

A note on estimating income inequality across countries using PPP exchange rates

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Abstract

The use of exchange rates based on Purchasing Power Parities to compare incomes across countries and over time has now become standard practice. But there are reasons to believe that this could lead to excessively inflated incomes for poorer countries and in some cases also inflate the extent of real changes over time. Estimates of gross domestic product growth in the Chinese and Indian economies in recent years provide examples of this.

JEL Codes: I32, N35, P52

Keywords

Economic development, exchange rates, global poverty, inequality, measurement, purchasing power parities, sustainable development goals, trade arbitrage

Introduction

There are many distinguishing features of Tony Atkinson's work, which have ensured that he had, and continues to have, a far-reaching intellectual influence among economists and policy designers across the world. His analytical innovations were obviously path-breaking and set the standard for poverty and inequality measurements. He was able to apply the concepts he developed to practical estimations with careful and painstaking empirical work. His work was designed not purely for academic consumption, but essentially for influencing policy, with the ultimate aim of a better, more just and humane economy and therefore society. But perhaps most of all, his approach to research was

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characterised by very deep integrity and intellectual honesty, of a kind that has been all too rare within the discipline of economics, especially in recent times.

Taking inspiration from that impressive honesty – and from the associated ability to question everything, even assumptions and axioms that are so standard as to be taken for granted – I consider here a practice that is now almost universal among economists, policy makers and even the general public: the use of exchange rates based on Purchasing Power Parities (PPPs) to compare incomes across countries and over time. In the next section, I briefly describe how the concept of PPP evolved and the current method of measuring PPP incomes. The third section critiques the concept and its application, as well as problems with the use of PPP to measure global poverty (which is integral to the approach of the Sustainable Development Goals (SDGs) and the relative economic size of countries). The fourth section considers the evidence on incomes in China and India according to PPP rates and market exchange rates (MER). The implications of this analysis are briefly noted in the fifth and final section.

PPP: The evolution of the concept and its application

The idea that exchange rates should reflect the relative purchasing power of different currencies was explicit in the work of Gustav Cassel (1967 (1924)), and became known as the PPP theory of exchange rate determination. Cassel himself relied on trade arbitrage (or the ‘law of one price’ for traded goods) to produce this result. Subsequently, various other mechanisms were put forward to justify this approach in a world of open trade and capital flows, including currency markets that respond to different real demand for money functions in different countries, or real investment flows that respond to differential profit rates, or financial flows that respond to interest rate differentials. In fact, however, there has been little empirical backing for this particular approach, and indeed, the degree to which MERs have consistently differed from the PPPs of currencies has been striking. Clearly, the ‘law of one price’ does not hold, not only for price levels across countries (which necessarily include non-traded goods and services) but even for traded items.

Such discrepancies in turn spawned attempts to evaluate incomes across countries not in terms of MERs but some estimation of the actual purchasing power of such currencies. While these have had a prolonged history, they became better-known in the latter part of the 20th century. In the early 1980s, Robert Summers and Alan Heston produced the first of what become known as the ‘Penn World Tables’ of national accounts data in different countries (Summers et al., 1980; Summers and Heston, 1984), on the basis of price comparisons that took into account the purchasing power of currencies across countries, relative to the US dollar. When they were first generated, the Penn World Tables were relatively crude, using a range of estimates and sometimes guesstimates of prices in different countries in the absence of available price surveys, and basing the index on a ‘representative basket’ derived from expenditure patterns in the United States. These authors acknowledged subsequently that their estimates were more likely to be valid for countries with per capita incomes close to that of the US, less accurate but still ‘acceptable’ for countries with less than half of the US per capita income at MER, and significantly less valid for countries with even lower per capita incomes (Heston and Summers, 1996; Summers and Heston, 1988).

Ever since then, the urge to use some deflator of MERs to compare incomes across countries has been strong. The economic theory behind this is the evidence that currencies typically can command very different baskets of goods and services in different countries, relative to what is suggested by prevailing MER. Typically, lower income countries have lower prices of a range of goods and services, and therefore lower aggregate price levels, which enable their currencies to have greater purchasing power within the domestic economies. This in turn suggests that comparative assessments of real per capita incomes in less developed economies that are based on MER consistently undervalue the non-traded goods sector, especially labour-intensive and relatively cheap services, relative to more advanced countries. They therefore lead to the underestimation of real incomes in these developing economies. In some cases, it has been suggested, this difference is so significant as to make inter-country per capita income comparisons based on MER misleading.

Essentially, therefore, the idea of using PPP exchange rates is to control for differences in price levels and standards of living in different countries. PPP rates have been typically referenced relative to the US dollar. The initial benchmark, as noted earlier, was the representative expenditure basket for the US (for both total expenditure or gross domestic product (GDP) and for consumption). But it is obvious that there is no reason for this basket to be the same or even similar in other countries; indeed, there is in fact every reason why baskets should be different in countries at very different levels of per capita income. To take only one example, the share of food in the average consumption basket is likely to be much higher (at nearly half) in a country like India, compared to the US (where it is around 10%), while the share of other forms of consumption (say on consumer durables) would be significantly higher in the US. If these prices move differently over time, this in turn would also change the actual purchasing power of a currency, but in a way that would not be captured with an unchanged PPP ratio.

Significantly, Heston and Summers (1996) also acknowledged that estimation errors reduced as per capita incomes increased – or to put it the other way, the lower the per capita income of a country, the greater the estimation error. This in turn could affect not just the income comparisons in any one year, but also their movement over time. Using the differences derived in a particular year to estimate changes in incomes of different countries over time using the same weights, could therefore not only be problematic for that one period, but also would be likely to generate potentially misleading trends over time, if some prices moved faster than others.

Concerns and criticisms like this meant that the estimation of PPP rates evolved considerably, and became much more sophisticated and nuanced in generating the comparison basket. The International Comparison Project (ICP) now managed by the World Bank is the culmination of this approach: an estimation of GDP across countries and over time, based on periodic surveys and with some rough attempts at normalising for the basket of goods and services whose prices are compared. This results in PPP exchange rates, which have become the standard way of comparing incomes across countries and over time, and provide the underpinning for all estimates of international inequality.

The first significant revision of PPP generated by the ICP was in 2005, when for the first time, several countries for whom price surveys had not been conducted (including China) were surveyed. This led to significant revision of the PPP-based income

estimates, as discussed below in the cases of China and India. The 2005 estimation also had several problems relating to the basket of goods and services used for the price measurements in different countries and regions, which were still heavily driven by US expenditure patterns, as elaborated by Reddy and Pogge (2010).

The most recent PPP estimates relate to those with reference year 2011, when the ICP has sought to make the estimation more regionally relevant, but thereby generating associated concerns about the comparability of the regional baskets given the varying weights of different commodities in the different baskets. The World Bank (2015) has argued that particularly for the 2011 estimation,

(c)onsiderable effort was made to ensure that the list was not dominated by the products of any one region and that the products are global so that they could be priced across most if not all regions. For the main price survey, regions developed their own regional product list by revising their regional product list from previous ICP exercises. The global core products were combined with those on the revised regional lists, and care was taken to avoid duplication. Inclusion in the final regional list depends on a product's availability within the region (the number of economies in the region that could price it) and on its importance within the region (the number of economies in the region that could price it and for which it was important). Global core products selected for the final regional list are treated as regional products meeting the same validation criteria and included in the calculation of regional PPP.

For each reference year (2005 and 2011), the following data were used for all economies included in the comparison: prices for selected products chosen from a common basket of precisely defined goods and services, a detailed breakdown of the national expenditure according to a common classification, MERs, and resident population. The prices and expenditures are used to calculate PPP and real expenditures (or volumes), the MERs and PPP rates are used to calculate price level indexes, and the population totals and real expenditures are used to calculate real expenditures per capita. Prices and expenditures are intended to cover the entire range of final goods and services comprising GDP by expenditure classification.

The way the PPP exchange rates are currently calculated in the ICP is as follows: There is a survey to measure national annual average prices of a set of predesignated products and services. Prices for the main survey are collected from a sample of outlets in rural and urban areas, with most countries collecting quarterly data on prices throughout the reference year (although this has not always been achieved in every country). Regional PPP rates are imputed using national accounts expenditure as weights and integrated through a Fisher index.¹ A set of 'global core products' (selected for the specific purpose of providing links or overlaps between the regional comparisons in which they are priced) is used to link the regions into a global comparison to form a global set of PPPs.

The PPP rates so derived are very widely used, serving a multiplicity of functions in global policy discussions, as well as in international negotiations and even in domestic policy considerations within countries. PPP exchange rates are now the basis on which the relative sizes and shares of different national economies in the global economy are assessed; per capita GDP in PPP terms is used to measure countries' economic progress, their relative economic strength and even their responsibilities in such areas as carbon

emissions; an international poverty line has been developed in terms of 2011 PPP US dollars and recommended for use for the first SDG target of eradicating extreme poverty; PPP per capita incomes provide one-third of the weight in the Human Development Index that is supposed to be a broader measure of social progress and conditions of life; and so on. Scholarly attempts at measuring global inequality in any one period as well as over time (such as Milanovic, 2016) also use PPP data generated by the ICP.

Indeed, the extent to which PPP measures are now routinely taken for granted as indicating real incomes across different countries is somewhat surprising, given the various conceptual and statistical leaps that are involved in such calculations. Some of the concerns are noted below.

Concerns with PPP measures of income and poverty

When the first set of PPP estimates was revealed in the Penn World Tables, several problems were noted with both the application of the theory and the quality of the data used to calculate the numbers. As noted above, the ICP has attempted to deal with several of those concerns over time, and particularly in the most recent set of data based on reference year 2011. Nevertheless, some issues remain. An underlying assumption made by the ICP is that the structure of each country's economy is similar to that of the benchmark country (the US) and changes in the same way over time beyond the reference year (McCarthy, 2013). This is obviously very different from the reality: not only do different countries' economic structures differ dramatically, but the way those structures evolve over time may also be completely different. In particular, treating the US economy, which is a large mature developed economy, as the benchmark for all other economies is fraught with problems. These problems are especially evident in relation to major emerging markets. In the period 1980 to 2010, for example, China not only had a much higher share of investment in total expenditure than the US, but that share also increased over time – and the share of household consumption decreased over time, once again unlike the US.

Another problem is that of discovering the actual prices of goods and services, and determining the representative prices in each country, since prices of goods and services also vary substantially within countries. Clearly, the choice of location and time period of the price surveys and the method of aggregation of the survey data are important and can make significant differences to the results. The 2011 estimate sought to improve on the previous somewhat more haphazard attempts at price surveys, but even so the experience of the ICP over time points to both the difficulties involved and the issues with the reliability of the associated PPP data. The case of China illustrates this very well: before 2005, no survey was undertaken at all in China, and the PPP data for China were therefore simply estimated using available secondary data. The findings of the 2005 price survey in China indicated much higher than projected prices, which then led to a 40 per cent decline in the PPP-adjusted per capita GDP, compared to the 2000 estimate! However, that survey also was confined to only a few regions/locations, which in turn created doubts about whether it was representative. The subsequent 2011 price survey then found prices to be somewhat lower (in the national average of quarterly surveys) which then led to a significant upwards revision in the PPP-adjusted per capita GDP.

Reddy and Pogge (2010) have critiqued the use of PPP-adjusted incomes to derive an international poverty line (at USD1 a day or USD1.08 a day, etc. – now increased to USD1.90 a day for the SDGs). They pointed out that, first of all, the PPP rates derived are themselves highly dependent on the choice of the base or reference year, which is obviously completely arbitrary. Furthermore,

The PPP depends upon the weights assigned for specific commodities. Allowing such weights to be determined by actual consumption patterns does not avoid arbitrariness: Consumption patterns vary from country to country due to diverse tastes, price vectors and income distributions. And the fact that only a small fraction of a country's consumption expenditure for medicines, for example, does not show that the price of medicines is of little importance for gauging the standard of living of its inhabitants. (Reddy and Pogge, 2010: 50)

Therefore, broad-gauge PPP rates derived from national income accounts are likely to be quite inappropriate to compare living standards across countries, or to permit comparative assessments of poverty and income distribution. These authors conclude that PPP rates from existing methods 'reflect quantities and prices that have no relevance to absolute poverty assessment' (Reddy and Pogge, 2010: 52).

This critique was not effectively countered by those associated with generating this international poverty line in the World Bank (see, for example, Ravallion, 2010). Concerns with the use of the standard international poverty line expressed in terms of PPP US dollars were also expressed by Angus Deaton (2010). He noted four specific aspects of ICP construction that necessarily imply that PPP comparisons between widely different countries rest on weak theoretical and empirical foundations. First, the absence of weights within basic headings of goods and services, including the lack of representative weights, can result in these basic headings being priced using high-priced unrepresentative goods that are rarely consumed in some countries (e.g. packaged corn flakes would be available in poor countries, but only accessed by a relatively small minority of rich people).² This is a particular concern for the ring of countries that provide the inter-regional linkages, where identical goods are matched across very different countries. But in fact,

... there is no non-controversial way of quality correcting price differences. Matching identical goods does not do the job if those goods are used in different ways in different countries, and the problem is intractable without some way of mapping (widely different) goods into common functionings. (Deaton, 2010: 33)

Second, the country PPP rates are constructed from the prices of basic headings using expenditure weights from the national accounts – but these do not reflect the consumption patterns of people who are poor by global standards. Third, the different regions are joined using the region-wide 'super' PPP rates, which generate, for example, a price level for all of (say) Asia relative to the Organisation for Economic Co-operation and Development (OECD) countries. Such aggregation is inevitably subject to all sorts of conceptual concerns as well as possible measurement errors, but these indices then play an important role in determining global inequality. Fourth, Deaton notes the presence of urban bias in the collection of price data through the surveys, particularly in large

countries such as China, but also in many other countries. All of these must generate some healthy scepticism about the use of ICP data to estimate global poverty and inequality.

Indeed, more recently, Tony Atkinson himself, in his capacity as the lead author of the Report of the Global Commission on Poverty, came to a rather similar conclusion. The Report therefore argued for abandoning altogether the practice of using a single international poverty line denominated in PPP USD:

Why do we continue to quote the International Poverty Line in terms of U.S. dollars? For the measurement of global economic magnitudes, as is the primary purpose of the ICP, the United States may be an appropriate benchmark, but it is not apparent why the global poverty objective should be stated in terms of the currency of a country where relatively few people live below the extreme poverty line. To this end, and to underscore the global political legitimacy that the extreme poverty line has now achieved, it is recommended that it should be cited in general terms without reference to a dollar amount, and given in each country in terms of its own currency per day. (Global Commission on Poverty, 2017: 17–18)

But it could further be argued that the ICP measures of PPP income (both aggregate and per capita) may not always be reliable estimates of economic magnitudes either. Indeed, there is a less discussed but possibly even more significant conceptual problem with using PPP estimates. In general, countries that have high PPP, that is, where the actual purchasing power of the currency is deemed to be much higher than the nominal value, are typically low-income countries with low average wages. (This is effectively what was recognised early on by Summers and Heston, in some form, as the greater margin of error for poorer countries.) This occurs precisely because there is a significant section of the workforce that receives very low remuneration, which then means that goods and services are available more cheaply than in countries where the majority of workers receive higher wages. When even these activities are further subsidised by the widespread incidence of unpaid labour, as is typically the case in poor households in low-income countries, then it is clear that the greater purchasing power of that currency reflects conditions of indigence and low or no remuneration for what could even be the majority of workers. Therefore, using PPP-modified GDP data may actually miss the point, by seeing as an ‘advantage’ (of greater purchasing power of a given monetary income) the very feature that reflects the greater absolute poverty of the majority of workers in an economy.

The analytical implication of this is analogous to the attempts to ascribe some value or price to goods and services that are provided through unpaid labour within households. Since the extent of such unpaid provision is typically much more in poorer households (and of course also tends to be gender-differentiated, though that is a separate issue for current purposes), it follows that valuing such goods and services and adding these to the assumed incomes of the household is effectively a double whammy: not only are such households so poor as to have to rely on a significant amount of unpaid labour for their subsistence consumption, but then they are described as being less poor simply because they get the results of that unpaid labour. In effect, the ICP’s PPP exercise is doing something similar in its circular reasoning: noting that people in poor countries have access to cheaper goods and services precisely because they are poor, and using that to add to their notional (PPP) incomes.

This point deserves to be restated somewhat differently so as to clarify the matter further. Essentially, when we compare incomes across countries, and particularly the US (say) with countries that have significantly lower per capita incomes, we should bear in mind that a low wage economy is also a low exchange rate economy and therefore a low price economy (in US dollar terms). This is essentially because, given world prices, nominal wages in an economy have an independent effect on prices, and the lower nominal wages in the poor country therefore affect domestic price levels. This is definitely true of non-tradeables, but it is also true of tradeables because of oligopolistic pricing to market, and so on. Further, this is true even when the distribution of income (or the wage share) changes within a country. This means that PPP income estimates are effectively overstating incomes of poorer countries *when it comes to comparing incomes across rich and poor countries*.

It is certainly true that MER-based comparisons also have a number of problems in addition to those highlighted by the proponents of PPP-based comparisons. For example, they are highly susceptible to foreign exchange market volatility driven by capital flows. Nevertheless, they may still be closer to the mark when comparing incomes across countries. In a poor country, if for some reason, there is capital flight that leads to a sustained depreciation, then it does involve a decline in income relative to the richer economy. If capital flows are volatile, then the impact on incomes would depend on the average over the year. For example, when the Thai baht depreciated by 70% in July 1997 relative to the US dollar and then stayed at that low level for nearly 2 years, this did actually reflect a genuine relative impoverishment of the Thai economy *relative to the US economy* (in terms of Thai per capita GDP as a proportion of US per capita GDP). However, the PPP decline in relative income was much lower.

So the absolute level of wages matters in determining the exchange rate (even recognising the added volatility and noise created by financial flows). In a world in which both trade and investment flows are more globalised, this point becomes even more important.

This has three important implications when it comes to international comparisons of income and therefore inequality. First, PPP tends to overstate the incomes of poorer countries in the manner so described. Second, because the base or reference year includes this overestimation, subsequent increases in economic activity get further magnified, so that the same growth rate applied to both MER and PPP exchange rates generates much larger absolute increases in income in PPP terms. This then leads to much greater absolute size of these economies measured in PPP, in the aggregate as well as in per capita terms. This may well be misleading in terms of the degree of increase, especially when inflation rates are higher in those poorer economies, and lead to overestimation of the actual size of such economies as share of global output. Third, this will necessarily affect calculations of global inequality that are made using PPP incomes.

In what follows, I consider this argument with specific reference to incomes in China and India, measured in both PPP and MER.

Estimating incomes in China and India

China – and to a lesser extent India – are seen as the two large developing countries that have grown rapidly in the period of globalisation. Indeed, all estimates of global ‘convergence’ depend heavily on the faster growth exhibited by these economies over the past

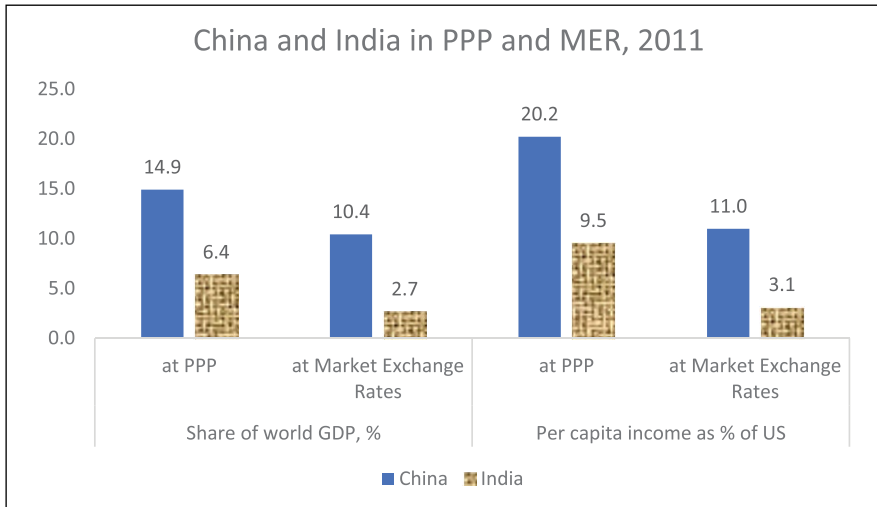


Figure 1. China and India – share of world economy in PPP and MER, 2011.

Source: World Bank.

three decades, especially given that together they account for around 40% of the world's population. Integrated estimates of global inequality also heavily depend on the estimations of income in these two countries – and it is worth noting that without exception, all such estimations use per capita income based on PPP US dollars (Figure 1).

Figure 1 shows what a difference that makes, using the 2011 PPP estimates. In PPP terms, China's share of global GDP increases by more than 40% compared to MERs, while India's goes up by 84%. In PPP terms, China becomes the largest economy in the world; in MER, it is still smaller than the US. In terms of the per capita income relative to the US, the difference is even more stark: China's per capita income relative to the US at the PPP ratio of 20% is nearly double the equivalent MER ratio, while for India, it is more than three times. In fact for India, the per capita income comes to only 3% of that of the US in MER. The perception of the dramatic emergence of these two economies changes substantially if viewed only in MER. The Indian MER (Rs per USD) in 2016 was 67, but the PPP equivalent was 17.5 – a ratio of 3.8: in other words, the PPP per capita income was nearly four times the MER per capita income.

Clearly, the use of PPP involves a very significant increase in both aggregate and per capita incomes, leading to possibly an exaggerated estimation of the economic size of these countries. But why should this be an exaggeration or overestimation at all? Essentially for the reason outlined earlier, that the PPP conversion factor (the estimated number of units of a country's currency required to buy the same amounts of goods and services in the domestic market as one US dollar would buy in the US) tends to be lower in countries with lower per capita income. Therefore, the poorer the country, the greater the degree to which the PPP income is likely to be higher than the MER income. Chart 2 indicates how, as Chinese per capita incomes increased, the PPP conversion factor also increased. There was also some increase for India, but less marked, just as India's aggregate income growth was also less rapid (Figure 2).

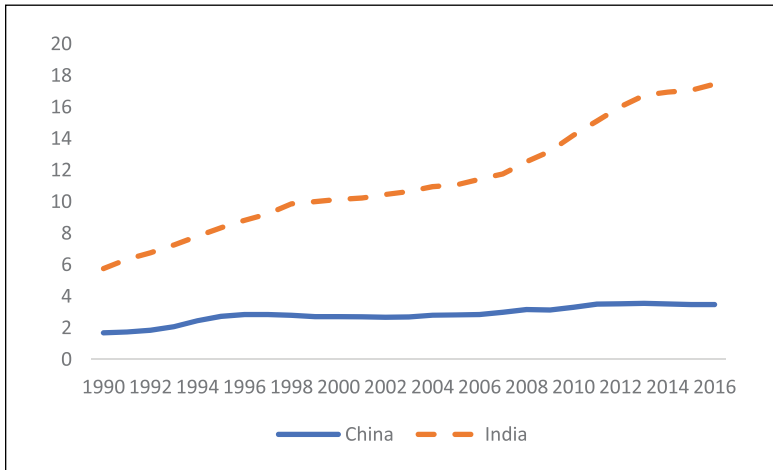


Figure 2. PPP conversion factors, GDP.

Source: World Bank.

The period when the country is poorer defines the base on which further increases in GDP are calculated on the basis of growth rates determined in local currency units. When these rates of growth are imposed on the PPP base year incomes, they obviously lead to larger PPP incomes over time. Charts 3 and 4 show that this was clearly evident for both China and India, with the absolute gap between PPP and MER per capita incomes increasingly quite dramatically over the period between 1990 and 2016. (Incidentally, the difference is just as marked when comparing the constant price data for 2011 PPP GDP estimates and MER GDP in constant 2010 USD.) The point here is not the relative change, but the absolute difference, and the fact that this creates a perception of significantly higher per capita GDP than may be warranted by the MER GDP data.

It stands to reason that the difference between PPP and MER would reduce – not necessarily over time, but with increasing incomes of the lower income country. As aggregate incomes increase, wages and prices in that economy also increase, typically relatively faster than in richer countries, thereby reducing the so-called ‘PPP advantage’. This is amply shown in the case of China – Chart 3 shows how the ratio of per capita income measured in PPP terms to that measured in MER declined from a high of nearly 4 to less than 2, particularly after the mid-2000s as the Chinese economy actually became richer. This was essentially because prices in China (as expressed in the GDP deflators in Renminbi and in current USD) moved upwards faster than in comparison countries especially in the later period, something that the assumption of the smooth PPP line fails to capture (Figures 3 and 4).

In India, the change in the ratio of PPP to MER GDP also declined over the 2000s, over the period of rapid economic growth. But since 2010, it has been rising once again, for reasons that are not immediately evident and therefore require more investigation. Meanwhile, the absolute gap between the PPP and MER GDP has grown to very significant levels.

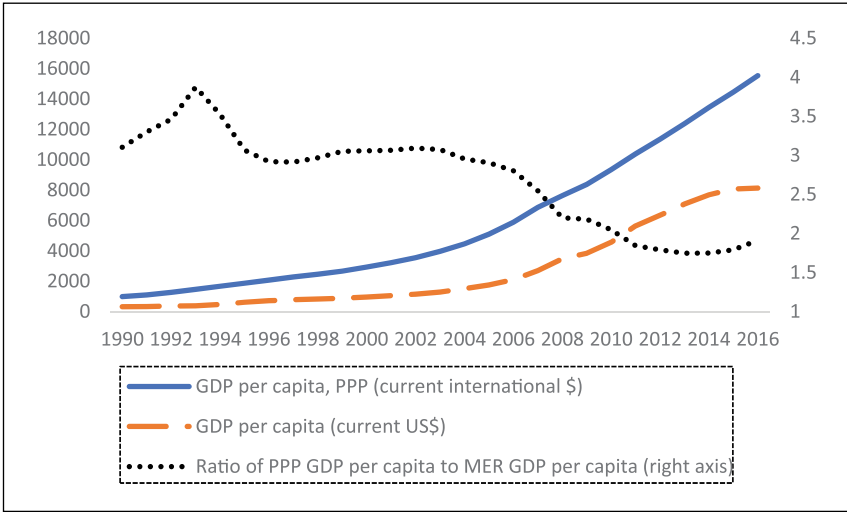


Figure 3. China: GDP per capita in PPP and market exchange rates.
Source: World Bank.

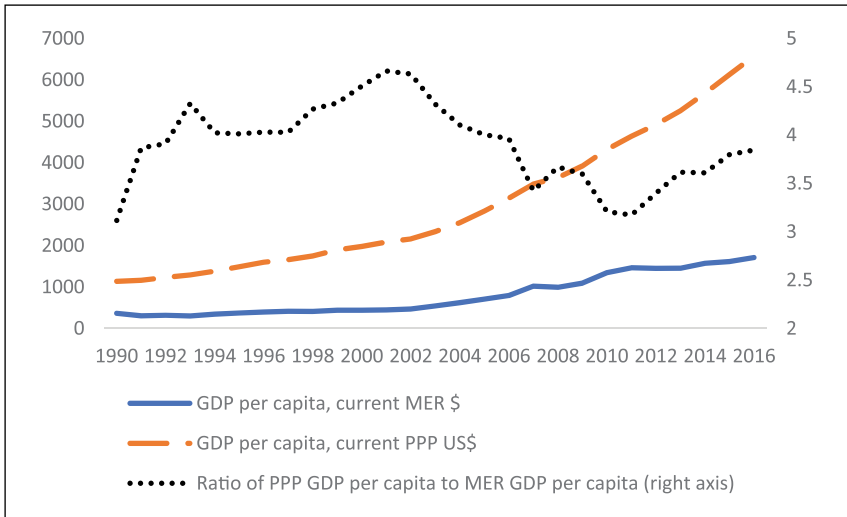


Figure 4. India; current GDP per capita in PPP and MER.
Source: World Bank.

Conclusion

What all of this suggests is that a country’s exchange rate tends to be ‘low’ – or the disparity between the nominal value of the currency and its ‘purchasing power’ tends to be greater – because the wages of most workers are low or even non-existent. A

low currency economy is a low wage economy, and as its wages and therefore prices increase over time, the PPP gap tends to be progressively reduced. This makes inter-country comparisons of per capita income based on PPP potentially misleading in that they do not properly reflect the actual material conditions of most of the people living in them. This can also affect the consideration of changes in real income over time.

There is an additional point that deserves to be made with respect to looking to international comparisons of income that determine the relative size of national economies in the global economy. In a peculiar way, the PPP estimates almost assume closed economies, in that national prices are taken to be determined independently of global prices. As the countries in the world have got more and more integrated through trade and investment flows (all of which are naturally calculated in MER not PPP terms) such underlying assumptions become even more untenable. When economies have shares of external trade to GDP of around half or even more, there is something slightly absurd in relying on estimated PPP rates that are so far removed from the operative MERs that are not only observed but also have to be faced by all agents in the country.

While all this does not amount to a comprehensive indictment of the use of PPP exchange rates, it does point to the need for abundant caution when using these estimates. It may well be asked, if we cannot use PPP measures to compare incomes across countries, then what can we use? To begin with, it is clearly worth always viewing these measures together with the estimates based on MER. But there is the further issue of what precisely we need these estimates for. As Deaton (2010) noted,

(g)lobal poverty and global inequality measures have a central place in a cosmopolitan vision of the world, in which international organizations such as the UN and the World Bank are somehow supposed to fulfil the redistributive role of the missing global government. ... For those who do not accept the cosmopolitan vision as morally compelling or descriptively accurate, such measures are less relevant. (p. 3)

Several decades ago, well before PPP rates were even conceived of, Amartya Sen (1973, 1976) had suggested that it is not really so necessary to try and make complete orderings between countries, or compute real income numbers for poverty and inequality comparisons. Instead, partial orderings could be obtained by comparing pairs of countries (establishing that one is richer or poorer or approximately at the same level of income) using the value of each country's commodity vector at the other country's prices. Without coming full circle, it would appear that there is a strong case for such an approach. Certainly, if we consider the package of concrete measures to reduce both global and national inequalities that Tony Atkinson (2015) elaborated upon in his final book, it would seem that we have no special need for PPP measures of income across countries to move forward.

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Notes

1. In the aggregation, countries are treated equally regardless of the size of their gross domestic product (GDP). For two countries, Purchasing Power Parities (PPP) rates are first weighted using one country's weights (Laspeyres index), and then weighted again using the second country's weights (Paasche index), such that each index provides a weighted average of the PPP between the two countries. Then the geometric mean is taken of the two aggregated PPP rates for every pair of countries in the comparison, resulting in a Fisher index.
2. Indeed, Deaton (2010) found clear examples of this in the 2005 ICP:

among the items successfully priced in Cameroon were (a) frozen shrimp (Fish basic heading: 90–120 shrimp per kilo, pre-packed, peeled), (b) Bordeaux red wine (Wine basic heading: Bordeaux *supérieur*, with state certification of origin and quality, alcohol content 11–13%, vintage 2003 or 2004, with region and wine farmer listed), (c) a frontloading washing machine (Major household appliances whether electric or not basic heading: capacity 6 kg, energy efficiency class A, Electronic program selection, free selectable temperature, spin speed up to 1200 rpm, medium cluster well-known brand such as Whirlpool), and (d) Brand: Peugeot/ Model: 407 Berline/ Edition: Petrol 2.0 litre 16v 140 CV/ Type: Saloon/ sedan/Engine: 1997 cc; kW/ bhp: 103/ 138/ Doors: 4/ Gears: Manual/ 5/ Standard equipment of basic edition:/ ABS: Yes/ Air condition: Yes/ Automatic climate control: Y. (p. 30)

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