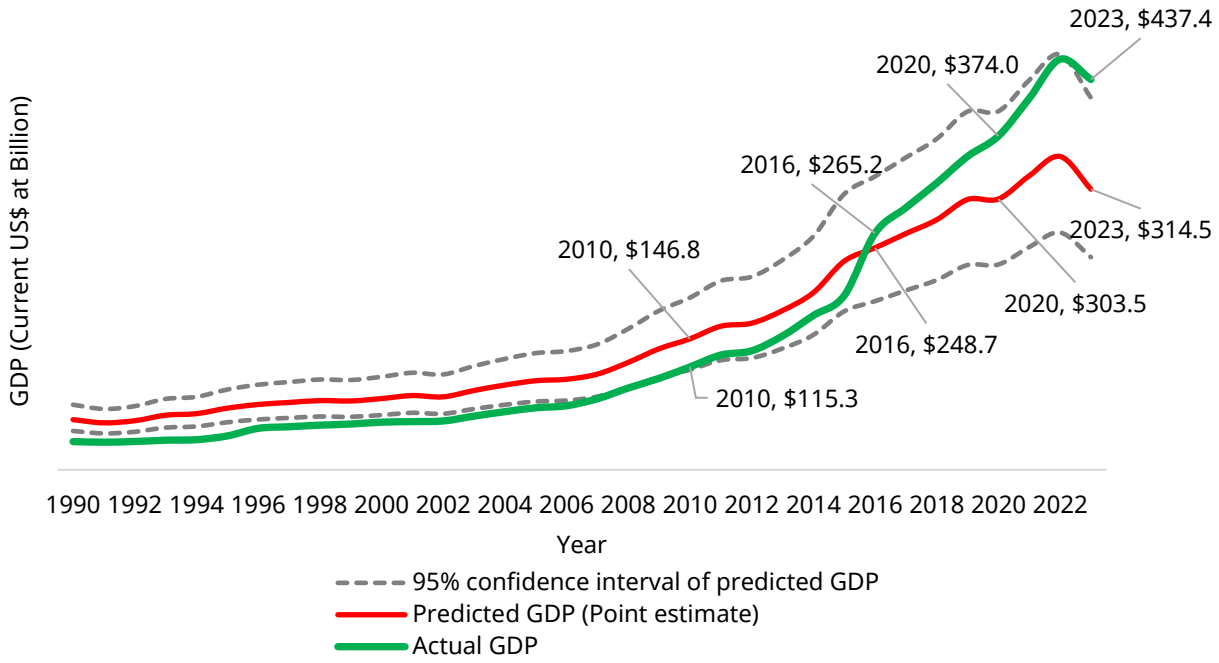
[1] For an 85 per cent RMG and 15 per cent non-RMG export share, the expected value addition is calculated as {(20.5 × 0.85 × 0.64) + (20.5 × 0.15 × 0.8)}, resulting in 13.6 per cent.

per cent confidence interval of the predicted GDP. The predicted line shows how Bangladesh's GDP could grow if it mirrors the typical link between energy use and economic size seen in other developing countries while capitalising on its energy efficiency.

Figure 4 reveals that the predicted GDP (point estimate) overestimated actual GDP size until 2015. However, from 2015 onwards, the actual GDP diverged significantly from the predicted trajectory, which aligns with the observation in White Paper Committee (2024).[2]

Based on this prediction in 2023, the estimated GDP size is $314 billion, with the 95% confidence interval providing a lower bound of $238 and an upper bound of $416 billion. For the higher level, the actual GDP figure is overestimated by 5 per cent, while for the point estimate, the overestimation is by 40 per cent.

Figure 4: Bangladesh's Actual GDP vs Predicted GDP Size (1990 – 2023)



Source: Authors' representation using the regression analysis result from table 1

IV. Caveats of this analysis

While energy consumption is a critical driver of economic activity, utilising it as the only determinant of GDP oversimplifies a far more complex reality. Technological efficiencies, the output composition of economies, urbanisation, and other factors also influence energy consumption, making its

[2] According to the white paper committee, the checks and balances BBS had through technical committees completely broken down from 2015 onwards.

endogeneity a far more intricate issue. The size of the informal economy differs across countries, and the contribution of such economic activities is captured variably, thereby distorting the energy-GDP relationship in a cross-sectional setting (Liddle, 2013). If the objective is to enhance the explanatory power of the model and improve predictability with a narrower confidence interval, variables for which more direct and concrete estimates are available—such as exports, imports, remittances, tax revenue, foreign direct investment, and government expenditure—can be used. Nevertheless, indirect estimates can in no way substitute formal GDP measurement. It is of utmost importance to ensure institutional independence and accountability in data production, and its oversight by an independent office can complement the process.

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