

Alternative measures of output in global economic–environmental models: Purchasing power parity or market exchange rates? — Comment

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Abstract

Nordhaus [Nordhaus, W. 2006, Alternative measures of output in global economic–environmental models: purchasing power parity or market exchange rates? *Energy Economics*, doi 10.1016/j.eneco.2006.02.003] examines the question of the use of purchasing power parity versus market exchange rates in constructing global economic models. He concludes that the best approach is to use PPP measures for relative incomes and outputs and national accounts' prices and quantity indexes for time series extrapolations. In this comment we argue and show that international real income comparisons based on PPP measures overstate the real incomes of poorer countries and underestimate the real incomes of richer regions. This is the case because the PPP approach fails to account for the differences in various non-traded attributes, such as availability of public goods and the location, attached to the final sale of the goods being compared. Additionally, using a teleporting consumer model we show that the use of real exchange rates to convert real quantities and the use of market exchange rates to convert nominal incomes preserve real income rankings across nations and this approach is consistent with standard economic theory.
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1. Introduction

The national accounting system provides a reasonable measure of 'real' income per person for a country in national currency units. When a need arises for comparing per person real incomes of

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two or more countries we face a problem as both income and prices are denominated in different currencies. The key question is what conversion factor should be used with these values to make correct comparisons of the underlying ‘real’ quantities?

Two competing methods that try to answer the above question are in use. One method simply converts the incomes denominated in national currencies using market exchange rates into a single currency unit (the MER method). The incomes thus converted have commensurable units and can be compared. However, what sort of real income equivalence has been maintained by this method is not clear. To see this we use the following steps. Take a bundle of ‘real output’ in a country, sell it in the home market, convert the proceeds using the market exchange rate, and then spend the sum on the bundle of ‘real output’ in the foreign market. The real output bundle sold in the home market and the bundle finally bought in the foreign market are thus treated as equivalents by the MER method. Clearly, in this process, market exchange rates provide the appropriate conversion factors for nominal incomes expressed in respective national currencies.

Since prices in different countries expressed in a single currency unit via the market exchange rate could be different, MER equivalent money incomes may not buy the same bundle of goods and services in two different countries. Say for example, it is not impossible that an orange in one country could be converted into two oranges in another using market prices and the market exchange rate. Therefore, it has been argued that MER cannot always be used as a correct conversion factor for international comparison of real incomes. Instead, an alternative conversion factor – the purchasing power parity (PPP) exchange rate, which is the ratio of prices in local currencies – is often suggested. The beauty of the PPP approach can be appreciated in the following way: spend the per person nominal income in the home country to buy a bundle of goods, take this bundle to the foreign country and sell there at their market prices. Whatever is the outcome of this transaction in the foreign currency unit is the foreign currency equivalent of the per person nominal income in the home country. They are equivalent because both incomes can buy *exactly the same bundle* in the respective countries. It is easy to see that the ratio of these two incomes, expressed in two currencies, is equal to the price parity or ratio of the prices in the two countries, which gives the required PPP exchange rate. Hence, it is strongly believed, almost universally, that if incomes in national currency units are converted into a single currency unit by their respective PPP exchange rates then their real income orderings are preserved. Therefore, it is argued, a valid international comparison of real incomes should be done by using PPP exchange rates.

It is now commonly accepted that prices, particularly those of non-tradables, in poorer countries quite often are two-thirds or even four-fifths lower than in richer countries (Balassa, 1964; Samuelson, 1964; Bhagwati, 1984; Heston et al., 2002) and so real incomes of the poorer countries relative to rich countries could be around three, four or even five times higher under the PPP conversions compared to the MER conversions. Notwithstanding this, global models of trade and environment, however, are usually calibrated with market values and market exchange rates.¹ Consequently, there are concerns expressed about the quality of policy analysis done with global economic–environmental models that are calibrated with market exchange rates and make income conversions based on market exchange rates. A heated debate has ensued around the emissions projections reported in the Special Report on Emissions Scenarios in which the majority of the models used to generate the projections are MER based (Nakićenović et al., 2000; Castles and Henderson, 2003a,b; Nakićenović et al., 2003; Grübler et al., 2004; Manne and Richels, 2004; McKibbin et al., 2004; Dixon and Rimmer, 2005a,b; Tol, 2004).

¹ Take for example the GTAP model (Hertel, 1997) and its many variants and other models based on the GTAP database.

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