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Decomposing permanent and transitory poverty

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Decomposing permanent and transitory poverty

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Abstract

This paper proposes a new method of calculating the proportion of permanently impoverished persons among persons in poverty as a whole. The paper shows that the widely used Shorrocks-Index for decomposing permanent and transitory inequality can also be acquired to describe poverty. This method overcomes certain difficulties involved in the methods of Rodgers & Rodgers (1993). The characteristics of the proposed Poverty-Stability-Index allow for an intuitive differentiation between the relative sizes of permanent and transitional poverty. Empirical results using data from the German Socio-Economic Panel (*GSOEP*) will be presented for East- and West-Germany.

Zusammenfassung

In der vorliegenden Arbeit wird eine neue Berechnungsweise des Anteils permanenter Armut an der gesamten vorhandenen Armut vorgestellt. Es wird gezeigt, dass der weithin genutzte Shorrocks-Index zur Zerlegung von permanenter und transitorischer Ungleichheit auch zur Beschreibung von Armut genutzt werden kann. Damit können Unzulänglichkeiten in der von Rodgers & Rodgers (1993) gewählten Berechnung behoben werden. Die Nutzung des hier vorgeschlagenen Armuts-Stabilitäts-Koeffizienten erlaubt eine gut interpretierbare Unterscheidung der relativen Größe von permanenter und transitorischer Armut. Empirische Ergebnisse werden anhand des Sozio-oekonomischen Panels für Ost- und Westdeutschland dargestellt.

Keywords: Permanent poverty; transitory poverty; poverty dynamics; panel data.
JEL classification D63; I32

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1 Introduction

The increasing use of a dynamic perspective in poverty research has meant that more and more researchers distinguish between permanent (or chronic) poverty and transitory poverty. The classification of different durations of poverty by Walker & Ashworth (1992) is based on the widespread method of N-times-X (NTX) measures and the associated use of individual cross-sectional income. Results from research on mobility and inequality indicate, however, that these studies of income at separate points in time fail to take long-term welfare level into account.

Using the well established concept of permanent income, Rodgers & Rodgers (1993) suggested dividing poverty into a chronic category and a transitory category. These results were then compared with those of NTX measurements.[1] Their results for the United States indicated that the NTX-method drastically underestimated the proportion of persons in permanent poverty among impoverished as a whole. One advantage of the method from Rodgers & Rodgers is that other inequality measures as well as the head-count ratio can be used. The Rodgers & Rodgers approach is not restricted to the comparison of classical poverty measures for different time intervals. However, the Rodgers & Rodgers index is not normalized, i.e. it does not ensure that the value calculated lies between zero and one. The approach discussed here, which is based on the Shorrocks method of measuring permanent inequality (Shorrocks, 1978), can, however, overcome this weakness.

The index introduced by Shorrocks (1978) (the so-called Shorrocks-Stability-Index or Shorrocks-Index) is widely used to compare inequality in m periods with the inequality in the aggregated period.[2] The index gives the exact proportion of permanent inequality to total inequality.

The paper will proove that any additive decomposable poverty measure – here shown for the index introduced by Foster, Greer & Thorbecke (1984) (FGT with $\alpha > 1$) – corresponds with the axioms set up by Shorrocks (1978) and that the Shorrocks index can therefore be used for the analysis of the effects of income mobility for poverty measurement as well.

The paper starts with a short description of Rodgers & Rodgers and Shorrocks basic ideas, then Shorrocks concept will be applied to the FGT. Finally, some empirical results for Germany, based on data from the German Socio-Economic Panel (*GSOEP*) will be given.[3]

[1] Other possibilities of directly including the duration of poverty in the poverty index are illustrated for the Sen-Shorrocks-Index by Osberg & Xu (2000) and for the FGT-Index by Weikard (2000).

[2] Burkhauser & Poupore (1997), Fabig (1999).

[3] The *GSOEP* database is a longitudinal representative survey containing socioeconomic information on private households in the Federal Republic of Germany (see Wagner et al., 1993).

2 Measuring permanent poverty according to Rodgers & Rodgers

A commonly used approach for the measurement of persistent and transitory poverty is the *NTX* method. It tabulates the proportion of persons with incomes below the poverty line in x out of n time periods, where $0 \leq x \leq n$. The prevalence of persistent versus transitory poverty is then assessed by comparing the proportion of people who where poor in all periods with the proportion of people who were poor in just one or a few periods.[4]

The concept of permanent income represents an alternative to the widespread *NTX* method of classifying and describing permanent or chronic poverty. In this approach, (real) income from several years are simply added up or averaged. This concept assumes that individuals can perfectly shift and redistribute their income over time. That entails that an individual can compensate for a short-term stint in poverty by self-insurance.[5]

In Rodgers & Rodgers approach, an average annual poverty index, which consists of the weighted average of the annual poverty measures for each year, is first defined as:

$$A_p(T) = \sum_{t=1}^{T} w_t P_t \ , \tag{2.1}$$

where $w_t =$ weight at time t, $\sum_{t=1}^{T} w_t = 1$ and $P_t =$ is an additively decomposable poverty measure at time t. Rodgers & Rodgers use the percentage of the cross-sectional population in the total population as weight ($w_t = \frac{n_t}{N}$, where $N = \sum_{t=1}^{T} n_t$ and n_t the number of respondents at time t). They define their population of interest to be all individuals who are present at the end of the income period (Rodgers & Rodgers, 1993, p. 36).

In order to measure chronic poverty, permanent income during the period studied is used and a poverty measure (P) is calculated: They use the head-count ratio

[4] Duncan et al. (1993) and Walker (1998).

[5] Due to the necessity of assuming intertemporal redistribution for calculating permanent income, Rodgers & Rodgers (1993) attempt to take the different interest rates for debt and savings into account. They give the following reason for doing so: "Given a T-year observation period, our measure of an agent's permanent income, Y^*, is equal to the maximum sustainable annual consumption level that the agent could achieve with his or her actual income stream over the same T years, if the agent could save and borrow at prevailing interest rates." (Rodgers & Rodgers (1993), p. 31.) The disadvantage of this type of approach lies with its failure to reflect individual need and therefore the poverty line. This leads to a situation in which savings and debt exist for all incomes (except for if income was the same in all the years), regardless of the income level. See Rodgers & Rodgers (1993), p. 36f. for a more detailed discussion.

and the $FGT_{\alpha=2}$.[6]

$$C_p(T) = P(\mathbf{Y}) \ , \tag{2.2}$$

where $\mathbf{Y} = (Y^*_{T1}, Y^*_{T2} \dots Y^*_{Ti} \dots Y^*_{Tn})$. n is the size of the population and Y^*_{Ti} is the permanent income of person i during the period T. The extent of transitory poverty is therefore defined (according to Rodgers & Rodgers) as the difference between the two indices:

$$T_p(T) = A_p(T) - C_p(T) \ . \tag{2.3}$$

In the approach of Rodgers & Rodgers, however, it is not necessarily the case that $A_p(T) \geq C_p(T)$. They comment on this as follows:

> "A positive $T_p(T)$ equals the amount of poverty which is not chronic in an average year. A negative $T_p(T)$ equals the amount of chronic poverty which is temporarily absent in an average year." (Rodgers & Rodgers, 1993, p. 32)

and, furthermore,

> "We have found that negative values for $T_p(T)$ occur quite frequently when the poverty index, P, is the head-count ratio [...]. Negative values seldom occur when P is a function of poverty gaps." (Rodgers & Rodgers, 1993, footnote 6)

This means, however, that the percentage of permanent poverty in average poverty is not always between zero and one. The incidence of a negative value does not necessarily indicate that chronic poverty did not appear in a certain year.[7] This value can be attributed to two other factors. One is the weights used, because they depend on the size of the population at the individual periods of time. This is particularly the case with the head count ratio, because each person is thereby counted using the same rate (in contrast to the $FGT_{\alpha=2}$). The second lies in the use of a fixed poverty line. Because of these two factors the concavity of the index during several periods is no longer ensured. A method of modifying the index so that it ensures a normalized value between zero and one will be outlined in the next two sections.

[6] The head-count ration is defined as $\frac{q}{n}$, where q = number of persons poor and n number of all persons. For the definition of the FGT, see equation 4.1.

[7] This is a rather unlikely interpretation when one considers that the term chronic does, by definition, mean that a person is *always* poor

3 The Shorrocks-Index

Shorrocks (1978) defines the following conditions for inequality measures to derive his coefficient:

$$I[\mathbf{Y}] = g\left(\frac{\mathbf{Y}}{\mu}\right), \tag{3.1}$$

where $\mathbf{Y} = (Y_1, Y_2, \ldots, Y_n)$ and $\mu = \frac{1}{n}\sum_{i=1}^{n} Y_i$.

Using a social welfare function (continuous, strictly monotonic and symmetric) written as $W = F(\mathbf{Y})$, the welfare level of the equally distributed equivalent income[8] (Y_e) is then equal to the welfare level of the empirical distribution:

$$F(Y_e, Y_e, \ldots, Y_e) = F(\mathbf{Y}) \tag{3.2}$$

and can be written explicity as

$$Y_e = f(\mathbf{Y}) > 0, \tag{3.3}$$

where $f(.)$ is also continuous, strictly monotonic and symmetric. The inequality index is then

$$I = 1 - \frac{Y_e}{\mu} = 1 - \frac{f(\mathbf{Y})}{\mu} = 1 - f\left(\frac{\mathbf{Y}}{\mu}\right), \tag{3.4}$$

if $F(.)$ is assumed to be strictly quasi-concave and homothetic. Therefore $f(.)$ is between $[0, 1]$ and linear homogeneous. These steps correspond to the assumption that the inequality measure is mean independent.

Shorrocks (1978) further shows that $g(x) = 1 - f(x)$ is strictly convex: Define $\sigma > 0$ such that $f(x) = \sigma f(x') = f(\sigma x')$ and after certain transformations (for further details, see Shorrocks (1978), p. 380) one reaches the following conclusion, which is the basic condition for convexity:[9]

$$g(\lambda x + (1-\lambda)x') = 1 - f(\lambda x + (1-\lambda)x') \tag{3.5}$$

$$g(\lambda x + (1-\lambda)x') \leq \lambda g(x) + (1-\lambda)g(x') \tag{3.6}$$

[8]"... the equally distributed equivalent income Y_e is that amount of income which, if received by all individuals, generates the same level of social welfare as the distribution $\mathbf{Y}$." Shorrocks (1978), p. 379.

[9]Where $0 \leq \lambda \leq 1$ and describes the range in which the convexity has to be fulfilled..

Finally, the Index can be written as:

$$\mathbf{S}_I = \frac{I(\mathbf{Y})}{\sum_{t=1}^{T} w_t I(y_t)}\ , \tag{3.7}$$

where $Y = \sum_{t=1}^{T} y_t$, $w_t = \frac{\mu(Y)}{\mu(y_t)}$ and $I(.)$ is a convenient convex inequality measure.

4 The measurement of permanent poverty

The well known poverty measure introduced by Foster et al. (1984) is defined as:

$$\mathbf{FGT}_\alpha = \frac{1}{n}\sum_{i=1}^{q}\left(\frac{z-y_i}{z}\right)^{\alpha};\ \alpha \geq 0 \tag{4.1}$$

where $q =$ is the number of persons poor, $z =$ poverty threshold, $n =$ number of all persons, $y =$ an indicator to describe poverty (i.e. income) and $\alpha =$ a parameter for weighting the individual poverty gap.

Besides other features, the FGT measure is mean independent (with the use of a relative poverty threshold). This means that

$$\mathbf{FGT}(y) = \mathbf{FGT}\left(\frac{y}{\mu}\right). \tag{4.2}$$

To use the FGT with the Shorrocks-Index, the following condition has to be satisfied:

$$\mathbf{FGT}(\lambda \cdot x + (1-\lambda)\cdot x') \leq \lambda \cdot \mathbf{FGT}(x) + (1-\lambda)\cdot \mathbf{FGT}(x'). \tag{4.3}$$

In other words, it has to be strictly convex. This will be the case, because “the strict convexity of P_α in the vector of poor incomes for $\alpha > 1$” is given (Foster et al. (1984), p. 763).

Assuming these steps, the Shorrocks Index can be similarly applied to measure the extent of permanent poverty and will be defined as follows:

$$\mathbf{S}_P = \frac{P(Y)}{\sum_{t=1}^{T} w_t P(y_t)}, \tag{4.4}$$

where $Y = \sum_{t=1}^{T} y_t$, $w_t = \frac{\mu(Y)}{\mu(y_t)}$ and $P(.)$ is a convenient convex poverty measure, like $FGT_{\alpha>1}$.

The proportion of permanent poverty can therefore be calculated precisely using

1. the concept of permanent income,
2. a convex poverty measure and
3. a relative poverty line.

5 Empirical Illustration

The measure from Foster et al. (1984) with $\alpha = 2$ was used for calculating the poverty stability coefficient. However, given the use of the $FGT_{\alpha>0}$ index, the interpretation of the results is somewhat different as compared to the *classical NTX* method which uses the head count ratio. A result of 40% does not mean that 40% of poor persons should be classified as permanently poor, but rather that 40% of poverty, as measured by the $FGT_{\alpha>0}$ index, is classified as permanent poverty.

Table 1: The Poverty Stability Coefficient for West-Germany (1985-1998) with increasing periods for permanent equivalent income (new OECD scale).

	POVERTY				INEQUALITY	
Year	Market Income	Decrease from prev. year	Net household income	Decrease from prev. year	Market Income	Net household income
1985	1.000	—	1.000	—	1.000	1.000
1986	0.893	0.107	0.639	0.361	0.966	0.953
1987	0.842	0.051	0.542	0.097	0.947	0.936
1988	0.807	0.035	0.480	0.062	0.934	0.923
1989	0.784	0.023	0.450	0.030	0.923	0.912
1990	0.771	0.013	0.421	0.029	0.912	0.901
1991	0.755	0.016	0.411	0.010	0.903	0.892
1992	0.740	0.015	0.385	0.026	0.892	0.883
1993	0.724	0.016	0.369	0.016	0.884	0.877
1994	0.708	0.016	0.361	0.008	0.876	0.873
1995	0.693	0.015	0.345	0.016	0.870	0.869
1996	0.676	0.017	0.334	0.011	0.864	0.865
1997	0.663	0.013	0.326	0.008	0.856	0.860
1998	0.650	0.013	0.316	0.010	0.850	0.856

Source: *GSOEP*-PSID-Equivalent-Files, author's calculations (net household income with 1% Bottom-Coding).

Table 1 and 2 show the values of the stability indices calculated for both net household income and market income over an extended period of time (Only persons from West Germany could be included leading up to reunification)[10].

[10] A *balanced-panel*-Design was used to calculate these values for each of the years listed, in table 1 balanced over 1985-1998 and in table 2 over 1985-1991 or 1992-1998. The data are weighted with

The value for 1985-1998 (Table 1) indicate that the clearest reduction of permanent income took place in the first three to four years studied. Permanent poverty continued to decrease after that, but at a slower rate.

Table 1 also provides the values for the original inequality stability coefficient (Columns 5 and 6). The reduction of inequality over time, as indicated by these values, is very low compared to the reduction in permanent poverty. Please note, however, that only the lowest end of the income distribution is considered when looking at poverty reduction, while a decrease in inequality reflects developments within the income distribution as a whole.

It is also clear that the degree to which poverty is reduced depends upon whether market or net household income is used. Again the index is very different from the index used in measures of overall inequality. The reduction of permanent poverty calculated using market income is used is clearly more significant than that calculated with disposable income. The difference, however, barely increases after two years.

The divergent trends of the two stability coefficients of inequality and poverty for market as well as net household income indicate that the tax and transfer system is more effective in preventing permanent poverty than in reducing permanent inequality.

Within the period used for the calculations in Table 1 48% of poverty, as measured using net household income, can be considered permanent after three years (in 1988), while the corresponding percentage for thirteen years later remains at 31.6% (if with an increased time period people are capable to perfectly shift and redistribute their income over time). Using market income, the percentages are 80.7% after three years and 65% after 13 years. This means that almost one-third of average poverty can be viewed as permanent, even over long time periods. However, this high proportion is due to the large number of pensioners in Germany who do not earn market incomes but receive public transfers only.

If one distinquishes between the trend from 1992 to 1998 as well as between the eastern and western parts of Germany, as presented in Table 2, clear differences become apparent. The difference between East and West with regards to market income is not very large. The percentage of permanent poverty after three years is 83,4% in the West and 78,5% in the East and, after six years, 76,3% and 68,3%,

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the *GSOEP* longitudinal weighting factors according to the underlying time periode. The poverty threshold of 50% of the mean of each wave was used, calculated separately for East- and West Germany if these population are analysed independently. The incomes are real incomes adjusted for inflation (base year: 1998), separatly for East- and West-Germany.

Table 2: Poverty Stability Coefficient (1985-1991 and 1992-1998)

	West-Germany			Germany		West-Germany		East-Germany	
year	market	hhnet	year	market	hhnet	market	hhnet	market	hhnet
1985	1.000	1.000	1992	1.000	1.000	1.000	1.000	1.000	1.000
1986	0.917	0.647	1993	0.908	0.668	0.913	0.677	0.892	0.633
1987	0.873	0.549	1994	0.864	0.586	0.870	0.619	0.823	0.410
1988	0.849	0.502	1995	0.830	0.520	0.834	0.557	0.785	0.336
1989	0.828	0.465	1996	0.796	0.454	0.800	0.486	0.734	0.322
1990	0.813	0.432	1997	0.774	0.424	0.779	0.462	0.708	0.269
1991	0.798	0.424	1998	0.756	0.393	0.763	0.436	0.683	0.258

Source: *GSOEP*-PSID-Equivalent-Files, author's calculations, new OECD-scale, net household income with 1% Bottom-Coding.

respectively.

This is, however, different when net household income is used – that is, when redistribution via taxes and transfers are taken into account. The percentage of permanent poverty is then 55,7% in the West and around 33,6% in the East after three years and, after six years, 43,6% and a mere 25,8%, respectively. This implies more than 40% fewer permanent poverty in the eastern part of the country compared to the western part.

Table 3: Permanent Poverty using different poverty measures: Comparison of additive decomposable poverty measures (Rodgers & Rodgers approach) and the poverty stability coefficient.

Percentage of permanent poverty based on net equivalent houshold income (new OECD scale) in average poverty	*NTX*$^{\alpha}$	Additive Decomposition (Rodgers & Rodgers)	Poverty Stability Coefficient (PSC)
West- Germany (1985-1991)	8.3	47.9	42.4
Germany (1992-1998)	8.9	49.7	39.3
West-Germany (1992-1998)	11.1	53.4	43.6
East-Germany (1992-1998)	1.4	45.0	25.8

Source: *GSOEP*-PSID-Equivalent-Files, author's calculations, 1% Bottom-Coding, new OECD-scale, 1985-1991 West Germany only.

$^{\alpha}$The NTX measurement calcalutes the percentage of permanently poor persons among all persons in poverty at that particularly time. Therefore, the numbers cannot be compared directly and were simply included here for the sake of completeness.

Comparison of the results from the poverty stability coefficient and the additive decomposition measure used by Rodgers & Rodgers (1993) indicates two major differences. (See the overview in Table 3). On the one hand, all the percentages computed with the method described in this paper are lower. The reason why the percentages calculated with the poverty stability coefficient are lower lies with the method of computation, which ensures that the coefficient always takes on values between zero and one. With additive poverty decomposition, the percentage of permanent income in western Germany rose from 47.9% in 1985-1991 to 53.4% in 1992-1998. In contrast, the poverty stability coefficient indicates only a small increase from 42.4% to 43.6%. On the other hand, the large difference between values for the two parts of the country (in East Germany 1992-98 additive decomposition: 45%; poverty stability coefficient: 25.8%) comes to light. The differences in the values for the eastern part of the country are, however, very large.

Exaggeration of permanent poverty indicated by the additive decomposition method is supported by additional calculations of inequality among the poor. In this analysis, the largest reduction in inequality is indicated for the cumulated income of the poor in the eastern part of the country. The NTX method also indicates that little enduring poverty existed in the eastern part of Germany.

6 Conclusions

The paper shows that it is convenient to use the Shorrocks-Index not only for overall inequality measure, but also with a convex poverty measure, i. e. the FGT with a poverty aversion parameter of $\alpha = 2$. This feature makes it possible to enhance the dynamic description of poverty, because the extent of permanent and transitory poverty can be estimated with the use of longitudinal datasets. A further advantage of this approach is that the Shorrocks-Index is well-known, can be interpreted quite easily, and is sensitive to the amount of mobility within the population.

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