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WIDER Working Paper 2017/149

On the poverty–growth elasticity

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June 2017

United Nations University World Institute for Development Economics Research
wider.unu.edu

Abstract: Poverty–growth elasticities are frequently calculated to provide insight into the inclusiveness of the growth process. Mathematically, the formula employed to calculate the growth elasticity of poverty leads to lower values for higher initial poverty rates, ceteris paribus. This paper discusses the potential for this property to produce misleading results both over time and space. Poverty–growth semi-elasticities provide a more robust measure of the responsiveness of poverty to growth.

Keywords: poverty, growth, elasticity, semi-elasticity
JEL classification: I32, O15, O40

Tables: at the end of the paper.

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This study has been prepared within the UNU-WIDER project on 'Reconciling Africa's growth, poverty and inequality trends—growth and poverty project (GAPP)'.

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ISSN 1798-7237 ISBN 978-92-9256-375-2 https://doi.org/10.35188/UNU-WIDER/2017/375-2

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1 Introduction

The impact of economic growth on poverty reduction, often measured by the growth elasticity of poverty, is a topic of ongoing interest. Not only is a wide academic literature devoted to estimating poverty–growth elasticities (PGE), but it is also highly relevant in policy discussions as is seen in its application in the most recent World Bank poverty assessment for Tanzania (World Bank 2015a). However, an often-overlooked property of PGE is that the use of proportional changes in poverty results in smaller absolute values of the elasticity for relatively higher initial poverty rates holding growth rates and income distribution constant.

Poverty reduction can be decomposed into both growth and distributional components (Bourguignon 2003). Most recent work uses household data to estimate PGE controlling for distributional effects in terms of initial inequality or mean income relative to the poverty line (Bourguignon 2003; Epaulard 2003; Fosu 2009; Kakwani 1993, Kalwij & Verschoor 2007; Ravallion 1997, 2001). In contrast, Ram (2011, 2013) argues that academic PGE estimations that hold distributional factors constant are not useful in policy settings compared to estimates based on actual changes in aggregate growth and poverty. Thus, Ram directly calculates PGE as the ratio of percentage change in aggregate poverty to the percentage change in growth.

Regardless of approach, the inverse relationship between PGE and initial poverty, not due to the structure of income distribution but the presence of initial poverty in the denominator of proportional poverty change, is overlooked. This issue was mentioned in the work of Klasen and Misselhorn (2008) who suggest that this potentially misleading property can be easily overcome by instead calculating poverty–growth semi-elasticities based on level changes rather than proportional changes in poverty. We concur. However, Klasen and Misselhorn do not detail the extent of the bias problem, and PGEs remain the standard in current research.

In this paper, we expound upon the bias inherent in the use of PGE and discuss the advantages of semi-elasticities. We demonstrate that diverging conclusions may be drawn from elasticities compared to semi-elasticities across time or space vis à vis different initial poverty rates and/or poverty lines. We present the merits of semi-elasticities in the growth-poverty context using both fabricated and real-world examples. We then replicate and extend the work of Ram (2013) to semi-elasticities and re-evaluate spatial and temporal conclusions.

2 Elasticities, poverty–growth elasticities, and semi-elasticities

The standard elasticity in economics, the percentage change in quantity divided by the percentage change in price, serves two functions. First, by taking proportions, it converts measures laden with units, quantities and prices, into unit-free proportions. Second, it provides a handy ratio in that it is reasonable to expect some proportional change in quantity for a proportional change in price.

Unfortunately, neither of these functions apply for the standard PGE calculation. Following Ram (2011, 2013), we focus on changes in aggregate poverty and growth and calculate the PGE as follows:

$$\text{PGE} = \frac{\frac{p_t - p_0}{p_0}}{\frac{GDP_t - GDP_0}{GDP_0}}$$

where p_t is the current poverty rate, p_0 is the initial poverty rate, GDP_t is the current GDP, and GDP_0 is the initial GDP. Note that both poverty rates in the numerator are already expressed in percentage terms and are thus unit free. There is no *a priori* reason to be bound to measuring poverty change in proportional terms; hence, the first function of the elasticity calculation is unnecessary.

Rather, there would appear to be good reasons to depart from the standard elasticity procedure. The most troublesome property of PGE is that for a constant percentage point change in poverty $(p_t - p_0)$, the poverty–growth-elasticity is inversely related to the initial poverty rate, p_0. Relatedly, the choice of a higher poverty line will tend strongly to push the poverty elasticity downward for constant percentage point reductions in the poverty rate. Section 3 suggests that these are distressing properties of the PGE. The influence of initial poverty effectively undermines the second function of an elasticity. In particular, it is not reasonable to expect a consistent proportional change in poverty rates independent of the poverty rate (or poverty line) for a given level of growth.

An alternative approach, suggested by Klasen and Misselhorn (2008), employs level change in poverty to calculate the growth semi-elasticity of poverty as follows:

$$\text{semi-elasticity} = \frac{p_t - p_0}{\frac{GDP_t - GDP_0}{GDP_0}}$$

Semi-elasticities eliminate any dependence on initial poverty rates. Semi-elasticities simply measure the percentage point change in poverty associated with a percentage change in GDP (or some other macro aggregate such as consumption).

Table 1 presents a fabricated example to demonstrate these points. Consider countries A, B, and C with identical growth rates. Despite equivalent percentage point reductions in poverty, a higher initial poverty rate in country B results in a lower PGE. Due to higher initial poverty in country C, countries A and C achieve the same PGE even though C reduces poverty to a greater extent. In contrast, semi-elasiticities reported in the final column are strictly rooted in level changes in the poverty rate.

Table 2 presents elasticities and semi-elasticities for Madagascar, Ethiopia and Malawi based on the work of Stifel et al. (2016), Stifel and Woldehanna (2016), and Pauw et al. (2016) in deriving utility consistent consumption poverty lines. Poverty rates are reported in two time periods based on the associated food poverty lines and 125 per cent poverty lines. In addition to actual growth scenarios, a synthetic and fully distribution neutral growth scenario is presented wherein a 5 per cent increase in GDP results in all households experiencing a 5 per cent growth in consumption.

Considering the synthetic case, the influence of initial poverty in the denominator of poverty change is unequivocal. Elasticities within each country are vastly greater using the lower food poverty line and the associated lower poverty rates. This result should be disturbing to users of the PGE, particularly when cross country comparisons are being made using national poverty lines, which are specific to each country.

It is also noteworthy that the percentage point reductions in poverty shown in Table 2 differ little across the two lines for each country, indicating that, within a relevant range of poverty lines, percentage point reductions in poverty, for a given fully distribution neutral GDP growth rate, differ relatively little. As a result, reported poverty growth semi-elasticities are quite consistent, regardless of initial poverty rates/lines. This would seem to be a desirable property.

Actual growth scenarios are more complex due to distributional changes that accompany growth. For example, in Ethiopia the synthetic growth scenario resulted in reduced poverty using both poverty lines whereas in the actual growth scenario, poverty based on the 125 per cent poverty line increased. Nonetheless, the actual growth scenario also illustrates that within each country large differences in elasticities, driven in part by initial poverty lines, are tempered with the use of semi-elasticities.

3 Replication

Table 3 presents a replication Ram's (2013) PGE calculations for the periods 1999–2005 and 2005–08 in developing countries, India, China, and sub-Saharan Africa (SSA) based on data from the World Development Indicators (World Bank 2015b). We extend Ram's analysis to include semi-elasticities. Poverty rates are derived from both the US$1.25 a day and US$2 a day poverty lines. In every country, as poverty lines (and the associated poverty rates) increase, PGEs fall. However, consistent with the results in Table 2, the relative magnitude of semi-elasticities is not tied to the choice of poverty line.

The differences are relevant. Considering the US$1.25 poverty line, the conclusions drawn in inter-country comparisons differ between elasticities and semi-elasticities. Relatively low initial poverty rates magnify China's rate of poverty reduction giving it the highest and second highest elasticities in 1999–2005 and 2005–08, respectively. However, China has the second lowest and lowest semi-elasticities. The reverse occurs in SSA in 1999–2005, which moves from third to first and in India in 2005–08, which moves from last to second.

4 Conclusion

In this paper, we illustrated that the PGE provides a potentially misleading estimate of poverty response to growth that is unduly biased by initial poverty levels. Holding growth, income distribution, and absolute changes in poverty reduction constant, countries with higher initial poverty rates have lower absolute values of PGEs due to the impact of the initial poverty rate in the denominator of proportional poverty change. Consequently, simply changing the choice of poverty line can result in substantively different elasticities. Semi-elasticities, avoid this bias while providing the more informative estimate of level reductions in poverty resulting from increased growth.

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Tables

Table 1. Hypothetical scenario illustrating elasticity versus semi-elasticity

Country	P_0	P_t	Percentage Change in Poverty Rate	Level Change in Poverty Rate	Growth Rate	Elasticity	Semi-Elasticity
A	30.0	10.0	-0.67	-0.20	0.34	-1.96	-0.59
B	50.0	30.0	-0.40	-0.20	0.34	-1.18	-0.59
C	50.0	16.7	-0.67	-0.33	0.34	-1.96	-0.98

Source: Authors.

Table 2. Synthetic and actual growth scenarios in Madagascar, Ethiopia, and Malawi

		Synthetic 5% Growth Scenario					**Actual Growth Scenario**			
	Poverty Line	P_0	P_1	Growth Rate	Elasticity	Semi-Elasticity	P_1	Growth Rate	Elasticity	Semi-Elasticity
Madagascar 2005–10	Food	42.5	39.8	5.0	-1.3	-0.54	46.0	-0.2	-43.70	-18.58
	125 %	71.4	69.0	5.0	-0.7	-0.47	74.4	-0.2	-23.26	-16.60
Ethiopia 2000–05	Food	23.0	19.5	5.0	-3.0	-0.68	16.6	18.4	-1.50	-0.34
	125 %	65.3	61.5	5.0	-1.2	-0.77	66.1	18.4	0.07	0.04
Malawi 2005–11	Food	24.6	22.1	5.0	-2.0	-0.50	24.4	22.7	-0.03	-0.01
	125 %	67.7	64.8	5.0	-0.9	-0.58	58.2	22.7	-0.62	-0.42

Source: Calculations based on Stifel et al. (2016), Stifel and Woldehanna (2016), and Pauw et al. (2016).

Table 3. Extension of Ram's (2013) Tables 1 and 2

	Poverty Rate			Annual Percentage Change in Poverty Rate		Annual Level Change in Poverty Rate		Annual Growth Rate		Elasticity		Semi-Elasticity	
	1999	2005	2008	1999 - 2005	2005 - 2008	1999 - 2005	2005 - 2008	1999 - 2005	2005 - 2008	1999 - 2005	2005 - 2008	1999 - 2005	2005 - 2008
US$1.25 Poverty Line													
Developing Countries	34.1	25.1	22.4	4.98	3.72	1.50	0.90	3.72	5.76	1.34	0.65	0.40	0.16
China	35.6	16.3	13.1	12.21	7.03	3.22	1.07	8.08	10.29	1.51	0.68	0.40	0.10
India	45.6	40.8	37.4	1.84	2.86	0.80	1.13	4.80	6.66	0.38	0.43	0.17	0.17
SSA	57.9	52.3	47.5	1.68	3.16	0.93	1.60	1.56	3.10	1.08	1.02	0.60	0.52
US$2.00 Poverty Line													
Developing Countries	57.4	46.9	43.0	3.31	2.85	1.75	1.30	3.72	5.76	0.89	0.50	0.47	0.23
China	61.4	36.9	29.8	8.14	6.88	4.08	2.37	8.08	10.29	1.01	0.67	0.51	0.23
India	78.9	75.0	72.4	0.84	1.17	0.65	0.87	4.80	6.66	0.18	0.18	0.14	0.13
SSA	77.4	74.1	69.2	0.72	2.25	0.55	1.63	1.56	3.10	0.46	0.73	0.35	0.53

Source: Authors' calculations based on World Development Indicators (World Bank 2015b).