There *is* poverty convergence

Abstract

Martin Ravallion ("Why Don't We See Poverty Convergence?" *American Economic Review*, 102(1): 504-23; 2012) presents evidence against the existence of convergence in global poverty rates despite convergence in household mean income levels and the close linkage between income growth and poverty reduction. We show that this finding is driven by a specification that demands more than simple convergence in poverty headcount rates, and is additionally driven by poorly measured low poverty incidences. If we motivate the poverty convergence equation using an arguably superior semi-elasticity specification, we find highly significant and robust evidence of convergence in absolute poverty headcount ratios and poverty gaps in the developing world.

Keywords: poverty convergence, economic growth, poverty trap, transition economies

JEL Classifications: I32, D31, P36

In a recent contribution, Martin Ravallion (2012) raised the question of why we do not see convergence in poverty rates across the developing world. The argument is that one would expect poverty headcount ratios to converge across countries since higher mean household income tends to lower poverty ("*advantages of growth*") and mean household incomes tend to converge across countries ("*advantages of backwardness*").[1]

Using a sample of household income data that covers about 90 developing countries between 1977 and 2007[2] and focusing on the conventional poverty headcount ratio at $2/day, Ravallion (2012) finds evidence that both of these individual channels are at work, but that we do not observe convergence in poverty headcount ratios across countries. The econometric specification used to assess poverty convergence is given by

$$\Delta \ln H_{it} = \alpha_i^* + \beta_i^* \ln H_{i,t-1} + \varepsilon_{it}^*, \tag{1}$$

where H_{it} is the (absolute) poverty rate of country *i* at time *t* and ε_{it}^* is a disturbance term.

This somewhat puzzling finding is explained in Ravallion (2012) by the adverse direct effect of poverty on economic growth and by the fact that a high initial poverty rate makes it harder to reduce poverty through growth in mean household income. Countries with low poverty rates have thus seen faster mean income growth and a higher elasticity of poverty reduction to mean income growth, given by η_i in the specification

[1] He empirically finds evidence for unconditional as well as conditional household income convergence, i.e. without and with control variables, with conditional convergence being quantitatively more rapid.
[2] The poverty and income dataset is obtained from survey data available at *povcal.net*. It has a median interval between surveys of 13 years. About three quarters of household surveys use consumption instead of income data, as is common in the literature. See Ravallion (2012) for more details.

$$\Delta \ln H_{it} = \delta_i + \eta_i \Delta \ln \mu_{it} + \nu_{it}, \quad (2)$$

where μ_{it}denotes mean consumption (income) and ν_{it} is the corresponding disturbance term. The parameter η_i in equation (2) is usually referred to as the "growth elasticity of poverty reduction". It is well-known from the seminal work of Bourguignon (2003) that this elasticity "is a decreasing function of the development level of a country," i.e. it necessarily increases (in absolute terms) at lower initial levels of poverty under the assumption of log-normally distributed incomes and if income growth is distribution-neutral.[3] This increase per se has nothing to do with economic effects of poverty on income growth and convergence, which might certainly be at work, but is a mere identity reflecting the shape of the log-normal distribution and the associated fact that low initial poverty levels ceteris paribus lead to a high *percentage* reduction of poverty rates for a given growth rate.

An additional problem associated with the use of the poverty elasticity of growth is its high sensitivity to low poverty incidence, when percentage changes are particularly large and influential. This can bias econometric results as measurement error is usually an important problem when low poverty incidence observations are present in the data.[4] Additionally, policymakers are usually interested in *percentage point*, not percentage changes of the poverty rate. As a result, Klasen and Misselhorn (2008) suggest to use a growth semi-elasticity of poverty reduction instead, based on the specification

$$\Delta H_{it} = \delta_i + \eta_i \Delta \ln \mu_{it} + \nu_{it}. \quad (3)$$

[3] For empirical evidence that the income *share* of lower-income deciles does not systematically vary among countries with different growth rates, see Dollar and Kraay (2002) and Dollar et al. (2016).

[4] Even rounding issues introduce substantial measurement error at low levels of poverty incidence. For example, if poverty incidence fell from 4.4 to 1.6%, this is a decline of 64%. If rounded to 4 and 2% it is a decline of 50%. Similar rounding errors are much smaller at higher levels of poverty incidence. When using percentage point changes, such rounding errors introduce the same bias at all levels of poverty.

The difference in results between specifications linking growth and poverty reduction is depicted in Figures 1 and 2, with an R squared of 37.7% and 51.5% for the elasticity and semi-elasticity, respectively. If we assume poverty dynamics given by equation (3) within the conceptual framework of Ravallion (2012), we obtain the poverty convergence equation

$$\Delta H_{it} = \alpha_i^* + \beta_i^* H_{i,t-1} + \varepsilon_{it}^*, \qquad (4)$$

instead of Ravallion's (2012) log-specification in equation (1). Also note that $\beta^* < 0$ in equation (4) is sufficient for poverty to converge, as countries with higher initial poverty rates would see faster *percentage point* reductions of poverty rates. Ravallion's equation (1) demands a much stronger concept of convergence, as it requires that a country should be more likely to reduce poverty from 60 to 30% than from, say, 4 to 2%, as both would imply a 50 *percent* reduction of the poverty rate.

Figure 1: Poverty elasticity of growth

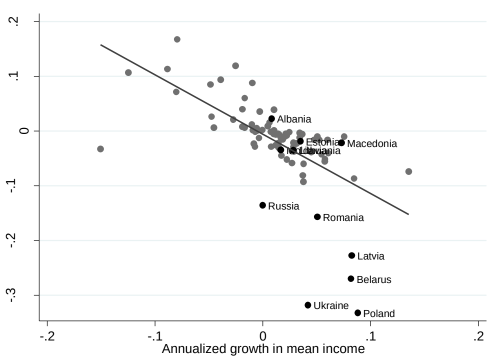
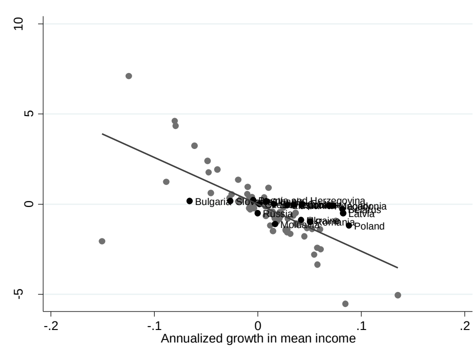


Figure 2: Poverty semi-elasticity of growth



Estimating equation (4) making use of the data in Ravallion (2012) reveals highly significant convergence dynamics in poverty headcount rates, as illustrated in column 2 of Table 1 (as a comparison, column 1 in Table 1 shows the results of the original specification in Ravallion, 2012). This finding is robust to alternative measures of poverty such as the poverty gap and even for the headcount ratio at the lower $1.25/day line, where the problem of initially low and imprecisely measured poverty rates is more severe.[5]

Table 1: Main results

	(1)	(2)	(3)	(4)
VARIABLES	$\Delta \ln(H_{\$2})$	$\Delta(H_{\$2})$	$\Delta(H_{\$1.25})$	$\Delta(PG_{\$2})$
Note:	Ravallion (2012)	Semi-elasticity Headcount $2	Semi-elasticity Headcount $1.25	Semi-elasticity Poverty gap 2$
Log initial poverty	0.00590			
$ln(H_{i,t-1})$	(0.0100)			
Initial poverty		-0.0163***	-0.0268***	-0.0295***
$H_{i,t-1}$		(0.00368)	(0.00474)	(0.00459)
Constant	-0.0400	0.384*	0.366*	0.298**
	(0.0409)	(0.206)	(0.215)	(0.138)
Observations	89	89	89	89
R-squared	0.008	0.112	0.206	0.261

Notes: The 'initial poverty' measure in columns (2)-(4) is the respective initial level corresponding to the dependent variable (i.e. the initial headcount at $2/day, at $1.25/day, and the initial poverty gap at $2/day, respectively). OLS results, heteroscedasticity robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Figure 1 further highlights that practically all of the most severe outliers for the growth elasticity of poverty reduction regression are Central and Eastern European (CEE) transition economies.[6] For these countries Ravallion (2012: 509) states that their experience "is clearly not typical of the developing world." As shown in

[5] Table A.1 in the appendix shows that these results are also robust to the inclusion of the control variables proposed by Ravallion (2012).

[6] The 11 Central and Eastern European countries in the sample, with their corresponding time spans, are Poland (1996-2005), Ukraine (1996-2005), Belarus (2000-2005), Latvia (1998-2004), Romania (1998-2005), Russia (1993-2005), Albania (1996/97-2005), Estonia (1995-2004), Lithuania (1996-2004), Moldavia (1997-2004), and Macedonia (1998-2003).

columns (1) and (2) of Table 2 and in Figure 3 (dashed line), dropping these observations or accounting for their special dynamics with a dummy variable is sufficient to obtain statistically significant poverty convergence even in the demanding log-specification (1) used by Ravallion (2012).[7] This result is robust to alternative measures of poverty (poverty gap at $2/day and the headcount ratio at $1.25/day) and to the inclusion of control variables proposed by Ravallion (2012).[8]

A detailed analysis of this finding poses more challenging data requirements and is beyond the scope of this note, whose focus is to show that poverty convergence only requires the specification of a growth semi-elasticity of poverty reduction and that under this specification poverty convergence *is* indeed present in the developing world. Our results, however, highlight several aspects that need to be taken into account when addressing global poverty dynamics. *First*, CEE transition economies had historically low poverty rates, so even small *percentage point* changes will be reflected in relatively high *percent* changes in the log specification and get a very high leverage in the corresponding least-squares regression. Figure 3 reflects this, as low poverty is the exception among developing countries, so the CEE observations are far off the sample mean. This might also explain the many outliers in Figure 1 and might point to measurement error in the case of economies with low poverty incidence.[9] *Second*, the fact that we do not have to control for the particular dynamics of poverty in CEE countries in our alternative specification in order to obtain evidence of convergence reflects the fact that the semi-elasticity

[7] In particular, it is sufficient to take out the observations of Poland, Ukraine, Belarus, and Latvia, which are the most outlying points, to obtain poverty convergence at the 5 percent level of statistical significance. Excluding Romania and Russia in addition leads to poverty convergence at the 1 percent significance level (results not reported but available on request). Furthermore, it is worth mentioning that there are no significantly different convergence dynamics within the CEE group, as indicated by a statistically insignificant CEE-specific convergence parameter (results not reported but available on request).

[8] See Table A.2 in the Appendix.

[9] The mean initial poverty headcount in the CEE subsample is 5.6%, compared to 30.6% in the overall sample of Ravallion (2012).

approach proposed by Klasen and Misselhorn (2008) is less susceptible to (sometimes arbitrary or poorly measured) developments at the very left tail of the income distribution. *Third*, however, there seem to be CEE-specific dynamics that cannot be fully explained by the analytical implications of the growth elasticity of poverty reduction as derived by Bourguignon (2003). Accordingly, the CEE dummy variable stays statistically significant in our specification of (absolute) poverty convergence (column (3) of Table 2),[10] without changing the overall results much (see Figure 4). *Fourth*, the two most promising channels to explain the specific CEE dynamics appear to be cyclical reversion effects for the mean income growth rate[11] and unique distributional effects that influence the growth elasticity of poverty reduction.[12]

[10] It seems also worth noticing in this context that dropping the 5 or 10 percent of Ravallion's (2012) sample that had the lowest initial poverty incidence, as is usual in many empirical assessments of the growth elasticity, does not lead to observing poverty convergence in the sense of equation (1).

[11] Prior to the sample period, CEE transition economies suffered severe shocks to their output level. Most neoclassical convergence models suggest that such countries, which are far off their steady state, should see higher subsequent growth ('cyclical reversion'). Indeed, CEE countries saw significantly higher mean income growth rates than implied by a simple mean income convergence regression (results are available upon request).

[12] Inequality levels increased substantially during the initial output collapse in transition economies, with a positive relationship between the size of the output collapse and the increase in inequality (see Ivashenko, 2003; Grün and Klasen, 2001). In subsequent years (which are those included in the sample) there was some decline of inequality in countries like Russia, Ukraine, and Belarus, moderating the massive inequality shock experienced earlier. As a result, the unconditional poverty elasticity of growth was larger in those countries, due to this decline in inequality, confirmed in Figure 1.

Table 2: Transition economies' results

VARIABLES	(1) $\Delta\ln(H_{\$2})$	(2) $\Delta\ln(H_{\$2})$	(3) $\Delta(H_{\$2})$
	Elasticity Headcount \$2 w/o CEE	Elasticity Headcount \$2 w/ CEE dummy	Semi-elasticity Headcount \$2 w/ CEE dummy
Log initial poverty	-0.0228***	-0.0220***	
$ln(H_{i,t-1})$	(0.00463)	(0.00631)	
Initial poverty			-0.0208***
$H_{i,t-1}$			(0.00413)
CEE dummy		-0.178***	-1.049***
		(0.0421)	(0.266)
Constant	0.0803***	0.0771***	0.731***
	(0.0195)	(0.0249)	(0.267)
Observations	78	89	89
R-squared	0.230	0.420	0.148

Notes: OLS results, heteroscedasticity robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Figure 3: Log poverty convergence

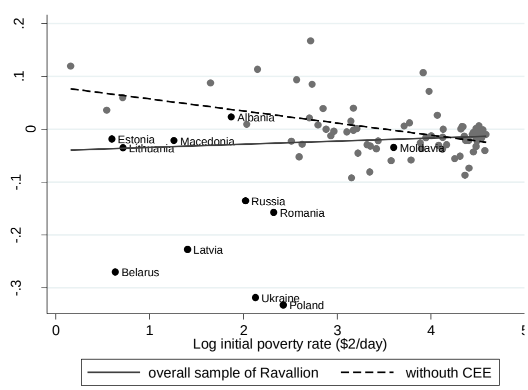
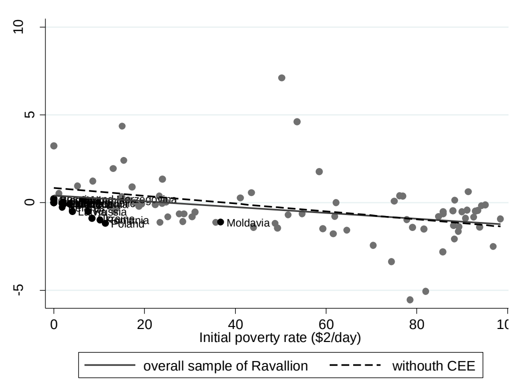


Figure 4: Absolute poverty convergence



Do our findings imply that the argument in Ravallion (2012) about the adverse effect of high initial poverty on growth and on poverty reduction through growth in mean income are mistaken? On the one hand, despite finding robust poverty convergence, we still confirm the finding in Ravallion (2012) that countries with higher initial poverty see lower mean income growth rates[13] and experience a lower growth elasticity of poverty reduction after controlling for CEE-specific poverty dynamics (see columns (1)-(3) of appendix Table A.3). On the other hand, this is purely driven by the log specification of the dependent variable, as the growth *semi*-elasticity of poverty reduction is no longer dependent on the interaction with the initial poverty level, which is far from being statistically significant in either levels or logs.[14] This suggests that there is not necessarily a relevant economic effect of initial poverty slowing down subsequent poverty reduction but that it is by definition more difficult to obtain higher *percent* reductions in poverty rates at higher initial poverty levels, as shown by Bourguignon (2003).

However, either specification suggests that poverty reduction strategies that are based exclusively on growth will only see very limited and slow effects on poverty reduction in countries where poverty is the most pressing problem. In the log specification, the significant interaction term implies that the positive effect between growth and poverty reduction practically vanishes for the majority of developing countries which face high initial poverty rates (see Figure 5 in the Appendix). In the semi-elasticity specification, this results from the implied economic magnitudes: based on Table 1, column (2), assuming a country with a poverty headcount index (at $2 a day) of 41.1 percent (which is the mean at the final period of the sample) would imply an annual poverty reduction of 0.29 percentage

[13] The negative effect of initial log poverty decreases from -0.02 (significant at the 1% level, Ravallion, 2012: Table 2, model 1) to -0.01 (significant at the 10% level) when including the CEE dummy. It is also significant (at the 10 % level) when it enters as the absolute headcount index (instead of logs). Results are available on request.

[14] See columns (4)&(5) of Table A.3 in the Appendix.

points, which is rather low and implies that reaching the international target of eliminating poverty by 2030 is unlikely. Of course, higher growth can make a difference. Based on column (6) in appendix Table A.3, moving from the average sample mean income growth rate of 1.3 % p.a. to the 75th percentile of 3.5 % p.a. would increase the annual percentage point reduction of poverty from 0.31 to 0.88 percentage points—still certainly too low for most developing countries to reduce poverty fast enough.[15] Clearly, higher poverty reduction can only be achieved if inequality is also reduced which, as shown by Bourguignon (2003) and Klasen and Misselhorn (2008), not only reduces poverty directly, but also increases the elasticity (and semi-elasticity) of growth to poverty reduction and might even, following Deininger and Squire (1998), increase growth.

[15] Similar quantitative impacts apply to the $1.25 poverty line, which is the measure that was originally targeted.

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Appendix

Table A.1: Robustness of semi-elasticity specification to control variables

VARIABLES	(1) $\Delta(H_{\$2})$	(2) $\Delta(H_{\$1.25})$	(3) $\Delta(PG_{\$2})$
Note:	Semi-elasticity Headcount $2	Semi-elasticity Headcount $1.25	Semi-elasticity Poverty gap 2$
Initial poverty	-0.0330***	-0.0396***	-0.0427***
$H_{i,t-1}$	(0.00660)	(0.00496)	(0.00493)
Log primary	-0.409	0.132	0.0686
schooling	(0.410)	(0.309)	(0.227)
Log life expectancy	-4.178**	-3.618**	-2.493**
	(1.793)	(1.416)	(1.043)
Log relative price of	0.477**	0.574**	0.440**
investment goods	(0.199)	(0.227)	(0.169)
Constant	18.03**	12.49**	8.603*
	(7.881)	(5.951)	(4.355)
Observations	88	88	88
R-squared	0.371	0.451	0.497

Notes: The table is equivalent to columns (2)-(4) of table 1 but includes the control variables proposed by Ravallion (2012). OLS results, heteroscedasticity robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table A.2: Robustness of log poverty convergence specification with CEE dummy

VARIABLES	(1) $\Delta\ln(H_{\$2})$	(2) $\Delta\ln(H_{\$1.25})$	(3) $\Delta\ln(PG_{\$2})$
Note:	$2 a day (headcount)	$1.25 a day (headcount)	Poverty gap ($2 a day)
Log initial poverty	-0.0312***	-0.0211*	-0.0247***
$\ln(H_{i,t-1})$	(0.00960)	(0.0112)	(0.00516)
CEE dummy	-0.173***	-0.184***	-0.184***
	(0.0440)	(0.0671)	(0.0392)
Log primary schooling	-0.0280		
	(0.0171)		
Log life expectancy	-0.0734		
	(0.0613)		
Log relative price of	0.0107		
investment goods	(0.0109)		
Constant	0.488*	0.0484	0.0577***
	(0.293)	(0.0411)	(0.0181)
Observations	88	82	89
R-squared	0.486	0.188	0.361

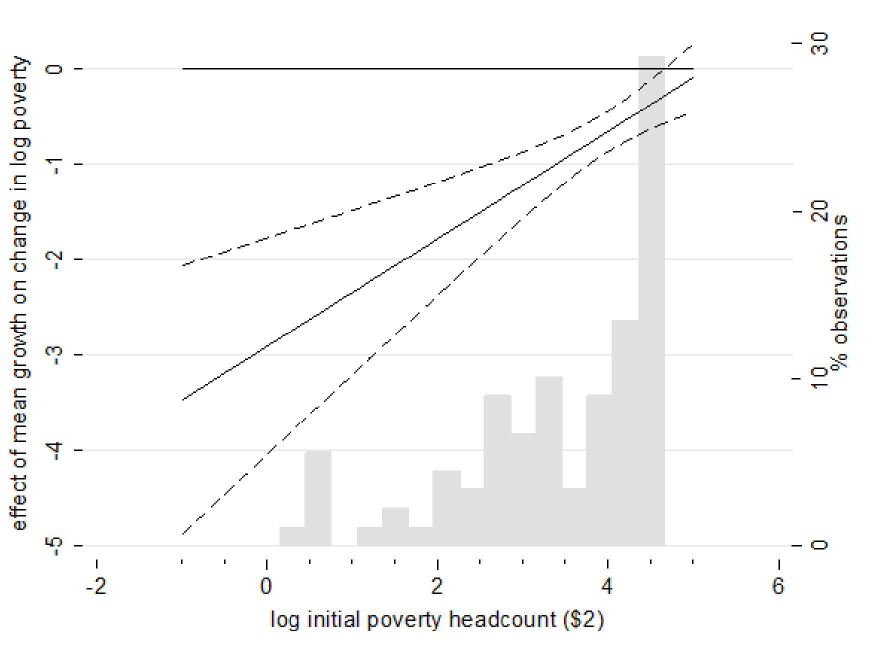
Notes: The 'log initial poverty' measure is the respective initial level corresponding to the dependent variable (i.e. the initial log headcount at $2/day, at $1.25/day, and the log initial poverty gap at $2/day, respectively). OLS results, heteroscedasticity robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table A.3: Effects of initial poverty on the poverty (semi-)elasticity of growth

VARIABLES	(1) % poverty change	(2) % poverty change	(3) % poverty change	(4) % point poverty change	(5) % point poverty change	(6) % point poverty change
Log(initial poverty)	-0.00529	-0.0137***	-0.0130***		-0.24049	
	(0.00498)	(0.00417)	(0.00432)		(0.18309)	
Initial poverty				-0.00942		-0.0112**
				(0.00679)		(0.00430)
Mean income growth	-2.587***	-2.103***	-2.905***	-34.96***	-18.20	-25.59***
	(0.366)	(0.342)	(0.690)	(9.747)	(14.94)	(7.423)
Initial poverty ×	0.0281***	0.0222***		0.136		
Mean income growth	(0.00479)	(0.00450)		(0.210)		
Log(initial poverty) ×			0.563***		-2.448	
Mean income growth			(0.170)		(5.635)	
CEE dummy		-0.0694**	-0.0673	0.853*	0.1637	
		(0.0347)	(0.0408)	(0.492)	(0.374)	
Constant	0.00869	0.0445***	0.0443***	0.302	0.773	0.483***
	(0.0204)	(0.0161)	(0.0164)	(0.192)	(0.470)	(0.156)
Observations	89	89	89	89	89	89
R-squared	0.680	0.721	0.675	0.585	0.573	0.566

Notes: Poverty is measured as the $2/day headcount ratio. Column (1) reproduces Ravallion (2012: Table 4, specification 1). Column (2) uses the same specification with the CEE dummy. Column (3) estimates the same model in a full log-specification, with the results used to obtain the parameters in Figure 6. Columns (4)-(6) show these estimates for absolute poverty levels and changes. As the CEE dummy in column (4) is only significant when the (insignificant) interaction term is included, we drop both in specification (6). OLS results, heteroscedasticity robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Figure 5: Growth elasticity of poverty reduction by initial poverty level



Note: Figure 6 displays the implied effect through the interaction between log initial poverty and mean income growth on log changes in poverty as estimated in Appendix Table A.3, specification (3)