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On the contribution of the three I's of poverty to chronic and transitory poverty

Osnat Israeli
Department of Economics, Ashkelon Academic College, Israel

Michal Weber
Department of Management, Bar-Ilan University, Israel

Abstract

This paper uses the Watts poverty index in order to derive a breakdown of poverty into chronic and transitory poverty. Following a paper by Chakravarty et al. (2008), we then suggest a new decomposition of these two components. Using the new decomposition, we are able to analyze the contribution of the "three I's of poverty" (see, Jenkins and Lambert, 1997), the incidence of poverty (i.e. the head count ratio), intensity (depth) of poverty (i.e. the Watts poverty gap ratio) and inequality among the poor (i.e. the mean logarithm deviation index of income inequality among the poor) to chronic and transitory poverty. An empirical illustration is also presented, based on a panel built by the Central Bureau of Statistics in Israel on the basis of administrative data during the period 1995-2006. The results show that chronic poverty is 57% of total poverty, and is affected more by the intensity (depth) of poverty than by inequality among the poor, while transitory poverty is roughly equally affected by the three I's of poverty.

1. Introduction

In the past, most of the studies on poverty took a static approach to the issue mainly because of the lack of panel data, so that they either analyzed how poverty varied over time in a given country or compared poverty in various countries at a point in time. Much scarcer were the attempts to look at what happened over time to given households or individuals. However, the growing availability of panel data makes it now possible to take a more dynamic view of poverty and to focus one's attention on the concept of chronic and transitory poverty, i.e. households (or individuals) who are permanently poor, and households who get in and out of poverty through time.

Three different views of chronic poverty seem to have appeared in the literature (see, McCulloch and Calandrino, 2003):

1) The "permanent income approach", where the chronically poor are those whose mean income or consumption over time is below the poverty line.

2) The "spells approach", when the chronically poor are those households (individuals) with a high frequency of being in poverty over some period of time (i.e, a high probability of being poor).

3) The "vulnerability approach", where the chronically poor are those households (individuals) for which one observes a high degree of persistence in poverty (that is a high probability of being poor if one was poor in the previous period).

The first method, the "permanent income approach", is the one which will be adopted in the present study. As mentioned previously, a household is defined as chronically poor if its permanent income is below the poverty line. The permanent income itself is usually computed as the income of the household averaged over time (Jalan and Ravallion, 1998, Haddad and Ahmed, 2002, and Cruces and Wodon, 2003). The permanent income is computed differently in Jalan and Ravallion (2000) where it is estimated using a regression model. The "permanent income" method is meant to identify those who are unlikely to escape poverty permanently over a long period of time, and also takes into account the depth of poverty, as a household may get in and out of poverty but if its mean income is below the poverty line, it is considered chronically poor.

A different approach is the "spells" approach (as called by McKay and Lawson, 2003), where the chronically poor are identified on the basis of the number or length of spells of poverty they experience. A household may be considered as poor if its income or consumption level is below the poverty line in each and every year of the data. A different criterion for being identified as chronically poor is if the household's income falls below the poverty line in three consecutive periods. A problem arises, of course, due to the truncated nature of the data, since even if the data follow the household for several consecutive years, we do not know its income levels before or after the survey period.

In both approaches (permanent income and spells) we should note that the results may be sensitive to the level of the poverty line or to the precise definition of the standard of living measure.

An alternative definition of chronic poverty is that a household should be poor a large number of times during a given period. This definition fits better with the intuitive notion that a household should be "typically" poor in order to be considered chronically poor. Therefore, vulnerability refers not to the current status of a household with respect to a given poverty line, but rather to the risk or probability that a household will be poor in some future period. While the concepts of vulnerability

and poverty are related, they are not the same thing. Having a high level of vulnerability can, however, be interpreted as one way of defining chronic poverty. (For more details see Mcculloch and Calandrino 2003)

2. Methodology

When estimating poverty, several measures of individual welfare may be considered; the most common are income and consumption. Consumption may be a better measure for living conditions than income, as it is usually more smoothed over time, whereas income fluctuates considerably (thus transient poverty may be overstated), and also considered as being less accurately measured. However, the panel data available for Israel do not include data on consumption so that we had to use income to measure chronic and transitory poverty (Cruces and Wodon, 2003, do the same, as they encounter the same problem).

As we noted above, chronic and transitory poverty may be defined in several ways, each focusing on persistent poverty from a slightly different aspect (McKay and Lawson, 2003, Hulme and McKay, 2007). We have decided (following Jalan and Ravallion, 1998, Cruces and Wodon, 2003, Rodgers and Rodgers 2009) to define a household as chronically poor if its average income over a certain period is below the poverty line[1]. An index of poverty for household (or individual) i aiming at measuring its poverty level over time may be written as:

$$P_i = P(s_{i1}, s_{i2}, \ldots s_{iT}) \tag{1}$$

where P is some poverty index, s_{it} the income of individual i at time t and T the total number of periods. Following Chakravarty et al. (2008) we are using the Watts index.

A chronic poverty index, on the other hand, would be the poverty index value when income is equal to mean income, over the whole period:

$$CP_i = P(\bar{s}_i, \bar{s}_i, \ldots \bar{s}_i) . \tag{2}$$

The transitory component is then simply the remainder:

$$TP_i = P_i - CP_i \tag{3}$$

Aggregating the poverty measure over all households (or individuals), we get an index of poverty for the population, which may be decomposed into its two components, chronic and transitory poverty.

In addition to choosing a poverty index, one should pay attention to the poverty line chosen. Generally, three approaches may be taken (Deutsh, Israeli, Silber, 2007): The absolute poverty approach, where the poverty line corresponds to the income level that is necessary to acquire some basic standard of living; a second one which takes a relative approach to poverty measurement. Such a point of view

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[1] We use standardized income, in order to take into account the number of persons in the household. In most studies of poverty, the unit of observation is the household. But one could also think of selecting the individual or the family. In fact the choice of unit of observation should depend on the assumption that is made with respect to the intra-familial allocation of resources. If one supposes that resources are divided equally between the members of the family (or household), one should prefer the family (or household) over the individuals. On the other hand, if one has reasons to believe that resources are not divided equally between the family or household members, the unit of observation should be the individual.

assumes that poverty is defined not in terms of deprivation with respect to resources but rather as a function of the distribution of the relevant welfare indicator of the society. The third approach emphasizes the subjective aspect of the identification of the poor. Here the threshold is not determined by experts or external observers but by the perceptions of the households themselves.

Rodgers and Rodgers (2009) used a relative poverty line, but two possibilities are presented when computing the relative poverty line based on average income (that is, a chronic poverty line). One possibility is to compute each person's average income during the period of observation, find the median of the distribution of these individual average income and then define the poverty line as a given proportion (say 50 per cent) of that median. The problem with this procedure is that it is possible that someone who is not poor in any year could be classified as chronically poor, and someone who is poor in every year could be classified as not chronically poor. To avoid this inconsistency, Rodgers and Rodgers (2009) decided that the chronic poverty line should be equal to the average income of someone who earns a given proportion (say, 50 per cent) of the median income in each year. Thus, someone who is below the poverty line every year will also be below the chronic poverty line and therefore classified as chronically poor. An individual who is not chronically poor but is poor in a particular year is said to be in transitory poverty.

Jalan and Ravallion (1998) selected a poverty line based on the normative food bundle set by China's State Statistical Bureau. Full details on the construction of such a poverty line may be found in Chen and Ravallion (1996).

After choosing a poverty line, one should select an index of poverty. Jalan and Ravallion (1998) used two measures of poverty. One is the squared poverty gap (SPG) which belongs to the family of the FGT poverty index (see Foster et al. 1984). The other is the Watts (1968) poverty index, which is simply the population mean log shortfall below the poverty line. This index is strictly convex, as is SPG. Following Jalan and Ravallion (1998) and Chakravarty et al. (2008) we use the uni-dimensional Watts poverty index P_{Wu}, which we aggregate over time in order to be able to make a distinction between chronic and transitory poverty:

$$P_{wu} = \frac{1}{T}\sum_{t=1}^{T}\frac{1}{n}\sum_{i=1}^{n_{pt}}\log(\frac{\gamma}{s_{it}}) \qquad (4)$$

where n is the number of households in the sample, n_{pt} the number of households below the poverty line in year t and γ the poverty line. We assume without loss of generality that the first n_p individuals with income $s_1, s_2, ... s_{n_p}$ are poor.

Following what we wrote above, we may decompose the Watts index into a chronic poverty component, and a transitory component. The chronic component is defined as:

$$CP_{wu} = \frac{1}{n}\sum_{i=1}^{n_p^c}\log(\frac{\gamma}{\overline{s_i}}) \qquad (5)$$

where n_p^c is the number of the chronically poor households (those households whose mean income in below the poverty line) assuming the mean incomes are classified by increasing order, and $\overline{s_i} = \frac{1}{T}\sum_{t=1}^{T}s_{it}$ is the average income of household i. The transitory component, as previously mentioned, is then the residual:

$$TP_{wu} = \frac{1}{T}\sum_{t=1}^{T}\frac{1}{n}\sum_{i=1}^{n_{pt}}\log(\frac{\gamma}{s_{it}}) - \frac{1}{T}\sum_{t=1}^{T}\frac{1}{n}\sum_{i=1}^{n_p^c}\log(\frac{\gamma}{s_i}) =$$

$$= \frac{1}{T}\frac{1}{n}\sum_{t=1}^{T}[\sum_{i=1}^{n_{pt}}\log(\frac{\gamma}{s_{it}}) - \sum_{i=1}^{n_p^c}\log(\frac{\gamma}{s_i})] \qquad (6)$$

Following the paper by Chakravarty et al. (2008), the Watts index for one period may be written as:

$$P_{wu} = H(P_{w,PGR} + L_p) \qquad (7)$$

where

$H = \dfrac{n_p}{n}$ is the head count ratio, and may reflect the incidence of poverty

$P_{w,PGR} = \log(\dfrac{\gamma}{s_{pt}})$,where s_{pt} is the average income of the poor households in year t.

This expression is called the "Watts poverty gap ratio" by Chakravarty et al.(2008) and is conceptually similar to the income gap ratio. This expression corresponds approximately to the percentage gap between the poverty line and the mean income of the chronic poor, so that it measures the intensity (depth) of poverty. The third

component in the R.H.S. of the equation is L_p, where $\quad L_p = \log(s_{pt}) - \dfrac{1}{n_{pt}}\sum_{i=1}^{n_{pt}}\log(s_{it})$

is the Bourguingnon (1979)- Theil (1967) mean logarithm deviation index of income inequality among the poor. It therefore measures the severity of poverty since it takes into account the degree of inequality among the poor.

However, when considering several time periods, the Watts index will be written as:

$$P_{wu} = \frac{1}{T}\sum_{t=1}^{T}H_t(P_{w,PGR_t} + L_{p_t}). \qquad (8)$$

If we want to pay attention to chronic and transitory poverty separately, then the above formulae may be decomposed into a component representing chronic poverty:

$$CP_{wu} = H^c(P^c_{w,PGR} + L^c_p) \qquad (9)$$

where

$H^c = \dfrac{n_p^c}{n}$ and $P^c_{w,PGR} = \log(\dfrac{\gamma}{s_p^c})$, where $s_p^c = \dfrac{1}{n_p^c}\sum_{i=1}^{n_p^c}\bar{s}_i$ and

$$L^c_p = \log(s_p^c) - \frac{1}{n_p^c}\sum_{i=1}^{n_p^c}\log(\bar{s}_i) = \sum_{i=1}^{n_p^c}\frac{1}{n_p^c}\log(\frac{s_p^c}{\bar{s}_i}).$$

The transitory poverty component is then equal to the residual, that is

$$TP_{wu} = P_{wu} - CP_{wu}$$

$$= \frac{1}{T}\sum_{t=1}^{T}H_t(P_{w,PGR_t} + L_{pt}) - H^c(P^c_{w,PRG_t} + L^c_p)$$

$$= \frac{1}{T}\sum_{t=1}^{T}\frac{n_{pt}}{n}[\log(\frac{\gamma}{s_{pt}}) + (\log(s_{pt}) - \frac{1}{n_{pt}}\sum_{i=1}^{n_{pt}}\log(s_{it}))] - \frac{n_p^c}{n}[\log(\frac{\gamma}{s_p^c}) + (\log(s_p^c) - \frac{1}{n_p^c}\sum_{i=1}^{n_p^c}\log(\bar{s}_i))]$$

$$(10)$$

Using the Shapley decomposition procedure, this expression may be further decomposed in order to derive the contribution of the three components of transitory

poverty. For example, to measure the contribution of the first component to transitory poverty, the incidence of poverty (H), we would eliminate the volatility of this component, i.e. replace H_t by H^c each year t. A similar approach would be adopted to derive the marginal contribution of P, the intensity of poverty, and of L, the income inequality among the poor. The full decomposition procedure is presented in the appendix.

Writing more simply equation (10) as

$$T = P - C = \frac{1}{T}\sum H_t(P_t + L_t) - H^c(P^c + L^c) \tag{11}$$

and using the Shapley decomposition procedure (see, Appendix), we then derive that

$$Cont(L) = \frac{1}{2}\frac{1}{T}\sum(L_t - L^c)(H_t + H^c) = \tag{12}$$

$$\frac{1}{2}\frac{1}{T}\sum(\log\frac{\gamma}{S_{pt}} + \log S_{pt} - \frac{1}{n_{pt}}\sum_{i=1}^{n_{pt}}\log S_{it} + \log\frac{\gamma}{S_p^c} + \log S_p^c - \frac{1}{n_p^c}\sum_{i=1}^{n_p^c}\log \overline{S}_i)(\frac{n_{pt}}{n} - \frac{n_p^c}{n})$$

$$Cont(P) = \frac{1}{2}\frac{1}{T}\sum(P_t - P^c)(H_t + H^c) \tag{13}$$

and

$$Cont(L) = \frac{1}{2}\frac{1}{T}\sum(L_t - L^c)(H_t + H^c) \tag{14}$$

where $Cont(H)$, $Cont(P)$ and $Cont(L)$ refer to the marginal contributions of the incidence of poverty, the intensity of poverty and the Bourguignon- Theil index of inequality among the poor.

3. Data Description

The empirical illustration presented here is based on a panel which the Central Bureau of Statistics in Israel constructed on the basis of administrative data. The basis of this panel is the set of households who had to fill an expanded questionnaire (including questions on their income) at the 1995 Census. A sample of 35,000 individuals was drawn from this set and the individuals in this sample were followed during the period 1995-2006. Individuals who died during the years were removed from the sample and replaced by individuals sampled from the Population Register in order to preserve the sample size. Each year, the administrative family members of the sampled individuals were added to the data as well. These are the only panel data available for research, and they combine demographic information obtained from the Census with economic variables retrieved from the Internal Revenue Service and the National Insurance Institute (Social Security).

The data we used cover the period 2000-2006 because for these years we also have data on allowances and social security benefits. The computation of the poverty indices was based on the households' income which include income from wages from salaried work and other (mostly self-employment), social benefits and other allowances (i.e. unemployment benefits, disability allowance, survivor benefits, pension, child allowance and income supplementary support). The sample analyzed

includes 21,418 Jewish households[2]. Standardized income was defined as household income divided by the square root of the number of individuals in the household.

4. Results

Let us now turn to the results obtained when adopting the Watts poverty index. Table I gives the value of the Watts index for each year as well as that of the three components distinguished by Chakravarty et al. (2008)[3].

It appears that, as a consequence of the recession that took place between 2000 and 2003 but also because of a change in social policy, the Watts poverty index increased throughout the period, starting in 2001. As was just mentioned, support for the population below the poverty line began to fall in the mid-1980s but this process reached its peak in 2002 when the Israeli government introduced big cuts in social benefits such as child allowances, eligibility for unemployment benefits and income support for the disabled (for more details see Schwartz, Ehrlich and Zadik ,2006, Shperman 2009 and Achdut, Cohen and Endeweld 2004).

It can be observed that these reforms had also an impact on the head count ratio since the latter increased between 2002 and 2005. Note that the two other components P_{w,PGR_t} and L_{p_t} of the Watts index P_{wu} also increased between 2002 and 2006. However, in all years, the impact of the intensity of poverty (P_{w,PGR_t}) to total poverty is much more important than that of the income inequality among the poor. Other researchers also found out that poor families became poorer and that their income moved away from the poverty line (see Achdut, Cohen and Endeweld, 2004). As mentioned previously, inequality between the poor (L_{p_t}) also increased, probably again because of cuts in social benefits but eventually also because of a deepening of the globalization process (see Shperman 2009).

In Table II the Watts index for the whole period is decomposed into chronic (as in equation (5)) and transitory (equation (6)) components. The Watts index for the whole period is equal to 0.172 while the chronic and transitory components are respectively equal to 0.096 and 0.076. The chronic component represents thus 56% of the overall poverty.

In equation (9) above, we have shown that the chronic poverty index may be expressed as a function of three determinants which are, respectively, the incidence of poverty (H^c), the intensity of poverty (P^c) and the income inequality among the chronically poor (L^c). Table III shows that the incidence of poverty H is equal to 0.23, the intensity of poverty P to 0.34 and the Bourguignon-Theil inequality index L to 0.078. The impact of P, which reflects the depth of poverty, on the Watts index is hence much stronger than that of L which measures inequality among the chronically poor.

Note also that the incidence of being chronically poor (equal to 0.23) is quite close to the annual headcount ratios (which was vary between 0.26 and 0.29). On the other hand the indices P and L among the chronically poor are quite lower than the annual values of these indices.

Finally, Table IV presents the contribution of each of the three components to transitory poverty. To compute these marginal contributions we applied the so- called Shapley (1953) decomposition technique (see the Appendix, Shorrocks, 1999 and

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[2] Non-Jewish households are not included in our sample as there are not many of these households who stay in the sample for the whole period.
[3] The decomposition is also presented in equation (7) above.

Sastre and Trannoy, 2002, for more details). The contributions of the three components to transitory poverty, which is equal to 0.076, (see, Table II) are respectively equal to 0.0232 for H, 0.0263 for P and 0.0262 for L. The corresponding propositions are 30.5%, 35% and 34.5% of it.

Table I: Watts Poverty indices and their decomposition, 2000-2006

Year	2000	2001	2002	2003	2004	2005	2006
Watts Index*	0.176	0.149	0.155	0.168	0.179	0.188	0.189
Incidence of poverty (H_t)	0.27	0.26	0.27	0.28	0.29	0.28	0.27
Intensity of poverty (P_{w,PGR_t})	0.48	0.42	0.425	0.43	0.44	0.45	0.46
Inequality among the poor (L_{p_t})	0.17	0.15	0.14	0.16	0.19	0.23	0.24

* Watts index= $H_t(P_{w,PGR_t} + L_{p_t})$

Table II: Decomposition of poverty into chronic and transitory poverty

Poverty index (Total)	Chronic poverty	Transitory poverty
0.172	0.096	0.076

Table III:Decomposition of chronic poverty*

Incidence of chronic poverty (H^c)	Intensity of chronic poverty (P^c)	Income inequality among the chronically poor (L^c)
0.23	0.34	0.078

* Chronic poverty= $H^c(P^c + L^c)$

Table IV: Shapley decomposition of transitory poverty*

Contribution of the incidence of poverty (H)	Contribution of the intensity of poverty (P)	Contribution of income inequality (L)
0.0232	0.0263	0.0262

* Transitory poverty= $Cont(H) + Cont(P) + Cont(L)$

5. Concluding Remarks

In this study, we decompose the Watts poverty index into chronic and transitory poverty. We then suggest a new decomposition, allowing us to analyze the contribution of the "three I's of poverty" (Jenkins and Lambert, 1997): the incidence of poverty, intensity of poverty and inequality among the poor, to chronic and transitory poverty. This decomposition enables us to identify the different impacts these three factors may have on the two components of poverty, and thus implement policies better suited for each in order to effectively reduce chronic and transitory poverty. The empirical illustration, which is based on a panel built by the Central Bureau of Statistics in Israel on the basis of administrative data during the period 1995-2006, shows that chronic and transitory poverty are important components of total poverty since their respective shares are 56% and 44%. We also observed that chronic poverty is more affected by the intensity of poverty than by inequality among the poor, whereas transitory poverty is about equally affected by the three I's of poverty.

Appendix

$$Cont(H) = \frac{2}{6}(\frac{1}{T}\sum H_t(P_t + L_t) - \frac{1}{T}\sum H^c(P_t + L_t)) +$$

$$\frac{1}{6}(\frac{1}{T}\sum H_t(P^c + L_t) - \frac{1}{T}\sum H^c(P^c + L_t)) +$$

$$\frac{1}{6}(\frac{1}{T}\sum H_t(P_t + L^c) - \frac{1}{T}\sum H^c(P_t + L^c)) +$$

$$\frac{2}{6}(\frac{1}{T}\sum H_t(P^c + L^c) - \frac{1}{T}\sum H^c(P^c + L^c)) =$$

$$\frac{2}{6}\frac{1}{T}\sum (P_t + L_t)(H_t - H^c) +$$

$$\frac{1}{6}\frac{1}{T}\sum (P^c + L_t)(H_t - H^c) +$$

$$\frac{1}{6}\frac{1}{T}\sum (P_t + L^c)(H_t - H^c) +$$

$$\frac{2}{6}\frac{1}{T}\sum (P^c + L^c)(H_t - H^c) =$$

$$\frac{1}{2}\frac{1}{T}\sum (P_t + L_t + P^c + L^c)(H_t - H^c) =$$

$$\frac{1}{2}\frac{1}{T}\sum (\log\frac{\gamma}{S_{pt}} + \log S_{pt} - \frac{1}{n_{pt}}\sum_{i=1}^{n_{pt}}\log S_{it} + \log\frac{\gamma}{S_p^c} + \log S_p^c - \frac{1}{n_p^c}\sum_{i=1}^{n_p^c}\log \overline{S}_i)$$

$$(\frac{n_{pt}}{n} - \frac{n_p^c}{n})$$

$$Cont(P) = \frac{2}{6}(\frac{1}{T}\sum H_t(P_t + L_t) - \frac{1}{T}\sum H_t(P^c + L_t)) +$$

$$\frac{1}{6}(\frac{1}{T}\sum H^c(P_t + L_t) - \frac{1}{T}\sum H^c(P^c + L_t)) +$$

$$\frac{1}{6}(\frac{1}{T}\sum H_t(P_t + L^c) - \frac{1}{T}\sum H_t(P^c + L^c)) +$$

$$\frac{2}{6}(\frac{1}{T}\sum H^c(P_t + L^c) - \frac{1}{T}\sum H^c(P^c + L^c)) =$$

$$= \frac{2}{6}\frac{1}{T}\sum H_t(P_t + L_t - P^c - L_t) +$$

$$\frac{1}{6}\frac{1}{T}\sum H^c(P_t + L_t - P^c - L_t) +$$

$$\frac{1}{6}\frac{1}{T}\sum H_t(P_t + L^c - P^c - L^c) +$$

$$\frac{2}{6}\frac{1}{T}\sum H^c(P_t + L^c - P^c - L^c) =$$

$$\frac{1}{2}\frac{1}{T}\sum (P_t - P^c)(H_t + H^c)$$

$$Cont(L) = \frac{1}{2}\frac{1}{T}\sum (L_t - L^c)(H_t + H^c)$$

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