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ABSTRACT

The results of new direct price level comparisons across 146 countries in 2005 have led to large revisions of PPP (purchasing power parity) exchanges rates, particularly for China and India. The recalculation of international and global inequalities, using the new PPPs, shows that inequalities are substantially   higher than previously thought. Inequality between global citizens is estimated at 70 Gini points rather than 65 as before. The richest decile receives 57 percent of global income rather than 50 percent.
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In December 2007, the preliminary results of the 2005 International Comparison Program (ICP) were published. In the Spring of 2008, the final results were presented to the public, fully confirming the preliminary data (World Bank, 2008). The new estimates of price levels in 146 countries—accounting for 95 percent of the world population and 98 percent of the world US dollar GDP—using the same methodology, led to the new estimates of PPP (purchasing power parity) exchange rates, and accordingly new estimates of national aggregates ((like gross or national domestic product, household consumption expenditures, gross fixed capital formation) for all the participating countries.[2] The ICP results implied a dramatic downward revisions in GDPs, expressed in PPPs, of the two most populous countries in the world, China and India, as well as of a number of other large countries such as Indonesia, Philippines and South Africa.[3] The new results, especially when used to retrospectively estimate PPPs and thus GDP per capita levels of all countries have led to serious adjustment of historical income levels. The revisions have thus directly affected estimates of global poverty and global inequality over time. Their effects on very numerous empirical studies produced in the last 15 years, which have used GDP data derived from the previous ICP round in 1993, are yet to be assessed. For example, many of the conclusions where GDP, GDP per capita, or some other formulation which includes GDP (e.g. trade/GDP ratio, or government expenditure/GDP) play a role may be affected. The range of such topics is huge since one or another formulation of GDP plays a role in many areas of economics: growth, inequality (Kuznets curve or its variants), governance, climate change, gravity trade models etc. GDP, in various formulations, is probably the most popular control in empirical economics, whether this is necessitated by structural models or not (i.e., GDP is often used in reduced-form regressions without much theoretical justification). The effect will be particularly strong for cross-country regressions. In panel data, run with country fixed effects, the current revisions may be regarded as affecting the intercept (coefficient on country dummies) only, so the "damage" to these results should be less.

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[2] And based on the regressions run across participating countries, even to the estimates for those that did not participate. The most important among the latter are Algeria, Burma and Uzbekistan.
[3] In the rest of the paper, GDP should be always understood to mean (unless stated otherwise) GDP in international dollars (of equal purchasing power parity).

This note is concerned with the effect of new PPP estimates on evolution of international and global inequality. In the first section, I will briefly explain some key characteristics and results of the 2005 round of ICP. Section 2 will present the new estimates of international and global inequality based on these results.[4] Section 3 concludes the note.

1. International Comparison Program, 2005 Round.

International comparison program is a joint UN-OECD-World Bank-regional development Bank project that, at approximately decennial intervals (the last survey was conducted in 1993), covers the entire world with the objective of determining, from direct price comparisons of about 1000 goods and services, price levels within nations.[5] The latest ICP was the largest such project in the history of ICP, and probably the largest worldwide single empirical economic project ever undertaken.

The 2005 estimates of purchasing power parity (PPP) exchange rates for 146 countries are not only the most recent and best estimates that we have, and the survey, "the most extensive and thorough effort ever to measure PPPs across economies" (World Bank, 2008, p. 9), but for a number of countries they are the first such estimates obtained from direct price comparisons. The number of participating countries has increased from 118 in the previous round (1993) to 146 now. China has for the first time participated in the ICP. Previous estimates of Chinese PPP exchange rates were based on 1983 and 1995 research papers (Ahmed 1983, and Rouen and Chen, 1995). Similarly, India has participated for the first time since 1985. Up to now, the PPP estimates for India were based on the extrapolations of the 1985 results. The price comparisons now include 48 African countries, more than ever before.

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[4] An initial estimate of global inequality with new PPPs for the year 2002 only was published by Milanovic (2008). The description of the 2005 ICP largely follows the description given there.
[5] One can consider the first global ICP to have been the one conducted in 1980. The earlier, much smaller rounds, limited to developed economies, were done in 1970, 1973 and 1975.

The results of the current round of ICP do not differ from the past only in terms of better country coverage but also in the methodology, and the scope of direct price comparisons. In the words of Australian Bureau of Statistics (2006, pp.13), "[The 2005 round] is the most comprehensive and firmly-based ICP round to date." Prices of more than 1000 goods and services were compared across countries, using the assistance of national statistical offices and regional statistical organizations (Asian Development Bank, Eurostat, Statistics Canada, Economic Commission for Latin America etc.). The project was organized around six regions (Africa, Asia/Pacific, Commonwealth of Independent States, South America, OECD/Eurostat, and Western Asia). The methodological innovation was the concept of "ring" countries. These are countries (ranging between 2 and 6 from each region, 18 in total) with developed market economies and wide range of goods and services such that direct price comparisons (using the same basket of goods and services) can be made between them. Prices of about 1200 goods and services were directly compared for the ring countries (see World Bank 2008, pp. 160-1). Using the results from the ring countries' price comparisons, the price levels for other countries belonging to a given region (for which ring countries are representatives) were linked to the rest of the world. The "ring approach" is considered better than the previously used "bridge-approach" (where only one "bridge" country's prices were directly compared to with those of the "neighboring" region) because it requires direct price comparison of the same bundle of goods and services to be conducted in all "ring" countries.

The most important results concern the new estimates of price levels in China and India. As they are now estimated much higher than previously, the GDPs per capita of these two countries have been correspondingly revised downward by about 38 percent (Table 1). But while these downward revisions are among the largest, they are not the only ones. Indonesia's GDP per capita was revised downward by 17 percent, Philippines's by 41 percent, Ghana's by 50 percent, Argentina's by 24 percent, South Africa's by 32 percent.[6] The upward revisions were much less frequent and more

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[6] The attention is sometimes unduly paid to the revisions for China only. It is argued (correctly) that prices in China were collected more in urban and better-off provinces than in rural and poorer provinces. But, as

modest: Russia's GDP per capita turned out to be 7 percent higher than previously thought, Mexico's about 10 percent, and Nigeria's GDP per capita (the largest upward revision among the populous countries) is now estimated to be almost 27 percent higher. For the advanced economies, the differences between the direct price comparison from this round of ICP, and the previously-used extrapolations from the 1993 benchmark, are relatively small, ranging around 3 and 4 percent. For the US, UK and Japan, the revisions are 1.5 to 3 percent down, for Germany 4 percent up. By region, the largest population-weighted revisions were for Asia/Pacific, where GDP per capita was revised 33 percent downward, followed by Africa (about 4 percent down). For other regions, the revisions were, on average, small (around 1 percent).

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the report mentions, the same approach was used in other large countries as, for example, in Brazil (World Bank 2008, p. 7), and an almost universal upward revision of price levels in Asia suggests that we are dealing here with a real phenomenon and not some peculiarly of Chinese statistics.

Table 1. New GDP per capita compared to the "old" WDI (World Development Indicators) data (13 most populous countries in the world; year 2005; PPPs year 2005)

	GDP per capita based on "old" PPPs	GDP per capita based on "new" PPPs	Revision (in percent)
Vietnam	3106	2143	-31.0
Philippines	4991	2956	-40.8
Mexico	10356	11387	+10.0
Japan	31262	30290	-3.1
Nigeria	1200	1520	+26.7
Bangladesh	2025	1068	-47.3
Russian Federation	11053	11858	+7.3
Pakistan	2437	2184	-10.4
Brazil	8854	8474	-4.3
Indonesia	3898	3209	-17.7
United States	42454	41813	-1.5
India	3536	2222	-37.2
China	6666	4088	-38.7

Note. Both GDPs per capita are expressed in 2005 international dollars.

The importance of these revisions does not lie solely in the fact that for the year in which the ICP is conducted, the national accounts of the countries are affected. The true, and at times dramatic, revisions ensue for the past years, because national account aggregates (in particular GDP, with which we are concerned here) are recalculated – based on the 2005 level—for all previous years. The recalculation is done is a such a way that the previous years' GDP levels are obtained by applying to the "new" 2005 level the national growth rates from the earlier years.[7] An obvious implication is that India and China will now be shown to have been poorer than previously thought for all the years since the late 1940s or early 1950s when their national accounts start. As this is a level effect (which of course varies from country to country), it will not impact countries' growth rates, but it will impact a number of other calculations. The new calculations of world poverty for the period 1981-2005, based on the 2005 ICP results, were presented by the World Bank in August 2008 (see Chen and Ravallion, 2008). Predictably, these results led to an upward revision in the number and proportion of world poor, but to little

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[7] This procedure has always been done although it is not strictly speaking entirely accurate: the PPP basket of goods is different from the basket of goods used by each individual country in calculating its own (physical) growth rate. But this is the only way that both spatial and temporal comparisons between countries' national account aggregates can be made.

change in the time evolution of world poverty (percentage change in the number of the world poor, or trend rate of decline of the global poverty headcount).[8] However, notice that in this case, as in the case of global inequality (as we shall show below), even if the overall trend may not be much affected, there are non-trivial annual revisions in the indicators because the weights of various countries in global output have changed due to the new ICP numbers. A nice example of this effect is presented by the December 2007 revision of IMF global output projections for the next year (2008), merely a week after the preliminary ICP results were unveiled. As the weight of the Chinese economy in the world was reduced (from almost 15 to about 10 percent), and as China's growth was expected to be higher than the world average, the global growth rate was revised downward on account of the change in weights only (that is, without any change in national real growth rate projections).

Up till now (Spring 2009), only the World Bank and the IMF have revised the GDP accounts for all the previous years. Penn World Tables, according to its website accessed on 6 April 2009, is in the process of doing so. The third source of long-term GDP data (Angus Maddison series) has not proceeded to any revision yet.

2. Recalculated international and global inequality, 1952-2006

Following Milanovic (2005) and World Bank (2006), we distinguish between international and global inequality. Unweighted international inequality (called also Concept 1 inequality) is inequality calculated across unweighted GDPs per capita of all countries in the world. It is similar to the so-called sigma convergence/divergence except that we use a more common measure of inequality, Gini coefficient, rather than the standard deviation of logs. Concept 1 inequality basically assesses whether there has been or not convergence among countries' mean incomes. Weighed international inequality (Concept 2) also uses national GDPs per capita but weights them by population size of the countries.[9] It thus begins to approach global inequality (inequality

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[8] It has also led to the replacement of the well-known global poverty line of $PPP 1 per capita per day by a new one of $1.25 per capita per day (in 2005 international prices).

[9] Note that the use of the term "international" here is not accidental. Concept 1 and 2 inequalities are truly those between national mean incomes (even when population-weighted), and not between individuals.

calculated across world *individuals*) because the number of people who live in various countries is taken into account even if they are all assumed to have the average income (GDP per capita) of their country. This assumption is abandoned in global inequality (or Concept 3) which calculates inequality across world citizens, taking in principle everybody's actual income into account.

When going from Concept 2 to Concept 3 inequality another important methodological change occurs, namely while Concept 1 and 2 are calculated from national accounts data, Concept 3 inequality can be calculated only from household surveys (since this is the only source for national income inequalities which are needed to get to Concept 3 inequality).[10] This creates two problems: national accounts and household survey means do not always coincide and have moreover recently been in many countries moving apart[11]; and second, household surveys for a sufficiently large number of countries (such that they would cover more than 90% of world population and 95% of world income) are available only from the late 1980s onward. They are also not available at annual intervals for most countries, thus necessitating the use of benchmark years, say spaced at 5-year intervals (so that all countries that have had surveys within that interval are included).

With these caveats in mind, we proceed to the calculations. Figure 1 shows the calculations of Concept 1 and Concept 2 international inequality for the period 1952-2006.

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[10] We obviously cannot calculate Concept 3 from national accounts; but we can calculate Concepts 1 and 2 from household surveys. The reason why the alternative approach is preferred is that it enables us to have a much longer time series, since national accounts (unlike household surveys) are available for most countries in the world for the last 50 years.
[11] For discussion see Ravallion (2000), Deaton (2005), Anand and Segal (2008).

Figure 1. Concept 1 and Concept 2 (international) inequalities, 1952-2006
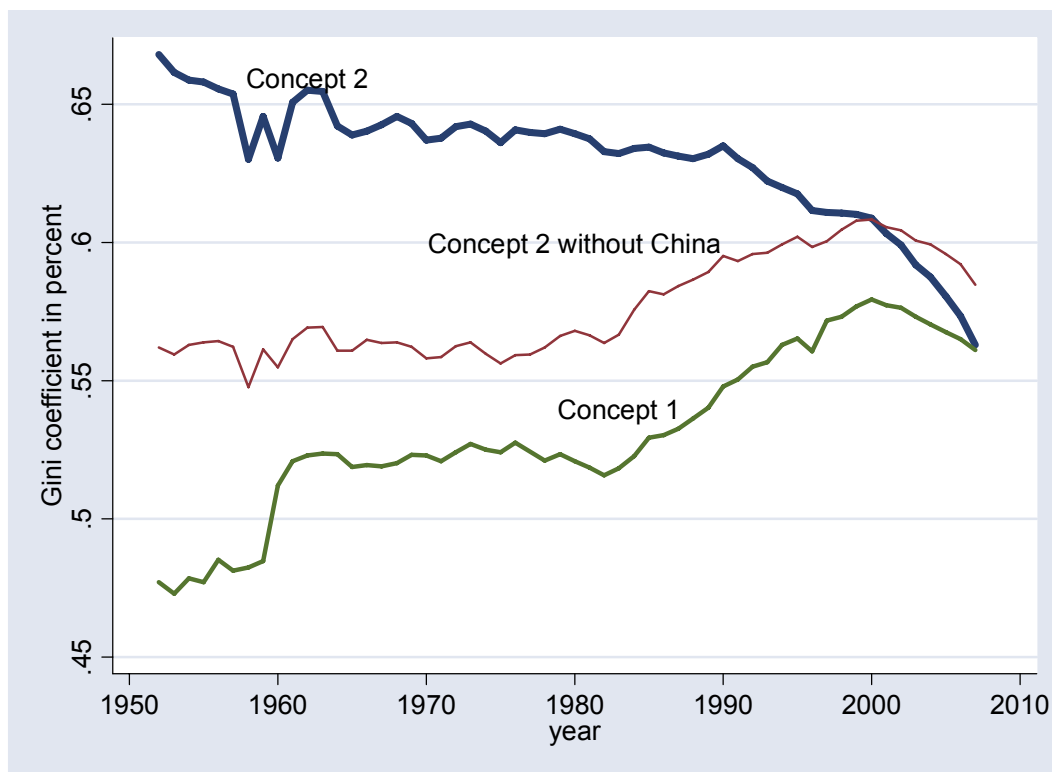
Note: Before 1960, there are between 80 and 90 countries included. After 1960, the number varies between 130 and 150. .

The data start in 1952, mostly because it is the first year for which GDP for China is available, and the calculation of Concept 2 international inequality without China would be meaningless.[12] The sample composition is practically fixed (the number of countries does not vary much) since 1960, when after decolonization the data for most African countries became available.[13] Let us focus first on Concept 1 inequality. Its *level* is between 4 and 5 Gini points higher than with the earlier PPP data (not shown here). Between 1960 and early 1980s, Concept 1 inequality was stable at the Gini value of about 53. After the early 1980s, and not just coincidentally with the increase in real interest

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[12] For more details on the data see Milanovic (2005, Chapter 4) although the calculations there were done with the "old" PPPs.

[13] For the countries that emerged after the break-up of the Soviet Union, Yugoslavia and Czechoslovakia we use, when available (and they generally are), their republican GDPs per capita for all years prior to independence. We do this in order to keep the composition and the number of the countries in the sample as fixed as possible. The same approach is applied to Pakistan and Bangladesh, and Ethiopia and Eritrea.

rates and Third World debt crisis, there is a process of rapid divergence in incomes between the countries. The "lost decade" (or rather two decades) in Latin America, stagnation and then substantial declines in income in Eastern Europe and the former Soviet Union, and the disastrous performance of many African countries, have been the main factors behind the divergence (combined of course with a rather respectable performance of rich economies). This fact is not new: it has been amply documented and is simply reflected here in the increase in inter-country inequality.[14] The new GDP numbers do not change our interpretation of the recent past, in that regard. Divergence lasted for some 20 years. However, since 2001, we notice a change. For the first time since 1982 divergence between countries' GDPs per capita has stopped and even become reversed. In effect, the period 2001-06 has been good not only for the global economy (which is driven by the largest and richest countries), but also for the African countries that have grown at the rate of more than 4 percent per annum, post-Communist countries (growth at more than 6 percent per annum), and Latin America (3 percent p.a.). These factors were behind the reversal of divergence which we observe after 2001. It is, of course, not obvious that the global financial crisis and its aftermath will allow these hopeful developments to continue. At the end, note that even with the favorable developments around the turn of the century, the level of Concept 1 inequality is now significantly greater than it was in the 1960s and 1970s.

The level of Concept 2 inequality is about 7-8 Gini points higher than with the "old" PPP data. This is, of course, mostly on the account of Chinese and Indian data revisions. Concept 2 inequality "enters" the 1960s with an extremely high level of 65 Gini points. There is then a mild slide until the mid-1980s, and after that, thanks to high growth rates first of China, and more recently of India, the slide becomes much steeper. By year 2006, when our series ends, Concept 2 inequality amounted to only 55 Gini points. This is a substantial decrease of 10 Gini points, or about 1/6th of international population-weighted inequality in 1960s. The line which shows Concept 2 inequality without China (Figure 1) allows us to notice an important change that occurred around the turn of the century. While until 2000, Concept 2 inequality was sliding downward

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[14] See Milanovic (2005a), Minoiu and Reddy (2009), Pritchett (1997).

thanks to China only (since Concept 2 inequality without China was still increasing), after 2000, the decline takes place even *without* China. As mentioned, this is due to the high growth rate of India. But it also shows that the world now has two "engines" of downward pressures on international (and ultimately global) inequality: high growth rates of China and India.

W now move to Concept 3 inequality. Table 2 shows the recalculated global Ginis and Theil indexes from household surveys covering approximately 120 countries and between 87 and 94 percent of the world population, and 95 and 98 percent of the world GDP. The new retrospective PPP exchange rates are simply applied to the existing survey data expressed in local curriencies from the benchmark years 1998, 1993, 1998 and 2002, and all inequality indicators recalculated. Obviously, an increase in China's price level will reduce the level of incomes in China, measured in PPPs, the same way that it reduces the GDP numbers for China. Table 2 shows a significant increase in the level of inequality, compared to the "old" PPP data, ranging between 4.4 and 6.1 Gini points. For the most recent year (2002), the new Gini is 5.1 points higher than the Gini calculated using the "old" PPP exchange rates. The pattern of change however remains the same. After an increase in global inequality between 1988-1993, there was a modest decline, and then another increase. Note however that the increase between 1988 and 1993 is smaller with the new PPP data (1.5 Gini points) than with the "old" data (+3.2 Gini points).

Theil coefficient with the new PPP values increases even more than the Gini, a reflection of Theil's greater sensitivity to the changes at the extremes of income distribution. Since China, India, Philippines and Indonesia all had their PPP-equivalent incomes reduced significantly, the decline has made many poor people from these countries seem even poorer [15] Moreover, Theil now shows an uninterrupted increase year after year. Over the entire 14-year period, it has increased by about 15 percent. The table also shows the recalculated top decile share of world income. It too increases

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[15] This is not merely an "accounting" decline but a real one: if poor people really face much higher price levels in those countries than was previously thought then they are really much poorer.

steadily in every benchmark year, going from 51.4 percent of global income in 1988 to 57.5 percent of global income in 2002. With the "old" PPP data, the top decile of individuals controlled about one-half of total income (not shown in Table). Thus, this indicator of inequality has increased too.

Table 3 shows the "new" global decile shares for the benchmark year 2002. We have already seen that the top decile receives more than 57 percent of global income. The top 5% of the population gets almost one-third of global income. It is also noticeable that not even the eighth decile receives its population share, that is the average income among the people belonging to the 8th decile is still below the world mean.

Table 2. Global inequality, with new 2005-based PPPs and "old" 1993-based PPPs
(based on household survey data from WYD dataset)

	1988	1993	1998	2002
Gini (new data)	68.4	69.9	69.4	70.8
	(1.7)	(1.8)	(1.8)	(1.3)
Gini (old data)	62.3	65.5	64.4	65.7
	(2.0)	(1.7)	(1.9)	(1.3)
Change (in Gini points)	*+6.1*	*+4.4*	*+5.0*	*+5.1*
Theil (new data)	87.5	93.7	94.2	100.1
	(6.3)	(7.1)	(7.3)	(5.7)
Theil (old data)	71.5	81.2	79.1	83.4
	(5.9)	(5.6)	(6.7)	(5.4)
Change (in Theil points)	*+12.0*	*+12.6*	*+15.1*	*+16.7*
Top decile share, in percent (new data)	51.4	53.4	57.0	57.5
Population coverage (in percent)	87	92	92	94
GDP coverage (in percent)	96	95	96	98
No of household surveys (countries) included	103	122	124	123

Sources: For 1988-1998 see Milanovic (2005). Data for 2003 calculated by author from WYD (World Income Distribution) dataset available at http://econ.worldbank.org/projects/inequality.

Table 3. Decile and top ventile shares of global income (year 2002; "new" PPPs; in %)

Decile	Percentage shares
First	0.61
2	0.94
3	1.25
4	1.62
5	2.19
6	3.13
7	4.99
8	8.26
9	19.71
Tenth	57.52
Total	*100*
Top ventile	31.34
Top-to-bottom decile ratio	94.6

3. Conclusions

1. All international and global inequality concepts show higher degree of inequality with the new 2005 PPP data than with the extrapolation based on the previous round of ICP. This is very significant since the new data include China (first time ever) and India (first time since 1985).

2. After 20 years of mean-income (GDP per capita) divergence, GDPs per capita of the countries of the world have begun a process of convergence since 2001. This is due to the pick-up-of growth in Africa, post-Communist countries and Latin America. It is unclear how the global crisis will affect this process.

3. Population-weighted (Concept 2) inequality which has gone down during the last twenty years of the 20th century thanks to the high growth rates of China, shows, after year 2000, a decline even when China is excluded. This is due to the high growth rates of India. Uncertainly as to the effects of the crisis remains there too although to the extent that the "locomotives" of Concept 2 decline, China and India, continue to expand at higher (per capita) growth rate than the rest of the world, Concept 2 may go on with its downward trend.[16]

4. Global inequality between individuals amounts to more than 70 rather than 65 Gini points as when calculated with the "old" PPPs. This is a significant upward revision. The trend, over the period 1988-2002, however is absent as the global Gini bounces between 68.4 and almost 71 Gini points. Its further evolution will, of course, depend on growth rates of China, India and the US (the "triangle" which explains about 10 Gini points of global inequality[17]), but also on how the next stage of the global crisis affects African, post-Communist and Latin American countries in particular.

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[16] Up to a point, quite remote now (and made remoter after the 2005 ICP results) when China's growth—due to its having become a relatively rich country—turn to be globally disequalizing.
[17] See Milanovic (2005, p. 89).

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