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Evaluating a long-run forecast: The World Bank poverty forecasts

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Abstract

This paper examines an issue in long-run forecasting, evaluating a forecast for which the actual data are not yet available. In this case, we analyze the World Bank's forecasts of the poverty headcount made in 2002, but the actual data for the terminal date will not be available for some time. The methodology requires one to infer a forecast for an intermediate date for which the data are available. We show that the long-rum projections were extremely accurate because they are consistent with the trends that are observed in the latest available data.

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This paper examines an issue in long-run forecasting: How to evaluate a projection made for a distant date that has not yet occurred. For example, climate forecasts are made for decades in the future; similarly, projections of the Social Security Trust Fund are made 75 years in advance; there are estimates of the number of people living in poverty 10 or more years in the future, etc. These outcomes won't be known for many years in the future, but, at some point in time, we would like to determine whether these projections are on a trajectory to reach their predicted values. This paper presents a method for making this determination.[1]

While this approach can be used to evaluate any long-term projections, we examine the World Bank's targets (goals) for the level of poverty for 2015. Starting in 1990, these projections have been made every year, but the *actual* aggregated poverty headcount numbers were only available in 2002, 2005 and 2008. We, therefore, examine the projections that were made in those years. The 2015 poverty headcount estimates will not be available until 2017 or 2018. Nevertheless, the actual data for intervening years can be used to determine whether the projections in those years were feasible achievable goals.

The conventional techniques that are used to evaluate macroeconomic forecasts are not applicable in this analysis for a number of reasons. First, as we have already indicated, the poverty estimates for 2015 are not yet available and won't be available for some time. Consequently, we must use the currently available *intermediate year estimates* of actual poverty head counts in a procedure that determines whether these long-run projections are on a path that can reach the target levels. Second, the estimates of the levels of poverty that existed at the time when the forecasts were prepared do not coincide with the current estimates of the poverty levels that prevailed in those base years. We must, therefore, adjust the forecasts of the number of people living in poverty to take into account the revisions in the base year estimates that were made after the forecast was issued. In other words, the vintage of the data that are used does matter and we must take this into account.

The next section discusses the issues involved in poverty forecasting. This is followed by a discussion of the methodology used to evaluate these forecasts. The data, the results and the conclusions constitute the final sections.

1. Long-run poverty forecasting

Unless naïve extrapolations are used, long-run poverty forecast are based on fundamentals as embodied in a particular model. The forecasts are then generated from the model by making specific assumptions. Our task in evaluating these forecasts is to develop a benchmark that is consistent with the model that generated the projections and also takes into

[1] Formally, there is a h–step forecast for a variable X that we are evaluating at time t+j, where $0 < j < h$, i.e. before the actual value of X at t+h has been become available..

account data revisions. Data revisions affect all long-run forecasts and it is accepted procedure to base evaluations on growth rates rather than on the magnitude of the errors. However, evaluating poverty forecasts poses a conceptual problem. Customarily, when the forecasts and the actual values of a variable are compared, there is no dispute about what constitutes the observed number. However, the definition of poverty has changed over time and the data that were used when the forecasts were made cannot be directly compared with the currently estimated number of people living in poverty.

The generally accepted definition of poverty is that the poor are those individuals whose income is equal or less than a threshold called the poverty line. We are evaluating the Bank's forecasts that were based on a threshold of $1 / day using 1993 Purchasing Power Parities (PPP). However, the actual estimates which are now available in PovcalNet[2] for 2011 use a $1.25 threshold and 2005 PPP.[3] Consequently, it is not possible to use the **level** of the headcount estimates as the actual values and the forecasts referring to the same years are not comparable. (See Chen and Ravallion, 2009).[4] This problem is illustrated in Table 1 which presents two vintages of the estimates of the poverty level that existed in 1999. One is the real-time estimate made in 2002 and the other is from the 2016 vintage. We, therefore, ask how well the **changes** in poverty that actually occurred were predicted. Consequently, our analysis will be based on rates or percent changes.[5]

2. Poverty Forecast Evaluation Methodology

2.1. Inferring a Forecast

The poverty forecasts that are being evaluated are the headcount numbers for 2015. We use the latest available data (for 2011 with 2005 PPP) as the actual numbers to determine whether the projections that were made for 2015 are achievable. To be achievable the 2011 values of the headcounts should be on the trajectory of that variable between the date of the forecast and 2015.[6] This means that the actual and forecast changes should be similar. Because none of the projections provide estimates of the poverty headcount for the intervening years between the dates of the forecast and 2015, our methodology must thus *infer* a value of that variable for 2011.

This inferred forecast will be obtained from the benchmark methods that are explained below and should be on the trajectory between the date when the forecast was made and 2015. We, therefore, assume that the percentage change in the poverty head count between the starting date and 2011 was identical to the forecast change to the target date, 2015. The inferred forecast *change* can then be compared with the actual *change* that occurred between the starting date and

[2] PovcalNet is an interactive tool located at the World Bank. It allows everyone to calculate the level of poverty using Bank Methodology.

[3] Forecasts made after 2010, that we are not evaluating, use 2005 PPP and the $1.25 poverty line.

[4] Using the 2005 PPP and the $1.25 poverty line rather than the old $1 poverty line with 1993 PPP increased the estimate of the number of people living in poverty.

[5] We assume that the rates of change using the two sets of poverty estimates are comparable.

[6] With a different stating date, the trajectories would differ because the poverty headcount estimates at the starting dates differ.

2011. The actual change can be calculated from the data in PovcalNet. The forecast error is the difference between the actual and forecast rates of change.

Regardless when the Bank made its projections for 2015, it showed only two points-the poverty estimate at the time when the forecast was made and the value for 2015. It did not make any projections for intermediate years over the forecast horizon. In order to obtain a "forecast" for 2011, we must assume the methodology that was used to generate the 2015 number and then back out the 2011 number.

Poverty forecasts are often made based on estimates of the growth elasticity of poverty and a forecast of long-term growth rate. The poverty number for the forecast period is obtained by assuming that the historical estimates of the growth elasticity of poverty remain constant over the forecast period and by predicting the long term growth rate. For example, if the growth elasticity of poverty for the last 10 years has been 0.2 percent, and the average annual growth rate for the next 10 years is expected to be 5 percent, poverty is projected to decline 1 percent per annum for the next 10 years.[7]

We did not have the data to utilize these approaches and instead used two simple benchmarks to serve as approximations to the model and to generate the poverty numbers for 2011. One was geometric; the other was linear. Since the benchmark should be conceptually related to the method that generated the projections, we focus on the geometric procedure. This approach is conceptually closer to the methods that the World Bank has used for poverty forecasting. The linear methodology is merely introduced as a basis for comparison.

2.2. Procedures for Inferring Forecasts

To illustrate the procedure, we use the World Bank forecast made in 2002. The forecast made in 2002 used the estimated headcount for 1999, which is denoted as HC^{e1999}, to calculate the forecasted poverty headcount for 2011, HC^{f2011}.

The geometric approach assumes that the headcount poverty number declines exponentially. Equation (1) was then used to derive the yearly percentage poverty headcount change between 1999 and 2015, r^{e1999}.

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[7] One extension of the method for inferring intermediate "forecasts" is to assume that the projection is based on a long-term growth rate and a constant elasticity of poverty reduction with respect to the inequality-adjusted income growth. Specifically, the constant elasticity of poverty reduction, P, can be estimated from the following equations. (See Ravallion, 1997).

$$P = AY^{-\beta(1-I)}$$

where *I* represents the Gini coefficient, and *Y* represents income growth. Taking logs yields

$$lnP = lnA - \beta(1 - I)lnY$$

from which we estimate β and then can use the coefficient to forecast the poverty headcount for 2011.

Another popular forecast method is to assume the shape of the most recent estimates for consumption/income distribution does not change for the forecast period; but the entire consumption/income distribution shifts in accordance with the long-term growth rate for the forecast period.

$$HC^{f2015} = HC^{e1999}(1+r^{e1999})^{16} \quad (1)$$

The inferred forecasted poverty headcount for 2011 would be

$$HC^{f2011} = HC^{e1999}(1+r^{e1999})^{12} \quad (2)$$

Then we can proceed to calculate the percentage decline in the poverty headcount between 1999 and 2011 based on the forecast made in 2002, R_{2002}.

$$R_{2002} = \frac{HC^{f2011}}{HC^{e1999}} - 1 \quad (3)$$

The inferred forecasts for 2011 derived from the forecasts made in 2005 and 2008 would be calculated similarly.

We use the 2002 forecast for the East Asia and Pacific (EAP) region as an example. In that year, the World Bank indicated that the poverty headcount would decline from 279 million in 1999 to 80 million by 2015.[8] Inserting those numbers into Equations 1-3 we obtain Equations 4-6.

$$80 = 279(1+r^{e1999})^{16} \quad (4)$$

$$HC^{f2011} = 279(1+r^{e1999})^{12} \quad (5)$$

$$R_{2002} = \frac{HC^{f2011}}{HC^{e1999}} - 1 \quad (6)$$

Solving these three equations yields the following results: The annual decline in poverty between 1999 and 2015 would be 7.5% ($r^{e1999} = -0.075$); more than 109 million people would still be in poverty in 2011, (HC^{f2011} = 109.325); and the number of people living in poverty would have declined more than 60% between 1999 and 2011 ($R_{2002} = -0.608$). The actual decline in the poverty headcount data was obtained from PovcalNet. The data showed that the actual poverty headcount had decreased by 75.7 percent between 1999 and 2011 in the EAP region. Our approximation had underestimated the decline.

The second approach for inferring the forecast for 2011 is to assume that the trajectory of poverty between the date of the forecast and 2015 is linear. Using a linear trend, it is possible to calculate the poverty headcount change from Equations (7)-(9):

$$HC^{f2015} = HC^{e1999} - b^{e1999}t \quad (7)$$

$$HC^{f2011} = HC^{e1999} - b^{e1999} * 12 \quad (8)$$

$$R_{2002} = \frac{HC^{f2011}}{HC^{e1999}} - 1 \quad (9)$$

Without providing all of the details for this example, using this linear model we estimated that poverty declined 53.5 % between 1999 and 2011. In this case, the underestimate was larger than the one that was obtained from the non-linear approach.

[8] These data were published in the January 2003 issue of *Global Economic Prospects*.

3. Data

We evaluate the World Bank poverty headcount projections that were made for the year 2015. They were made in 2002, 2005, and 2008 based on the available data for 1999, 2002, and 2005, respectively. Each set of forecasts consists of headcount projections for six regions: Africa, East Asia and Pacific, Europe and Central Asia, Latin America and Caribbean, Middle East and North Africa, and South Asia. These projections were published in Global Economic Prospects. The actual data are for 2011, the last year for which data are available with the 2005 PPP version, and were obtained from PovcalNet.

4. Results

Figure 1 presents the actual levels and the three forecasts of the poverty headcount for each region. But as we have indicated, both the inferred forecasts and the actual estimates were the percent changes in the headcount numbers. The evaluation of these forecasts is conducted in percent changes, and the projected and actual percent changes in the poverty headcount in each region are presented in Table 2. There are too few observations to undertake a formal quantitative evaluation, but we can present an informal analysis.

There are 18 observations overall; the direction of change in the poverty numbers is correctly predicted in all but two cases. The error in the 2002 MENA forecast is entirely attributable to the data issue.[9] The other difference in signs occurred in the 2008 SSA forecast when a small increase in the headcount was predicted but a small decline occurred. The other finding was that some of the large declines in the poverty headcount were underestimated even in the later projections.[10] From the World Bank's perspective, it is doubtful whether a reduction in poverty which was greater than it had projected would be a cause for concern.

These results indicate that the actual changes are on trajectories that are consistent with the actual forecasts for the distant date. This is a quite striking result given that these were inferred forecasts for 2011 made three to nine years in advance based on data that were even three years older. *An overall qualitative evaluation indicates that these long-run poverty forecasts were extremely accurate.*

5. Conclusions

This paper has made two contributions. First, we have developed a methodology that permits one to evaluate any long-run forecast before the actual data for the target date are available. The methodology generates an inferred forecast for an intermediate date and determines whether the forecast is on a trajectory that is consistent with the actual forecast for the distant date. The methodology was then applied to the World Banks' poverty projections.

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[9] The poverty headcount for 1999 using the 2016 vintage numbers is twice that of the 2002 vintage (See Table 1). The forecast made in 2002 showed poverty increasing from the lower number to a value in 2015 which was less than the currently available number for 1999. Thus the forecast predicts an increase in the headcount while in fact there was a decrease. This discrepancy did not occur in the 2005 and 2008 forecasts.

[10] This discrepancy can be attributed to the change in the headcount as reflected in the redefinitions and revisions of the 1999 data in those regions. (See Table 1).

The results show that those projections for 2015 were consistent with the trends that have been observed in the latest data, which, currently, are only available through 2011.

References

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Table 1. Poverty Head Count for 1999, based on 2002 and 2016 Vintage Data

Region	2002 vintage	2016 vintage
EAP	279	661.3
ECA	24	18.01
LAC	57	55.49
MENA	6	13.04
SA	488	617.4
SSA	315	385.76

Unit: million

Table 2. Actual and Predicted Percentage Changes in Poverty Headcount from the Date of Forecast to 2011.

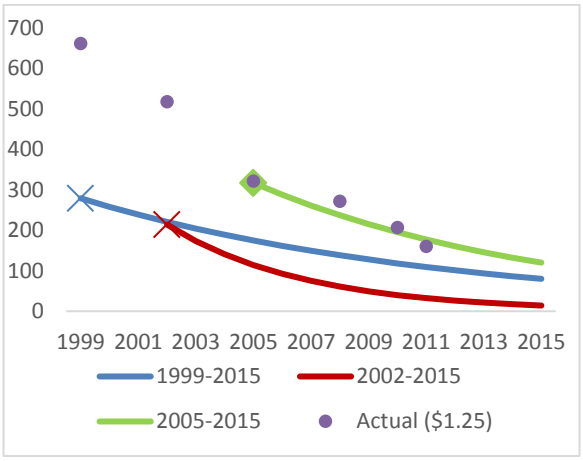
Forecast made in

Region	2002					2005					2008				
	Actual	Non-Linear	Error (NL)	Linear	Error (Linear)	Actual	Non-Linear	Error (NL)	Linear	Error (Linear)	Actual	Non-Linear	Error (NL)	Linear	Error (Linear)
EAP	-75.7	-60.8	-14.9	-53.5	-22.2	-69.0	-84.9	15.9	-64.7	-4.3	-50.0	-44.2	-5.8	-37.3	-12.7
ECA	-87.0	-60.3	-26.7	-53.1	-33.9	-76.5	-47	-29.5	-41.5	-35	-60.4	-39.1	-21.3	-33.8	-26.6
LAC	-50.2	-13.5	-36.7	-13.2	-37	-48.9	-22.6	-26.3	-21.4	-27.5	-31.6	-21.6	-10	-20	-11.6
MENA	-56.7	24.1	-80.8	25.0	-81.7	-48.8	-29.8	-19	-27.7	-21.1	-37.9	-30.5	-7.4	-27.3	-10.6
SA	-35.4	-36.9	1.5	-34.4	-1	-37.5	-35.5	-2	-32.5	-5	-33.1	-22.6	-10.5	-20.9	-12.2
SSA	7.8	20.5	-12.7	21.2	-13.4	3.8	7.4	-3.6	7.5	-3.7	4.2	-3.29	7.49	-3.25	7.45

Figure 1. Poverty Forecast and Actual by region

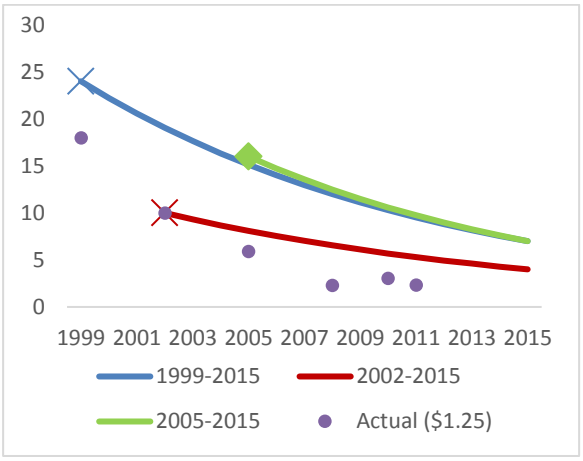
East Asia Pacific

Headcount number (million)



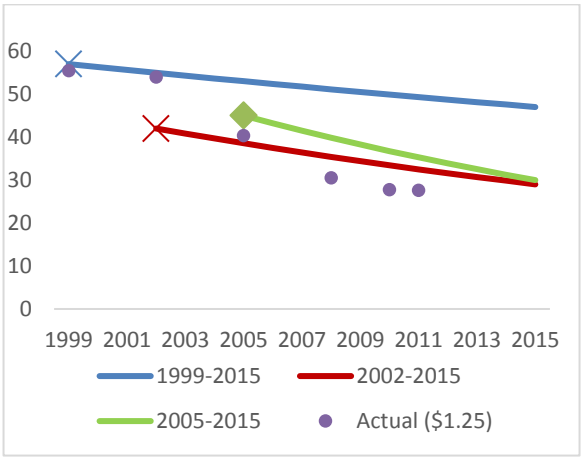
Europe and Central Asia

Headcount number (million)



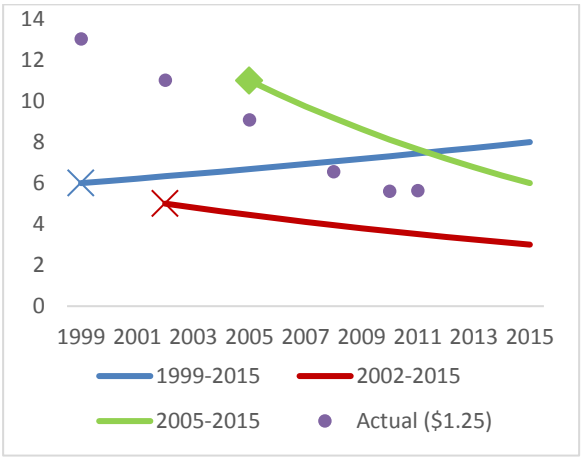
Latin America and Caribbean

Headcount number (million)



Middle East and North America

Headcount number (million)

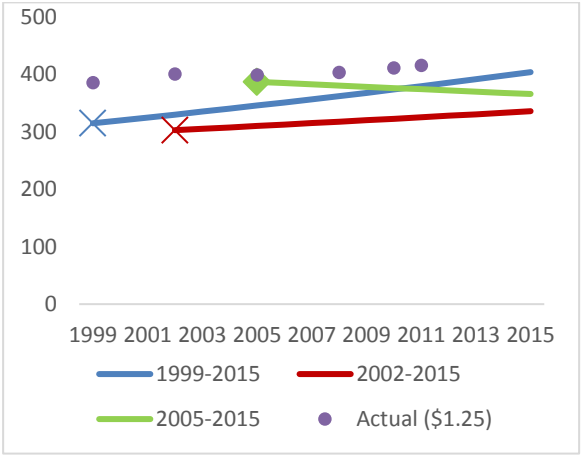


South Asia

Headcount number (million)

Sub Saharan Africa

Headcount number (million)



: $1.08 with USD 1993 PPP ; : $1.25 with USD 2005 PPP.