Has recent economic growth in Poland been pro-poor?

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Abstract

This paper applies two recently introduced measurement frameworks to analyze the effects of economic growth and inequality changes on the performance of the poor's living standard in Poland during the recent decade of 1998–2008. We use both an approach based on a general class of pro-poorness indices as well as dominance-based techniques, which allow for robust statistical inference on pro-poorness. Using repeated cross-sectional household survey data, we find that over the decade, there was a statistically significant absolute pro-poor growth in Poland for both disposable income and consumption. However, because of the increasing inequality, the rates of growth for incomes and consumption of the poor were generally lower than those of the non-poor. For this reason, economic growth over the decade was anti-poor in relative terms. The pro-poorness indices used suggest that the only episode of relative pro-poorness was for income growth during fast-growth years from 2005 to 2008. This result holds, however, only for a limited range of possible poverty lines.

Keywords: pro-poor growth, inequality, absolute poverty, economic transition, Poland

1. Introduction

Poland is widely perceived as one of the most successful transition countries of the Central and Eastern Europe (CEE). Perhaps the most obvious reason for this assessment is Poland's growth performance after 1989. The cumulative growth of GDP between 1989 and 2003, including severe recession of 1990–1991, achieved 35% and was the highest in this period among eight CEE countries as well as higher than the average growth of the 15 countries making up the European Union (EU) in 2003 (Kornai, 2006). The pace of growth during the 1990s and 2000s was, however, uneven. It was on average 5.3% during 1992–1997, but slowed down to 3.6% over 1998–2005 and was particularly weak between 2001 and 2002 averaging 1.3%. After Poland joined the EU in May 2004, the rate of growth accelerated to 5.4% per year during 2005–2008.

The solid GDP growth did not always translate into growth of personal incomes and consumption. For example, despite positive growth numbers for both GDP and private consumption taken from National Accounts Statistics (NAS) during 1998–2005, household survey data show falling numbers for the mean disposable incomes and consumption expenditures (see Paci et al., 2004 and Szulc 2008).[1] However, for the recent period between 2005 and 2008, fast GDP growth went hand in hand with rapid growth of living standards as estimated form household surveys.

A common theme in recent literature on distributional consequences of growth has been that a meaningful evaluation of economic performance of a country should include not only the country's record in improving its aggregate welfare gains, but also an assessment of how these gains from growth (or losses from contractions) are shared among different individuals or groups in society. In particular, works in this strand of literature provided a number of formal tools for investigating the question whether gains from growth (or losses from recessions) are distributed in a way that is in some sense

[1] See also Table 1 in this paper showing estimates of mean disposable income and consumption expenditures calculated using household survey data. Possible explanations of these inconsistencies between NAS and household surveys include the unusually high investment accumulation in Poland over the 1990s and the relatively high export rate (Paci et al., 2004) as well as measurement errors and different coverage and accounting practices (Ravallion, 2003).

favourable for the poor or, equivalently, whether the economic growth is "pro-poor" (see reviews by Essama-Nssah and Lambert, 2009 and Araar et al., 2009). These tools are commonly used now in development economics literature to assess the growth performance of developing countries, but similar techniques are used also to evaluate the pro-poorness of growth in developed countries (see e.g. Jenkins and Van Kerm, 2006; 2011).

In this paper, we apply several pro-poorness measurement frameworks in order to verify if recent economic growth in Poland has been pro-poor. In particular, we use the growth incidence curves of Ravallion and Chen (2003), pro-poorness indices proposed by Essama-Nssah and Lambert (2009) and a pro-poorness stochastic dominance framework introduced by Duclos (2009) and operationalized by Araar et al. (2009). The latter two approaches have the advantage that they are generalizations of several contributions suggested by earlier authors. In addition, the second of them offers not only estimation methods, but also statistical inference tools that allow for robust testing for pro-poorness of growth using survey data.

Our analysis is based on repeated cross-sectional micro-data taken from the Polish Household Budget Surveys (HBS) conducted yearly by the Polish Central Statistical Office. Specifically, we use data for 1998, 2005 and 2008. The choice of the starting date is dictated by data comparability limitations (more on this, see Section 3), while the 2008 is the last available year. The middle year, 2005, divides the studied period into two sub-periods: recession and stagnation during 1998–2005 and fast-growth experience between 2005 and 2008.[2] In all our analyses, we exploit detailed information about the sampling design of the HBS, which allows us to calculate corrected standard errors for use in inferential procedures.

This paper is related to the substantial literature on poverty and inequality in Poland during transition. For reviews of this literature, see Szulc (2008) in case of poverty and Brzezinski and Kostro (2010) in case of inequality. The paper most closely related to the present one is that of Paci et al. (2004), which analyzes the impact of growth on

[2]As remarked earlier, the HBS data show a recession (negative mean income and consumption growth) during the most of 1998–2005 period, while the NAS data suggest that the growth rates were positive over the same period, but very low (stagnation).

poverty in Poland between 1994 and 2002 using, inter alia, growth-inequality poverty decompositions and growth incidence curves. However, the pre-1998 analysis in this paper does not account for data comparability problems (see Section 3). The authors do not verify also if their estimates are statistically significant. The analysis in the present paper covers the longer period, including the fast-growth years of 2005–2008, and uses recently developed tools allowing for robust and statistically informed pro-poorness judgments.

Son and Kakwani (2008) provide a cross-country analysis of pro-poor growth in 80 countries between 1984 and 2001 using grouped data on income distribution provided by the World Bank. They use an index of pro-poorness similar to the poverty equivalent growth rate (*PEGR*) proposed by Kakwani and Son (2008).[3] For Poland, they analyze five 3–year growth spells between 1984 and 1999 obtaining results that three of these spells were anti-poor while the remaining two were pro-poor. However, they do not address the problem of data comparability related to the fact that during the studied period various features of the Polish Household Budget Survey (HBS) have changed several times making unadjusted data incomparable. These problems are reviewed more closely in Section 3.

The outline of the paper is as follows. Section 2 reviews the three main approaches to measuring pro-poorness of growth applied to Polish data. The HBS micro-data are introduced in Section 3. Section 4 presents and discusses empirical results and Section 5 concludes.

2. The measurement of pro-poor growth

In recent years, a number of approaches to defining and measuring pro-poorness of economic growth have been proposed. Most influential contributions include Kakwani and Pernia (2000), Ravallion and Chen (2003), Son (2004), Kraay (2006), Kakwani and Son (2008), Duclos (2009), and Essama-Nssah and Lambert (2009). These approaches differ along several dimensions, one of which is whether the pro-poorness should be defined in an absolute or a relative way. According to an absolute approach, growth is

[3] The *PEGR* index is discussed in Section 2.2.

assessed pro-poor if incomes (or consumption expenditures, wealth, etc.) of the poor increase. Klasen (2008) differentiates between the "strong absolute" pro-poor growth and a "weak absolute" one. The former requires that that during the growth experience absolute income gains of the poor are larger than average gains (or gains of the non-poor). The latter is satisfied when the growth rate of the poor's incomes is greater than 0.[4]

The relative approach defines growth as pro-poor only when the incomes of the poor grow faster than the incomes of the non-poor. In other words, the relative definition demands that inequality between the poor and the non-poor must decrease. From the perspective of the absolute approach, one should be interested in the impact of growth on absolute poverty, while the relative approach perspective focuses on how growth affects relative inequality. The choice between the two definitions involves several difficult positive and normative considerations (see e.g. Klasen, 2008 and Duclos, 2009). For instance, absolute pro-poor growth seems to be more important in developing countries since absolute poverty reduction is the main distributive policy objective in these countries.[5] In developed countries, the relative approach may be equally interesting as relative poverty and inequality have more prominence there. As observed by Duclos (2009), the interest in relative pro-poorness of growth may be strengthen if relative inequality has negative impact on growth, causes relative deprivation, social exclusion, unequal opportunities, political or social instability, or if it is is unacceptable from the ethical point of view.

Another important distinction in the literature on measuring pro-poor growth is related to the use of the *anonymity axiom*, i.e., the assumption that two distributions are equivalent whenever one distribution is obtained from the other by a permutation. The anonymity-based approaches do not take into account the identity of persons or households before and after the growth experience. Measures introduced in such approaches compare income of a person at a specific quantile in period t with income of a person at the same quantile in period $t+1$ ignoring the fact that the two persons may be (and usually are) different individuals. In other words, these approaches do not allow for measuring

[4]The weak concept of absolute pro-poorness has gained significantly more attention in the literature than the strong one.

[5]See, however, Ruiz-Castillo (2009) for an argument that concern with relative poverty should play a bigger role in developing and transition countries.

chronic poverty (which happens when those initially poor remain poor after growth experience) or income mobility (which happens when those initially poor become finally non-poor). Recently, several new methods of measuring pro-poorness of growth without postulating anonymity have been proposed (see Grimm, 2007, Jenkins and Van Kerm, 2006; 2011, Wagstaff, 2009 and Bourguignon, 2011). However, the non-anonymous measuring of pro-poor growth requires longitudinal data, while anonymous approach can be applied with more accessible cross-sectional data. Unfortunately, at the time of writing this paper, only repeated cross-sectional household survey data for Poland are available. For this reason, the paper focuses on the anonymous perspective of pro-poorness evaluation.

2.1. Growth incidence curve and rate of pro-poor growth

Ravallion and Chen (2003) introduced probably the most popular toolbox for measuring pro-poorness of growth. It consists of a graphical tool for visual inspection of pattern of growth, the "growth incidence curve" (GIC), and a pro-poorness index, "rate of pro-poor growth" ($RPPG$), which provides some help when the GIC approach fails to provide unambiguous evaluation. GIC can be defined in the context of two income distributions observed at dates $t-1$ and t. The growth rate of income x at the pth quantile, $g_t(p)$, is

$$g_t(p) = \frac{x_t(p)}{x_{t-1}(p)} - 1. \tag{1}$$

Letting p vary from p_1 to p_{max}, $g_t(p)$ traces out Ravallion and Chen's (2003) GIC. The $RPPG$ in date t is defined as the area under the GIC up to the headcount index of poverty at time $t-1$, H_{t-1}, normalized by H_{t-1}:[6]

$$RPPG_t = \frac{1}{H_{t-1}} \int_0^{H_{t-1}} g_t(p)\mathrm{d}p\,. \tag{2}$$

GIC and $RPPG$ can accommodate both absolute and relative concepts of pro-poor growth. If the former is assumed, then growth is pro-poor if the GIC is above 0 up to the quantile

[6]Headcount index of poverty is defined as the proportion of poor individuals in a society, i.e. individuals with incomes below or equal to the poverty line z.

corresponding to the poverty line z, while it is not pro-poor (or it is "anti-poor") if the GIC lies below 0 over the same range of p. If the GIC lies above (below) 0 for all p, then there is first-order poverty dominance (see Atkinson, 1987 and Foster and Schorrocks, 1988) and poverty decreases (increases) over time for all poverty lines and all poverty measures within a broad class. When the GIC switches sign before H_{t-1}, then one cannot in general infer if growth is pro-poor on the basis of the GIC alone. In this case, the $RPPG$ index can be used: if $RPPG_t > 0$, then growth is absolutely pro-poor and if $RPPG_t < 0$, it is not.[7]

When one wants to check if growth is pro-poor in the relative meaning, then the GIC has to lie above the horizontal line at the growth rate in the overall mean, γ, for all p up to the initial headcount index. Conversely, if the GIC lies below γ everywhere over the same range of quantiles, then growth is not pro-poor. Again, if the GIC switches its sign, no general conclusions can be drawn. In this case, one can compute the $RPPG$ index: if $RPPG_t > \gamma$, then growth is pro-poor in relative terms and if $RPPG_t < \gamma$, it is otherwise. Moreover, the fact that the GIC is strictly increasing (decreasing) over all quantiles implies that inequality rises (falls) over time for all inequality measures satisfying the Pigou-Dalton transfer principle (Ravallion and Chen, 2003).[8]

2.2. Essama-Nssah and Lambert's (2009) pro-poorness indices

Several authors proposed various pro-poorness indices, which are alternative to the $RPPG$. Essama-Nssah and Lambert (2009) provide a very useful common analytical framework allowing for comparing some of these indices, and also introduce a new family of measures. Their approach follows Osmani (2005) in insisting that economic growth should be considered pro-poor if it achieves absolute poverty reduction greater than the reduction that would occur in a benchmark case, which could be a desirable growth pattern or a counterfactual. Following Ravallion and Chen (2003) and Kakwani

[7] Ravallion and Chen (2003) show also that the $RPPG$ is the annualized change in the Watts index of poverty (see section 2.2 for definition) divided by the initial headcount index.

[8] The approach of Duclos (2009) and Araar et al. (2009), presented in section 2.3, provides, inter alia, a generalization and extension of the GIC approach along several dimensions, e.g. delivering tools for statistical inference.

and Son (2008), they accept *distributional neutrality* as the benchmark case. It is defined as a growth process that does not change relative inequality, i.e. a process under which incomes of all individuals grow at the same rate. In this sense, their approach relies on the relative meaning of pro-poorness.

The basic concept of Essama-Nssah and Lambert's (2009) framework is a "growth pattern", $q(x)$, which is defined as a point elasticity of individual income x with respect to the mean income:

$$q(x) = \frac{\mu}{x} \cdot \frac{\mathrm{d}x}{\mathrm{d}\mu} = \frac{\mathrm{d}\ln(x)}{\mathrm{d}\ln(\mu)}. \tag{3}$$

It is worth noting that there is a close connection between $q(x)$ and the GIC: the latter is simply $q(x)$ multiplied by the growth rate of mean income. Therefore the plot of growth pattern function can also be used to evaluate the pro-poorness of growth.

The benchmark case of distribution-neutral growth, $q_0(x)$, can be defined as: $q_0(x) \equiv 1$, for all x. In evaluating pro-poorness of growth, Essama-Nssah and Lambert's (2009) focus on the class of additively separable poverty measures (with the headcount index of poverty added) and define that a growth pattern is pro-poor for an index P in this class if this growth reduces P by more than distribution-neutral growth would.[9] The additively separable poverty indices take the form:

$$P = \int_0^z \psi(x \mid z) f(x) \mathrm{d}x, \tag{4}$$

where $\psi(x \mid z)$ is a convex and decreasing function which measures individual deprivation and is 0 when $x \geqslant z$ and $f(x)$ is the density function for income distribution. This class of indices includes the Foster, Greer and Thorbecke (1984) family of poverty indices $FGT(z;\alpha)$ with $\alpha \geqslant 1$ and the Watts poverty index (Watts, 1968)[10]. For this class of poverty indices, Essama-Nssah and Lambert's (2009) derive the growth elasticity of P for

[9] This definition assumes that the growth rate over time is positive. Negative growth (recession) can also be analyzed in the presented framework. In such a case, recession is declared pro-poor if it raises poverty by less than the distribution-neutral recession would.

[10] For the $FGT(z;\alpha)$ indices and $\alpha \geqslant 0$, the deprivation function takes the form $\psi_\alpha(x \mid z) = (1 - x/z)^\alpha$ for $x < z$ and 0 otherwise, while for the Watts index it is $\psi_W(x \mid z) = \ln(z/x)$. $FGT(z;\alpha = 0)$ is the headcount index and $FGT(z;\alpha = 1)$ is the average poverty gap.

the growth pattern $q(x)$:

$$\phi_P(q) = \frac{1}{P}\int_0^z x\psi'(x|z)q(x)f(x)\mathrm{d}x. \tag{5}$$

The growth elasticity for the growth pattern can be derived also for the headcount index, H: $\phi_H(q) = -zq(z)f(z)/H$. This result allows authors to express two classes of pro-poorness measures in a unified framework. They notice that the reduction in poverty associated with a 1% increase in mean income under the growth pattern $q(x)$ is equal to $-P\phi_P(q)$, while for the distribution-neutral growth it is: $-P\phi_P(q_0)$. Therefore the relative pro-poorness of $q(x)$ can be expressed in an additive way as a difference of these two terms or in a non-additive form as a ratio the terms. The additive index is:

$$\pi_P(q) = P[\phi_P(q_0) - \phi_P(q)] = \int_0^z \{-x\psi'(x|z)\}[q(x)-1]f(x)\mathrm{d}x. \tag{6}$$

According to this index, a growth pattern $q(x)$ is pro-poor for poverty index P if and only if $\pi_P(q)$ is positive. This index is different from the $RPPG$ and all other pro-poor growth indices introduced by earlier authors. The ratio measure is defined as:

$$\kappa_P(q) = \frac{-P\phi_P(q)}{-P\phi_P(q_0)} = \frac{\int_0^z x\psi'(x|z)q(x)f(x)\mathrm{d}x}{\int_0^z x\psi'(x|z)f(x)\mathrm{d}x}. \tag{7}$$

Using $\kappa_P(q)$, one can assert that a growth pattern $q(x)$ is pro-poor for poverty index P if and only if $\kappa_P(q)$ is greater than 1. If $\pi_P(q) < 0$ or $\kappa_P(q) < 1$, the growth pattern $q(x)$ is not pro-poor or it is "anti-poor".[11] Essama-Nssah and Lambert's (2009) show also that the fact that the plot of a growth pattern function lies above 1 up to the poverty line is sufficient but not necessary condition that both additive and ratio measures evaluate this pattern as pro-poor.

The ratio measure can be shown to be equivalent to the pro-poorness measure introduced previously by Kakwani and Pernia (2000). Moreover, there is a close relationship between $\kappa_P(q)$ and another pro-poorness index – the poverty equivalent growth rate

[11] In case of recessions, the authors suggest to use converse measures, i.e., $-\pi_P(q)$ and $1/\kappa_P(q)$. This suggestion will be used in our empirical analysis in Section 4.

($PEGR$) – developed by Kakwani and Son (2008). The $PEGR$ is defined as the growth rate, γ^*, that would result in the same proportional change in poverty as the actual mean income growth rate γ with pattern $q(x)$ but under distributional neutrality.[12] Essama-Nssah and Lambert's (2009) show that the $PEGR$ can be defined in terms of $\kappa_P(q)$ simply as:

$$\gamma^* = \kappa_P(q) * \gamma . \tag{8}$$

Another important property of the ratio measure, $\kappa_P(q)$, is implied by the fact that the $PEGR$ for the Watts poverty index is precisely the $RPPG$ index introduced by Ravallion and Chen (2003). Therefore, $RPPG = \kappa_{Watts}(q) * \gamma$.

In practice, the specific functional form of pro-poorness measures $\pi_P(q)$ and $\kappa_P(q)$ depend on the poverty index used. For the additively separable class of indices the form of the pro-poorness measures depends on the form of deprivation functions used in defining poverty indices. For the headcount index, the indices take simple forms: $\pi_{Headcount}(q) = z[q(z) - 1]f(z)$ and $\kappa_{Headcount}(q) = q(z)$ (Essama-Nssah and Lambert, 2009, p. 9).

2.3. Stochastic dominance approach

Duclos (2009) and Araar et al. (2009) develop a set of tools that serves to test in a robust way whether growth has been pro-poor. Their stochastic dominance approach gives evaluations, which are robust to: 1) the choice of poverty line, and 2) the method of aggregating the impact of growth on the poor. Moreover, the approach provides not only estimation methods, but also tools for statistical inference on pro-poorness comparisons. It covers both absolute and relative pro-poorness measurement.

2.3.1. Relative pro-poor judgements

Duclos (2009) presents an axiomatic framework for making robust pro-poor judgements. In case of relative pro-poorness, he assumes that in order to evaluate growth as pro-poor the incomes of the poor must change $(1 + g)$ times, where g is some standard set

[12] The $PEGR$ measure can be defined for the same class of additively separable poverty indices as Essama-Nssah and Lambert's indices.

on ethical, statistical or political basis. In the simplest case, g may be the rate of growth of mean income. Next, for a vector $\mathbf{x}^1$ of non-negative initial incomes and vector $\mathbf{x}^2$ of non-negative final incomes and a poverty line z, he defines a pro-poor evaluation function as a difference between two evaluation functions $P(\mathbf{x}^1;z)$ and $P^*(\mathbf{x}^2,1+g;z)$:[13]

$$W(\mathbf{x}^1,\mathbf{x}^2,g;z) \equiv P^*(\mathbf{x}^2,1+g;z) - P(\mathbf{x}^1;z). \tag{9}$$

The change from $\mathbf{x}^1$ to $\mathbf{x}^2$ is then called pro-poor if $W(\mathbf{x}^1,\mathbf{x}^2,g;z) \leq 0$. Duclos (2009) imposes next a set of axioms on function W to define two classes of relative pro-poor evaluation functions: the *first-order* and the *second-order* class.[14] The first-order class includes most of popular poverty indices, including the FGT indices and the Watts index. The second-order class is more limited excluding the headcount index and the FGT indices with $0 \leqslant \alpha < 1$. Duclos shows that a movement from $\mathbf{x}^1$ to $\mathbf{x}^2$ is evaluated as pro-poor by all first-order relative pro-poor functions if and only if

$$FGT_2((1+g)z;\alpha=0) \leq FGT_1(z;\alpha=0) \quad \text{for all } z \in [0,z^+], \tag{10}$$

where $FGT_j(z;\alpha)$ denotes the $FGT(z;\alpha)$ poverty index defined in (4) (see also footnote 10) computed for period j. In practice, verification of the above condition requires testing if for all poverty lines in the range $[0,z^+]$ the headcount index in the initial distribution is larger than the headcount index in the final distribution scaled by $1/(1+g)$.[15]

Less demanding judgements can be obtained with the second-order relative pro-poor functions. For this class, a growth experience from $\mathbf{x}^1$ to $\mathbf{x}^2$ is evaluated as pro-poor if and only if

$$FGT_2((1+g)z;\alpha=1) \leq FGT_1(z;\alpha=1) \quad \text{for all } z \in [0,z^+], \tag{11}$$

[13] Functions P and P^* may be poverty functions, but not necessarily so.

[14] The first-order class satisfies the following axioms: *focus*, *population invariance*, the anonymity axiom, *monotonicity*, *normalization* and a *relative* axiom. The second-order class additionally satisfies the Pigou-Dalton transfer principle. For precise definitions of these axioms, see Duclos (2009).

[15] Alternatively, one may test the condition (10) by comparing the growth in quantiles of distribution to the growth in the mean income. This approach is equivalent to Ravallion and Chen's (2003) GIC approach.

which is equivalent to condition (10), but stated in terms of the average poverty gap, not in terms of the headcount index.

2.3.2. Absolute pro-poor judgements

In the absolute case, Duclos (2009) assumes that absolute changes in incomes of the poor should be compared with some absolute pro-poor standard a. When Klasen's (2008) weak absolute pro-poorness is assumed, a is set to 0. Similarly to the relative judgements' case, an axiomatic framework is imposed on functions W resulting in first-order and second-order absolutely pro-poor evaluation functions.[16]

Duclos (2009) proves then that a movement from $\mathbf{x}^1$ to $\mathbf{x}^2$ is evaluated as pro-poor by all first-order absolute pro-poor functions if and only if

$$FGT_2(z+a;\alpha=0) \leq FGT_1(z;\alpha=0) \quad \text{for all } z \in [0,z^+]. \tag{12}$$

Analogously, a change from $\mathbf{x}^1$ to $\mathbf{x}^2$ is evaluated as pro-poor by all second-order absolute pro-poor functions if and only if

$$(z+a)FGT_2(z+a;\alpha=1) \leq zFGT_1(z;\alpha=1) \quad \text{for all } z \in [0,z^+]. \tag{13}$$

2.3.3. Statistical inference

Araar et al. (2009) operationalize the approach of Duclos (2009) by providing statistical tools for testing pro-poorness dominance using household survey data. Statistical inference for any of conditions (10)-(13) involves jointly testing a set of null hypotheses about differences in poverty indices over some range of poverty lines. The authors propose to test a null hypothesis as a union of null hypotheses of the form:

$$H_0 : \Delta^s(z) > 0 \text{ for some } z \in [0,z^+], \tag{14}$$

[16] These axioms are identical as for the relative pro-poorness judgements with the exception of the relative axiom, which is replaced with an *absolute* axiom, see Duclos (2009, p. 51).

against an alternative hypothesis that is an intersection of alternative hypotheses:

$$H_1 : \Delta^s(z) \leq 0 \text{ for all } z \in [0, z^+], \tag{15}$$

where $\Delta^s(z)$ is a relevant statistics for sth ($s = 1, 2$) order of absolute or relative pro-poorness. For example, the test statistics corresponding to (10) is $\Delta^1(z) = FGT_2((1+g)z; \alpha = 0) - FGT_1(z; \alpha = 0)$. The null hypothesis of anti-poorness is rejected in favor of the alternative hypothesis of pro-poorness of growth only when each of the individual hypotheses in the null is rejected at a conventional significance level. This procedure can be implemented by calculating one-sided confidence intervals for $\hat{\Delta}^s(z)$ – the sample estimate of $\Delta^s(z)$. In order to do this, Araar et al. (2009, pp. 859–863) develop the asymptotic variance of $\hat{\Delta}^s(z)$, denoted by $\sigma^2_{\hat{\Delta}^s(z)}$. The null hypothesis can be rejected if the upper bound for a one-sided 95% confidence interval around sample value of $\Delta^s(z)$, denoted by $\Delta^s_0(z)$, lies below the horizontal axis:

$$\Delta^s_0(z) + \sigma_{\hat{\Delta}^s(z)} 1.96 < 0 \quad \text{for all } z \in [0, z^+]. \tag{16}$$

In principle, the dominance tests described in this section should be carried out over the whole range of poverty lines $z \in [0, z^+]$. However, as discussed by Davidson and Duclos (2009), there may be too little information in real-world samples about the tails of the distributions to test meaningfully for any statistical hypothesis. Therefore, in practice dominance tests must be restricted to a range that is lower-bounded by some number z^-, which is greater than 0.[17]

3. Data

The main source of micro-data for this paper is the Household Budget Survey (HBS) study conducted yearly by the Polish Central Statistical Office (CSO). The detailed de-

[17] Araar et al. (2009) show also how to extend tests reviewed in this section to account for complexity of survey design. In this paper, we use the implementation of these methods in Stata's DASP package (Araar and Duclos, 2009).

scription of the HBS design and its other features can be found in Kordos et al. (2002) and CSO (2008). Before 1993, the survey did not cover properly several groups such as self-employed outside agriculture, social welfare recipients, as well as security, police and military personnel. In 1993 two major changes were introduced. First, the HBS became fully representative for all main socio-economic types of households. Second, monthly rotation replaced previously used quarterly rotation. For these reasons, pre-1993 and post-1993 HBS data are not directly comparable unless some complex adjustment procedure is applied (see Keane and Prasad, 2002). Another important modification of the HBS occurred experimentally in 1997, and definitively in 1998, when in order to adjust the HBS to Eurostat recommendations, new definitions of some core concepts (i.e. disposable income) were implemented. Again, due to this change it is rather difficult to construct fully comparable data series for the period before 1998 and after this year. Therefore, in this paper we use the HBS data for the post-1997 period. In particular, as announced earlier, we use the data for 1998, 2005 and 2008.

The HBS uses a two-stage stratified sampling scheme. In the first stage, the population is divided into a fixed number of strata from which primary sampling units (PSUs), that is clusters, are randomly chosen. PSUs consist of enumeration statistical districts (ESDs) or clusters of ESDs covering at least 250 dwellings. In the second stage of sample selection, dwellings are randomly selected from the PSUs selected in the first stage. Sample sizes are rather large and range from about 32 000 to about 37 000 households. In 2000 and 2001 there were several changes in the design of the stratification of population (see Kordos et al., 2002, pp. 565–567). From 2001 on, the population has been stratified in 96 strata by voivodships, and in each voivodship by the size of the cities or in case of rural areas by groups of counties ("powiats"). In our empirical calculations in Section 4, we use the detailed information about stratification and clustering of the HBS samples for every studied year to calculate corrected standard errors and confidence intervals for all pro-poorness measures used.

All calculations in this paper are performed for two standard of living indicators — income and consumption. Household net disposable income (i.e. post-tax-and-transfer in-

come) is the main income concept used. It includes cash wages and salaries, self-employment income (including farm income), cash property income, social transfers (including social insurance, social assistance) and other income. Income taxes, mandatory payroll taxes and gifts donated to other households are not included. As a consumption measure we use total expenditures on consumer goods and services, which include expenditures on food, clothing, housing, health care, transportation and communication, culture and recreation and education. The measure includes expenses on durables and natural consumption.

Just like in case of inequality or, to a lesser extent, poverty measurement, an important methodological problem in estimating pro-poorness measures from survey data is the presence of negative and zero incomes. Since some of the pro-poorness measures are undefined for zero or negative incomes, we replace such incomes with household consumption expenditures. We consider the individual as the main unit of analysis. In order to obtain personal distributions, all household observations are weighted by the product of household weights provided by the HBS and household sizes. HBS weights are non-response weights adjusting sample data for the differential non-response rates of different types of households. We use consumer price indices provided by CSO to adjust for differences in the prices faced by households in different years and/or regions. For income distributions, we use monthly price indices of consumer goods and services specific for five socio-economic groups. In case of consumption expenditures, we have used quarterly consumer price indices for voivodships and for 12 categories of consumption expenditures. All distributions have been expressed in 2008 price levels. Finally, in order to adjust for the size and composition of households, all incomes are equivalised using the original OECD equivalence scale, which assigns weights 0.7 to any adult household member beyond the first and 0.5 to children under 14 years old. Szulc (2006) argued convincingly that for Poland the original OECD scale is more appropriate than the modified OECD scale and other non-estimated scales as economies of scale in Polish households are rather low due to the relatively high expenditures on food and relatively low expenditures on housing.

4. Empirical results

Table 1 presents basic descriptive statistics and a profile of growth, poverty and inequality for Poland using the HBS disposable income and consumption data for 1998, 2005 and 2008. The table provides point estimates and standard errors for various distributional indices as well as test statistics for pairwise difference-in-means t-tests. The critical value for a 5% significance level is about 1.96. For both income and consumption expenditures the mean equivalised per month standard of living decreased slightly between 1998 and 2005 by approximately 2.5%. On the other hand, it increased substantially during 2005–2008 by 28% in case of income and by 21% in case of consumption.

In order to compute poverty indices, the "corrected social minimum" for 2003 is used as an absolute poverty line. This is taken from Szulc (2008) and updated to 2008 prices using the overall consumer price index. Table 1 shows that over the full period under study, absolute poverty in Poland decreased considerably irrespective of poverty index used. This result is not sensitive to the choice of poverty lines. (This will become evident from our analysis of the stochastic dominance approach to come in this Section). All changes in mean welfare levels and poverty indices for the analyzed pairs of years are statistically significant.[18] During the first sub-period under study, the absolute poverty increased sizably in the range from 12 to 36% depending on the poverty index used. The smallest increases can be observed for the headcount index, which rose by 12% and 22% for consumption and income, respectively. Fast growth in mean standard of living between 2005 and 2008 was accompanied by radical reduction in absolute poverty. In case of disposable income, all poverty indices display values reduced by 50% and more, while the drops in case of consumption lie in the range from 34 to 48%.

As measures of inequality, the paper uses the Gini index and three members of the generalized entropy – GE(α) – family of indices with sensitivity parameter α set to 0, 1 and 2. These indices are also known, respectively, as the mean log-deviation (MLD), Theil index, and half of the coefficient of variation squared, $CV^2/2$. They possess different sen-

[18] The calculation of standard errors for the mean welfare levels and poverty indices account for complex survey features of the HBS sample design. For methods, see Howes and Lanjouw (1998).

Table 1. Basic distributional statistics, Poland, HBS data, 1998–2008

Statistics	Estimates			Test statistics		
	1998	2005	2008	2005 versus 1998	2008 versus 2005	2008 versus 1998
Disposable income						
Mean	1054.2	1030.8	1319.7	−2.783	28.414	27.079
	(5.6)	(6.3)	(8.0)			
Headcount index	0.237	0.289	0.144	10.119	−31.605	−20.849
	(0.004)	(0.004)	(0.003)			
FGT_1	0.061	0.082	0.037	11.165	−27.268	−15.758
	(0.001)	(0.001)	(0.001)			
FGT_2	0.025	0.035	0.016	9.947	−20.827	−10.512
	(0.001)	(0.001)	(0.001)			
Watts	0.084	0.114	0.053	9.949	−22.363	−11.854
	(0.002)	(0.002)	(0.002)			
Gini	0.294	0.323	0.315	8.584	−2.337	5.730
	(0.002)	(0.003)	(0.003)			
GE(0)	0.152	0.182	0.173	7.726	−2.005	5.077
	(0.003)	(0.003)	(0.003)			
GE(1)	0.160	0.194	0.191	5.126	−0.335	3.432
	(0.004)	(0.005)	(0.008)			
GE(2)	0.232	0.305	0.407	2.448	0.938	1.647
	(0.014)	(0.027)	(0.106)			
Consumption						
Mean	943.5	917.4	1113.2	−3.488	23.331	20.090
	(5.3)	(5.2)	(6.6)			
Headcount index	0.336	0.377	0.247	6.889	−23.581	−15.789
	(0.004)	(0.004)	(0.004)			
FGT_1	0.084	0.103	0.059	8.366	−22.095	−13.091
	(0.002)	(0.002)	(0.001)			
FGT_2	0.031	0.040	0.021	8.410	−19.470	−10.898
	(0.001)	(0.001)	(0.001)			
Watts	0.107	0.134	0.074	8.549	−21.259	−12.402
	(0.002)	(0.002)	(0.002)			
Gini	0.306	0.319	0.322	3.905	0.954	4.714
	(0.002)	(0.002)	(0.002)			
GE(0)	0.156	0.168	0.171	3.502	0.808	4.159
	(0.003)	(0.002)	(0.003)			
GE(1)	0.181	0.188	0.194	1.099	1.162	2.114
	(0.004)	(0.004)	(0.004)			
GE(2)	0.297	0.285	0.308	−0.635	1.188	0.528
	(0.015)	(0.012)	(0.015)			

Notes: Poverty line = 642.5 PLN (in 2008 1 USD = 2.41 PLN, 1 EUR = 3.42 PLN). Standard errors given in parentheses account for the complexity of the HBS sample design.

sitivity to differences in various parts of distribution with the MLD being the most sensitive to differences in the lower part of distribution and GE(2) being the most sensitive to top values.[19] Standard errors for these inequality indices that take into account the complexity of sample design were computed according to methods introduced by Biewen and Jenkins (2006) for generalized entropy indices and by Kovacevic and Binder (1997) for the Gini index.[20]

The inspection of point estimates suggests that, according to majority of indices, inequality in Poland increased slightly during 1998–2005 for both income and consumption distributions. For example, the Gini index displays a 9% rise in inequality for disposable incomes and a 4% rise in inequality of consumption distribution. Only the Theil and GE(2) indices for consumption suggest that inequality changes were not statistically significant. For the second sub-period, 2005–2008, most of the inequality changes are statistically insignificant with the exception of the Gini index and the MLD for income distribution, which show a small inequality decline. The full-period analysis implies that according to all indices beside GE(2), there was a statistically significant rise in income and consumption inequality in Poland in the range from 7 to 19% depending on the index used. For both income and consumption distributions, the standard errors for GE(2) index are rather large. Moreover, one very large observation in the 2008 income distribution has a heavy impact on the point estimate of this measure. Together, these facts imply that inequality changes for GE(2) index are statistically significant only in one case.[21]

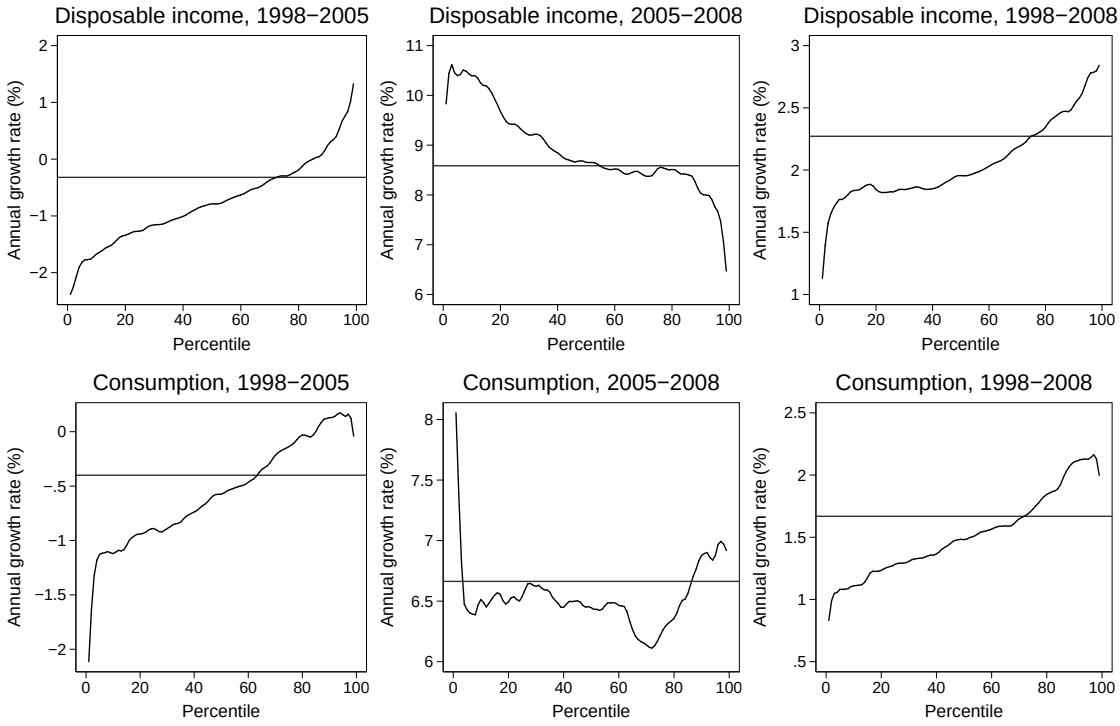
We start our pro-poorness analysis with Figure 1, which plots GICs for both standard of living indicators during the full period and the two sub-periods studied. The GICs for the 2005–2008 and for the full period cases lie everywhere above the 0 suggesting that the growth was absolutely pro-poor.

[19] Formal definitions and reviews of various properties of inequality indices can be found in Cowell (2000) and Jenkins and Van Kerm (2009).

[20] These methods are implemented in Stata programs provided by Biewen and Jenkins (2005) and Jenkins (2006).

[21] Non-robustness of GE indices with $\alpha > 1$ to extremely large observations is an active research field, both in a theoretical (see e.g. Cowell and Flachaire, 2007) and practical setting (Jenkins et al., 2011). Brzezinski and Kostro (2010) model the upper-tail of Polish income distributions by robustly fitting the one-parameter Pareto model. The estimates for the GE(2) index and its standard error are significantly reduced after such procedure in comparison with unadjusted estimates.

Figure 1. The Growth Incidence Curves for Poland



Notes: Horizontal lines denote growth rate in mean. GIC were smoothed using locally weighted regression smoother.

However, the curves for the full period under study are generally increasing, which implies that the growth was not relatively pro-poor. The annual growth rate in the mean between 1998 and 2008 is equal to 2.3% in case of income and 1.7% in case of consumption. The $RPPG$ for the same period is, respectively, 1.8 and 1.2%. During the fast growth sub-period, from 2005 to 2008, the growth rates for the lower part of the income distribution were higher than the growth rate in the mean income ($\gamma = 8.6\%$) with the $RPPG = 10.0\%$. In case of consumption distribution no clear conclusions can be drawn. In overall, this relative income pro-poorness was, however, outdone by the anti-poorness of negative economic growth during 1998–2005. The GICs for this sub-period and for both income and consumption distributions lie below 0 up to at least 60th percentile. The curves are generally increasing, which suggests that not only the recession and stagnation was anti-poor in an absolute Ravallion and Chen's meaning, but also that the losses of the poor were greater than those of the non-poor. In fact, top parts of both welfare distributions have positive gains during this period.

Tables 2–3 extend the analysis by providing estimates of Essama-Nssah and Lam-

bert's additive and multiplicative indices together with their 95% confidence intervals computed by bootstrap methods. These confidence intervals may be used to test hypotheses whether the additive indices, π_P, are significantly different from 0 or whether the ratio measures, κ_P, are significantly different from 1. This allows for statistical inference on relative pro-poorness of growth in Essama-Nssah and Lambert's (2009) framework.

Table 2. Essama-Nssah and Lambert's (2009) additive pro-poorness indices for Poland during 1998–2008

Period	$\pi_{Headcount}$	π_{FGT_1}	π_{FGT_2}	π_{Watts}
Disposable income				
1998–2005	−1.68	−0.66	−0.31	−0.93
	[−7.21,−0.85]	[−2.75, −0.34]	[−1.33, −0.16]	[−4.11, −0.47]
2005–2008	0.06	0.04	0.02	0.05
	[0.01,0.11]	[0.02, 0.06]	[0.01, 0.03]	[0.02, 0.08]
1998–2008	−0.14	−0.04	−0.02	−0.06
	[−0.18,−0.09]	[−0.05, −0.03]	[−0.03, −0.01]	[−0.08, −0.04]
Consumption				
1998–2005	−0.81	−0.38	−0.20	−0.55
	[−2.12, −0.34]	[−1.07, −0.19]	[−0.56, −0.10]	[−1.57, −0.28]
2005–2008	−0.02	−0.00	−0.00	−0.00
	[−0.06, 0.03]	[−0.02, 0.02]	[−0.01, −0.01]	[−0.03, 0.03]
1998–2008	−0.16	−0.07	−0.04	−0.10
	[−0.22, −0.10]	[−0.09, −0.05]	[−0.05, −0.03]	[−0.13, −0.07]

Notes: Poverty line = 642.5 PLN. Bias-corrected 95% percentile-based bootstrap confidence intervals computed with 1000 replications are given in square brackets. The bootstrap methods used account for the complexity of survey data (see Kolenikov, 2010).

The results show that for the full period under study the additive indices are significantly less than 0, while the ratio indices are significantly less than 1, irrespectively of the welfare indicator chosen. This confirms the graphical insights from the GIC approach – economic growth was not relatively pro-poor. In case of the fast-growth sub-period from 2005 to 2008, the results for both groups of measures are again consistent. For the assumed poverty line, economic growth was relatively pro-poor in a statistically significant way for income distribution, while the changes for consumption distributions are not significant. Finally, the sub-period of recession and stagnation from 1998 to 2005 was relatively anti-poor for both income and consumption distributions according to every measure in both sets of pro-poorness indicators.[22] This result is statistically significant

[22]Note that for this period of negative growth converse measures, $-\pi_P$ and $1/\kappa_P$, have been used as discussed in Section 2.2.

Table 3. Essama-Nssah and Lambert's (2009) ratio pro-poorness indices for Poland during 1998–2008

Period	$\kappa_{Headcount}$	κ_{FGT_1}	κ_{FGT_2}	κ_{Watts}
Disposable income				
1998–2005	0.26	0.21	0.19	0.20
	[0.08,0.41]	[0.06, 0.34]	[0.06, 0.31]	[0.06, 0.33]
2005–2008	1.09	1.17	1.21	1.18
	[1.01,1.16]	[1.09, 1.26]	[1.10, 1.33]	[1.08, 1.28]
1998–2008	0.79	0.77	0.72	0.75
	[0.72,0.86]	[0.69, 0.85]	[0.62, 0.84]	[0.64, 0.84]
Consumption				
1998–2005	0.48	0.40	0.35	0.38
	[0.26, 0.67]	[0.19, 0.57]	[0.16, 0.52]	[0.17, 0.54]
2005–2008	0.97	0.99	1.00	1.00
	[0.91, 1.05]	[0.92, 1.07]	[0.91, 1.08]	[0.92, 1.09]
1998–2008	0.78	0.71	0.66	0.69
	[0.71, 0.87]	[0.63, 0.80]	[0.57, 0.77]	[0.61, 0.79]

Notes: See notes to Table 2.

with a conventional 95% level of statistical confidence.

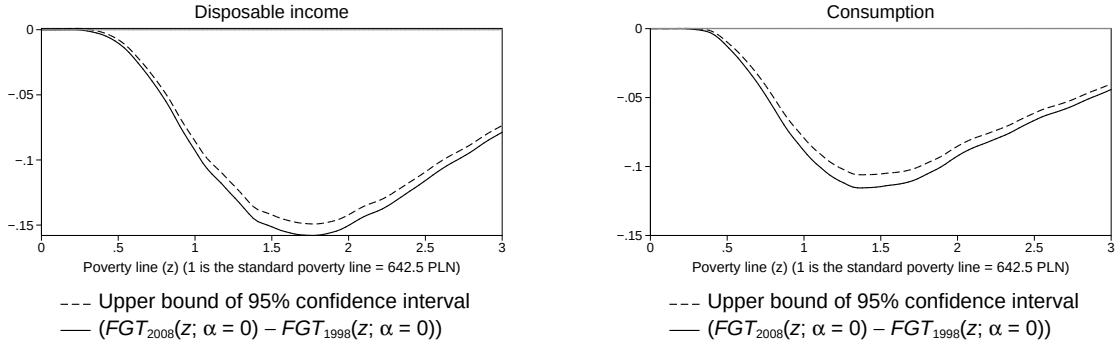
In order to see if the above results are robust to the choice of poverty line and pro-poorness measure, we now turn to statistical tests for pro-poorness using dominance approach of Duclos (2009) and Araar et al. (2009). These tests can be performed using information displayed in Figures 2–8, which were prepared using Stata's DASP package (Araar and Duclos, 2009).[23] We have chosen the maximum poverty line to be equal to three times the standard poverty line (z = 642.5 PLN) that was used in previous analyses. The maximum poverty line is much higher than the levels of mean equivalized disposable income and consumption expenditures (see Table 1), but it is not completely implausible. For example, the subjective poverty lines estimated from the survey data collected by the influential "Social Diagnosis" study conducted in Poland every second year since 2000 were 1373 PLN (2007 estimate) and 1544 PLN (2009 estimate).[24] In order to ease the interpretation of results, we have normalized incomes and consumption expenditures by the standard poverty line (z = 642.5 PLN).

Figure 2 shows results for tests of first-order absolute pro-poor growth dominance between 1998 and 2008. In case of consumption, the headcount index for every poverty line up to 3 is lower in 2008 than in 1998. Moreover, the upper bound of 95% confidence

[23] All curves plotted in Figures 2-8 are smoothed using locally weighted regression smoother.
[24] For more details about this project, see http://www.diagnoza.com.

interval for estimates of $\Delta^1(z)$ lies below 0 everywhere. Therefore, the conclusion that in case of consumption expenditures economic growth over the full period under study was absolutely pro-poor is robust to the choice of poverty line and pro-poorness index within a broad class.

Figure 2. First-order absolute pro-poor growth in Poland, 1998–2008



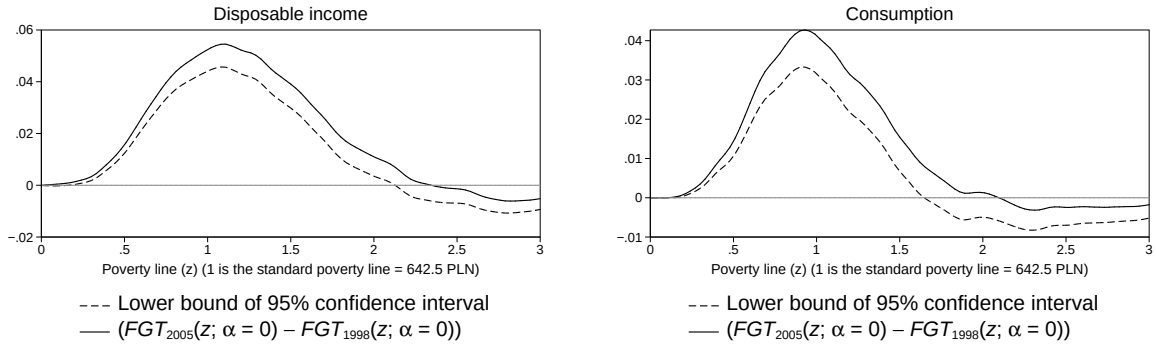
In case of income, it is impossible to verify dominance for poverty lines less than about 0.4 ($z^* = 257$ PLN). However, poverty headcount at z^* is only about 1.0% in 2008. Therefore, there is probably too little information in the samples near zero income to allow for meaningful statistical analysis as suggested in Section 2.3.[25] With this restriction, it is possible to confirm the absolute pro-poorness of growth for every reasonable poverty line higher than about 0.4.

The results for fast-growth period from 2005 to 2008 are very similar to those obtained for the full period and we do not show them for brevity. For this period, growth is absolutely pro-poor for both welfare indicators with the reservation that for income the dominance can be verified for poverty lines ranging from about 0.25 to 3.

The 1998–2005 period depicted on Figure 3 presents a more interesting case. The results suggest that no robust conclusions based on first-order testing can be drawn. Figure 4 shows the application of the second-order test for the same period. This time the

[25] Moreover, it is worth noting here that the individual biological subsistence minimum level of income as calculated by the Institute of Labour and Social Affairs in Warsaw was on average about 401 PLN in 2008, which corresponds to the normalized poverty line equal to 0.62. This suggests that we may take this subsistence minimum as the lower bound z^- to the range of possible poverty lines. Such approach could be justified on the basis of ethical views arguing that the distribution of living standards under some very low minimum should not matter normatively as everyone below that minimum is unambiguously in a very bad situation. Davidson and Duclos (2009) use such normative views to justify their formulation of the *restricted* stochastic dominance approach.

Figure 3. First-order absolute pro-poor growth in Poland, 1998–2005



lower bounds of the 95% confidence intervals for the test statistics $\Delta^2(z)$ lie almost everywhere above 0. The only suspect range is up to about 0.25 for income distribution. However, it seems that this is again the result of little sample information in the lower tail of distributions. Therefore, the second-order absolute pro-poorness test allows to evaluate the 1998–2005 negative growth experience as anti-poor for all poverty lines in case of consumption and for a broad range (0.25–3) in case of income.

Figure 4. Second-order absolute pro-poor growth in Poland, 1998–2005

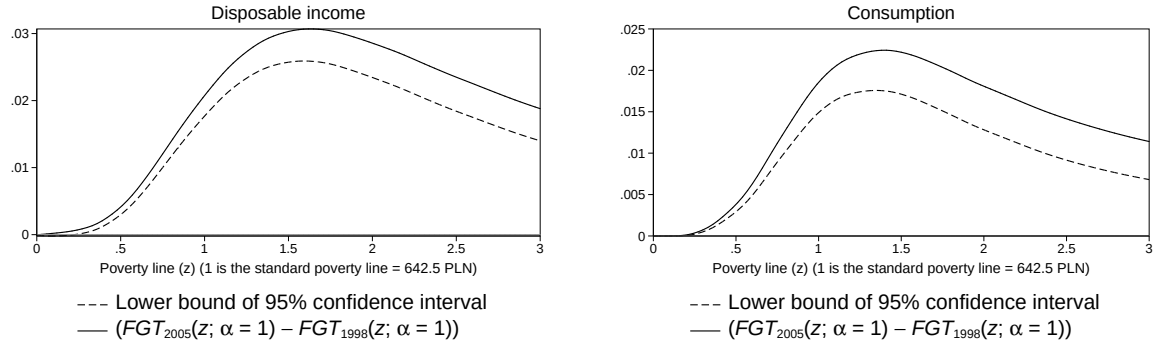
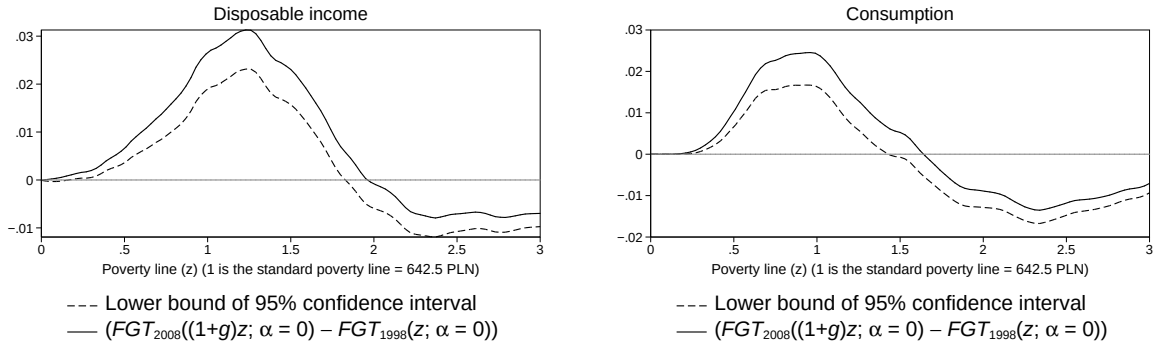


Figure 5 provides dominance test of first-order relative pro-poorness of growth in Poland between 1998 and 2008. The most important lesson from this figure, is that the changes are not statistically significant since for both income and consumption the lower bounds of confidence intervals for test statistics become negative for poverty lines much lower than 2. Moreover, in case of disposable income, just like in previous analyses, the lower bound of confidence interval overlaps the horizonal axis for poverty lines up to about 0.2. It is therefore necessary to test for the second-order dominance, which can be done using Figure 6.

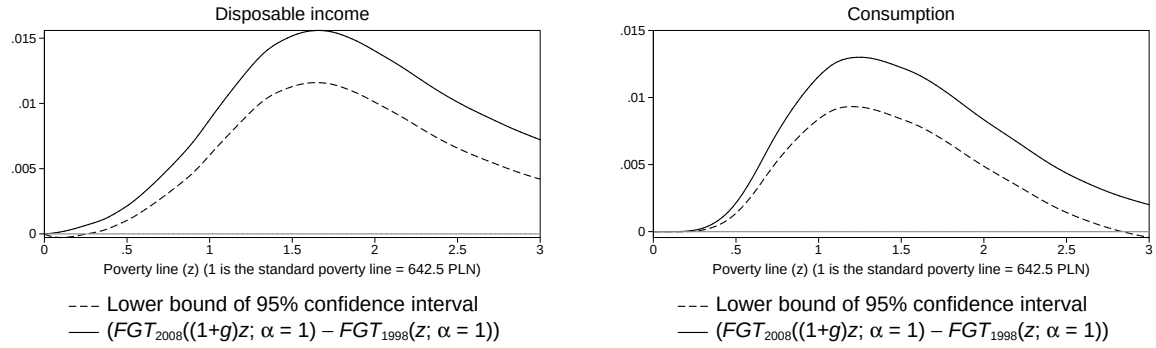
The conclusions for disposable income distribution and consumption distribution

Figure 5. First-order relative pro-poor growth in Poland, 1998–2008



are different. For the former, lower bound of confidence interval clearly is negative only for poverty lines for up to about 0.3, which following arguments presented earlier concerning little sample information about the lower tail, permits to conclude that income growth was relatively anti-poor according to the second-order test. For the latter, both the test statistics and the lower bound of confidence interval are everywhere positive up to poverty line equal to about 2.8, which means that for the very wide range of poverty lines consumption growth was relatively anti-poor according to the second-order dominance test.

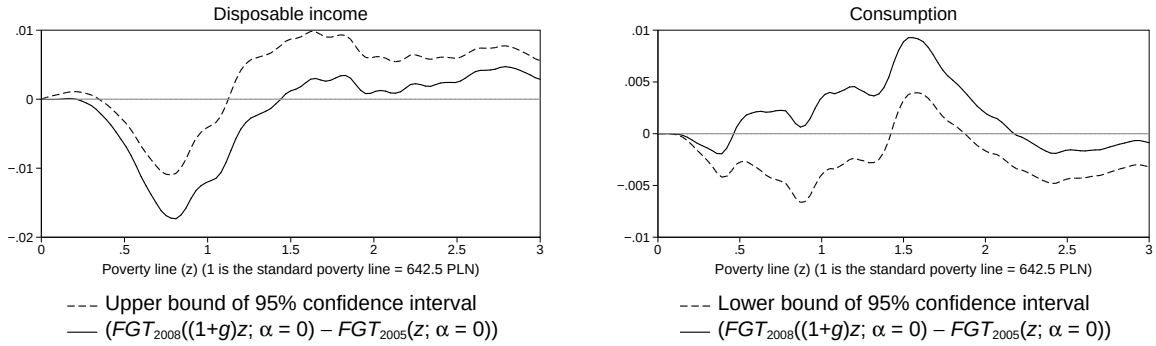
Figure 6. Second-order relative pro-poor growth in Poland, 1998–2008



The results on relative pro-poorness for the sub-period of recession and stagnation during 1998–2005 are similar to the results for the full period under study (not shown). There is no statistically significant first-order dominance. If one moves to the second-order tests, then negative income growth over this period is relatively anti-poor in the range of poverty lines from about 0.3 to 3, while in case of consumption there is dominance over the range from 0 to about 2.3.

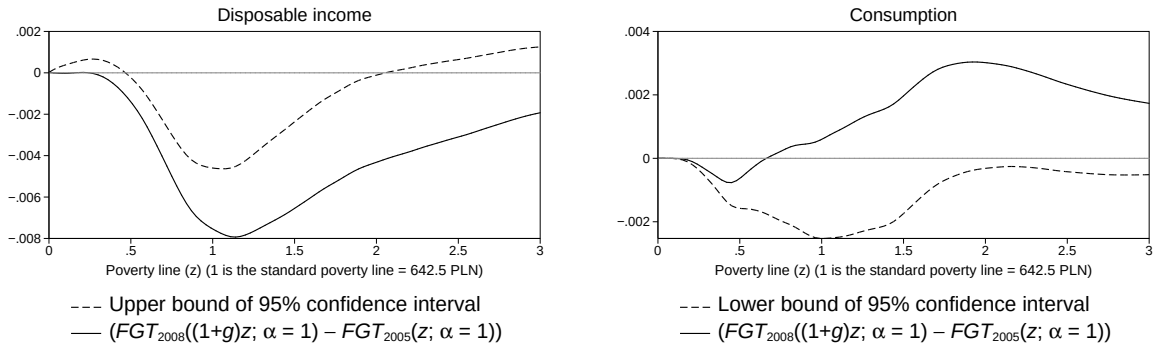
Finally, the results for the sub-period from 2005 to 2008, in which the economic growth was particularly fast, are presented in Figures 7-8. These results show that during this growth acceleration consumption changes with respect to relative pro-poorness measurement were not statistically significant.

Figure 7. First-order relative pro-poor growth in Poland, 2005–2008



On the other hand, as shown in Figure 8, there is a second-order pro-poorness dominance in the case of income growth for a range of poverty lines from about 0.48 to about 2.08. This is consistent with previously reported estimates of the Essama-Nssah and Lambert's pro-poorness indices calculated for poverty line equal to 1. However, it seems that the range of poverty lines for which dominance is satisfied is too narrow to conclude that income growth over this period was relatively pro-poor in a robust way.

Figure 8. Second-order relative pro-poor growth in Poland, 2005–2008



5. Conclusions

This paper applied some recently introduced measurement and inference techniques to test whether economic growth in Poland during 1998–2008 was beneficial to the poor. It

tested pro-poorness of growth for two welfare indicators, disposable income and consumption, and also for two concepts of pro-poorness, an absolute and a relative one. Beside graphical insights delivered by Ravallion and Chen's (2003) growth incidence curves, we have calculated Essama-Nssah and Lambert's (2009) pro-poorness indices, which generalize many pro-poorness indices introduced earlier. We have also provided statistical inference for these indices by calculating confidence intervals accounting for the complex features of our survey data. Finally, we have applied a dominance framework introduced by Duclos's (2009) and Araar et al. (2009) that allows for statistical inference on pro-poorness of growth, which is robust to the choice of poverty line and pro-poorness index.

The decade between 1998 and 2008 can be divided into two sub-periods — the recession and stagnation years of 1998–2005 and the fast-growth years from 2005 to 2008. In overall, during the decade the mean standard of living increased sizably by approximately 18% in case of consumption and by approximately 25% in case of disposable income. Inequality during the period increased slightly, but noticeably in the range from about 5% (for consumption) to about 7% (for income) in the case of the Gini index. The increase occurred mostly during the first sub-period analyzed.

Both formal approaches to measuring pro-poorness used in this paper provide broadly consistent conclusions. Therefore, we report here mainly on the results of the approach of Duclos's (2009) and Araar et al. (2009), which is more general. According to these results, economic growth in Poland over the studied decade increased the absolute standard of living of the poor, thus the growth was pro-poor in absolute terms irrespectively of the poverty line and pro-poorness measure used. However, because of increasing inequality, the rates of growth for income and consumption of the poor were generally lower than those of the non-poor. Therefore, the growth was anti-poor in relative terms for a broad range of poverty lines and pro-poorness measures. This second result is, however, weaker than that for absolute pro-poorness, as it is valid only for a smaller (second-order) class of pro-poorness measures. Both results are statistically significant at conventional levels.

The only episode of relatively pro-poor economic growth, as suggested by Essama-Nssah and Lambert's pro-poorness indices, was for income (but not consumption) growth

during fast-growth years of 2005–2008, which brought income inequality, as measured by the Gini index, down by 2.5%. Results of the dominance approach show, however, that this conclusion is valid only for a limited range of possible poverty lines.

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