Logarithm of Per Capita GDP as an alternative to per capita GDP on PPP basis

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Abstract: *The Human Development Index has an Income Index which is calculated using logarithm of per capita GDP. The idea is that by taking logarithm the effect of income changes is minimised since income changes are not adequate predicator of human development. Per capita GDP between nations vary widely, but to compare standard of living between nations per capita GDP on PPP basis is often used because, prices vary drastically between nations. Thus per capita GDP on PPP basis is better predicator of standard of living. One is tempted to ask if logarithm of per capita GDP can also be used to compare standard of living between nations.*

I.   Introduction

The Human Development Index is used to assess welfare and development with an indicator that is different from usual per capita gross domestic product. The human development index has three indicators – income index, education index and life expectancy index.

Now income index brings back the per capita gdp. Hence it could be questioned if that is not contradictory, since human development index was supposed to be an indicator that is different from per capita GDP.

But here is the redemption – the income index uses logarithm of per capita gdp and thus minimises wide variations in per capita gdp. This makes because welfare and human development do not vary as much as variations in per capita gdp might suggest.

This is because prices vary widely. Hence per capita gdp is often corrected for price changes and instead of comparing per capita gdp on nominal basis usually per capita gdp is compared on PPP basis.

Here is a thought that is revolutionary. Why not also use logarithm of per capita gdp as an alternate measure of nations income instead of per capita gdp on PPP basis.

Why not give it a shot?
The idea seems absurd. After all nobody has ever thought of comparing logarithm of per capita gdp of nations of world.
But the fact is that logarithm of per capita gdp has been used in income index in human development index. Hence it is appropriate to think that logarithm of per capita gdp may be an economic indicator. It is also useful to compare
The following table compares per capita gdp of few nations on PPP basis and logarithm of per capita gdp and tries to find correlation between the two.
We are including rich countries and middle income countries and poor countries.

Nation	Per Capita GDP(USD 2022	Per Capita GDP (PPP basis) USD	Logarithm of Per Capita GDP to the base e(2.718)
Luxembourg	127,000	140,000	11.75
Norway	92000	78000	11.42
United States	75000	75000	11.22
United Kingdom	47000	56000	10.75
Japan	34000	49000	10.43
Saudi Arabia	28000	55000	10.23
China	13000	21000	9.47
Thailand	7700	21000	8.94
Indonesia	4700	14500	8.45
Vietnam	4100	13000	8.31
India	2500	8300	7.82
Pakistan	1600	6600	7.37
Ethiopia	1100	3400	7.00
Congo	660	1300	6.49

Burundi	300	850	5.70

Source Wikipedia

Analysis

We are trying to analyse if logarithm of per capita gdp can be an alternative to per capita GDP on PPP basis.

The first thing that strikes one is that even after adjusting for PPP(purchasing power parity), the per capita GDP between nations varies a great deal from 850 USD of Burundi to 8300 USD of India 140,000 USD in Luxembourg. The logarithm of per capita GDP varies very little from just 5.70 for Burundi to 7.82 for India and 11.75 of Luxembourg.

Secondly the logarithm of per capita GDP varies in same direction as per capita GDP, not linearly of course, but if a nation has a high per capita GDP than another nation than the logarithm of per capita GDP of that nation will also be higher than another nation. The direction of change of per capita gdp on PPP basis and per capita gdp on nominal basis is not predictable. For instance the per capita gdp of Luxembourg on PPP basis is higher than its per capita GDP on nominal basis , whereas per capita gdp of Norway on PPP basis is lower than its per capita GDP on nominal basis though both Norway and Luxembourg have per capita gdp higher than United States.

II.   Conclusion

The per capita gdp on PPP basis does not actually capture the difference in welfare adequately. This is because the variations in per capita GDP on PPP basis are far higher than variation in education index or life expectancy index of human development index. However, the variation in logarithm of per capita gdp are in the same order as variations in education index and life expectancy index of human development index. Hence there may be a strong case for using logarithm of per capita gdp as an indicator of development. Still better way is to substract number 5 from logarithm of per capita gdp.