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Poverty Alleviation in the Subsistence Fisheries Sector: A Microeconometric Analysis

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Abstract

This working paper applies the Foster Greer and Thorbecke (FGT) (1984) index of poverty measures to the subsistence fishing industry in South Africa in order to evaluate the impact of resource transfers on poverty. The sample of subsistence communities was identified by the Chief Directorate: Marine and Coastal Management of the Department of Environmental Affairs and Tourism.

Data on these communities was taken from the Census (1996) and the October Household Survey (1995). The contribution of the paper is unique in that it modifies the expenditure equations of the FGT methodology to account for different species of fisheries, and in this way quantifies the impact of public sector poverty alleviation efforts. We are then able to estimate the impact on poverty and inequality relative to the quantities of rights transferred to subsistence communities by the state.

The findings suggest that poverty can be completely eradicated in subsistence communities relative to a R1000.00 poverty line by allocating approximately 16.69 percent of the landed value or 6.12 percent of the wholesale processed (Free On Board) value of known subsistence fisheries to the recipients. Of course, this must be balanced within the context of scarce public resources, and a discussion of the opportunity costs of the transfer is given due regard. The technique developed is scalable and decomposable, making it ideal for use in planning exercises in the public domain.

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1. Introduction

This working paper seeks to make a contribution to the understanding of the impact of income transfers on poverty levels. For the purposes of explication, the analysis is based on the characteristics of the subsistence fisheries sector. The objective of the paper is to empirically guide the understanding of the poverty reducing impact of income transfers, and to discuss how these transfers may be linked to quantities of individual fish species. The unique contribution of the paper lies in its adaptation of a reproducible method to quantify this impact, which is then used to assess the opportunity costs of public policy choices.

Methodologically, the empirical approach is based on the Foster, Greer and Thorbecke (FGT) (1984) index of poverty measures, which have already been successfully employed in the analysis of poverty alleviation and public expenditure in South Africa (see Bhorat 1999; Bhorat and Leibbrandt 1999). However, this paper will extend the method beyond the realm of an income grant , and apply it within the context of a resource transfer that can be associated with quantities and values of various fisheries. Once this empirical relationship has been defined, we then extend the analysis to include post-resource transfer effects, specifically with respect to both poverty reduction and inequality levels. The method thus allows us to answer some of following questions, what is the impact of the transfer on income levels in the target population, who are the likely beneficiaries and why, and what are the opportunity costs of the transfer given limited state resources? Despite the explanatory power of the methodology, it is important to stress that this is a hypothetical exercise in static econometrics, and the results of the simulations in no way imply causality.

The data on subsistence fishing communities is taken from the Census (1996) and October Household Survey (1995) (OHS95).

2. Background: The Fishing Industry in South Africa

The fisheries sector makes a small, but significant contribution to Gross Domestic Product (GDP). In 1995, the total commercial catch was approximately 580 000 metric tons, which translated into a wholesale (processed) value of approximately R1.7 billion (approximately 0.5 percent of GDP in 1995) (Chief Directorate: Marine and Coastal Management (CD: MCM) 1997: 7). In employment terms, it is estimated that the total number of people employed in the commercial sector is approximately between 26,000 and 27,000, distributed equally between sea- and shore-based workplaces. In addition to these, it has also been estimated that another 60 000 people find employment in related sectors, exclusively or partly dependent on the fishing industry as a market for its supply of stores, equipment and services (*ibid*: 7). Provision of the same equipment and services to the recreational sector is another source of employment, though accurate estimates in this regard are not available. Similarly, no reliable information is available with respect to employment in the subsistence sector, though the importance of the industry as a source of both income and nutrition to coastal communities is fairly intuitive.

The history of the fisheries sector is filled with turbulence. During Apartheid, fishing rights were taken both from the oppressed and coastal communities more generally, and granted to medium- to large-scale corporations. The tendency to favour large-scale industries over smaller firms was indeed consistent with the policy of import substitution followed by the regime. Administratively, this meant that the state, which presided over the allocation of fisheries, allocated vast quantities of rights to commercial large-scale enterprises. The racial bias to the application of this policy was, again, consistent with the prevailing ideology of the time, exacerbated in the fishing industry by the criminalisation of poorer members of coastal communities who tried to harvest resources in either a subsistence or commercial manner.

The transition to democracy thus brought with it hopes of change for subsistence-fishing communities. However, considerable acrimony has been experienced while trying to effectuate this change. Three discernible reasons have contributed towards this.

- Fisheries are natural resources that must be managed in a sustainable manner. This requires a *precautionary approach* to the granting of exploitation rights, especially given imperfect information concerning the stock levels of individual species at any given time.

- Demand for the rights to fish far outstrips the supply of these rights. This has become politically volatile in a post-Apartheid environment where the historically oppressed are seeking restitution of fishing rights.

- Up until 1994, no allowance was made in the total allowable catch for subsistence rights, which meant that thereafter, far more pressure was placed on government to correct this. However, very little was known about the nature or definition of subsistence fishing, which further inhibited efforts to encourage the sector's growth.

Since 1994, considerable effort has been placed on the latter point, yet despite these laudable efforts, there are few if any guidelines to assist policy-makers in understanding the potential contribution that fisheries can *and cannot* make, and the necessary support services that may be needed to ensure that coastal economic development is engendered through fishing. Section 3 will explore the impact of an initial allocation of resources to subsistence communities, and evaluate whether it may positively impact poverty levels.

3. Methodology

The primary methodological task is to link poverty alleviation to fisheries. Thus it is not only necessary to understand the scale and scope of poverty in the sample, but also to understand how public transfers of income – which, in this instance, equates to allocations of different species of fish – affects the magnitude of poverty in the sample.

3.1 The FGT Index

The FGT index of static poverty measures allows us to identify the required public expenditure necessary to lift a population of individuals out of poverty, which is set at a given poverty line[1]. The index can be presented in the general form as:

$$P_a = \frac{1}{n}\sum_{i=1}^{q}\left(\frac{z-y_i}{z}\right)^a \qquad (1)$$

Where n is the total sample size, z is the chosen poverty line, q is the number of poor agents and y_i is the standard of living indicator of agent i. The parameter α measures how sensitive the

[1] *The chosen poverty line in this paper is an income-based measure, though consumption and nutrition-based measures are equally, if not more valid (see Deaton 1997:134-162). The reason why we have chosen income is because data on caloric consumption is not available in either the OHS95 or the Income and Expenditure Survey (1995). It is also necessary to note that because we are dealing with communities that harvest fish as part of their weekly consumption (which they are not always paying for), we are dealing with a nutritionally biased sample (because fish is a protein-rich source of food); hence, both nutrition ranges and consumption metrics would be less valid poverty lines in this instance.*

index is to transfers between the poor units. Hence, P_0 measures the poverty head count index, P_1 measures the poverty gap (PG), and P_2 measures the severity of the poverty index. The PG measure is the key simulation that we are interested in here, for it allows us to identify all individual agents below the given poverty line and calculate the level of expenditure necessary to raise this population out of poverty.

The PG thus represents a direct measure of agents' incomes relative to the chosen poverty line, which, in turn, translates into a money metric of poverty. Thus, we can calculate the minimum financial cost of alleviating poverty by measuring the total income needed to lift all *q* agents above the poverty line; that is:

$$\sum_{i=1}^{q}(z-y_i) \equiv nzP_1 \qquad (2)$$

Here, nzP_1 represents the minimum commitment required by the income-granting agent to eradicate poverty, in that it assumes perfect targeting with zero administrative costs. It is also assumed that the scheme will elicit no behavioural responses from recipients (Kanbur 1987).

The value of nzP_1 can be extended to include sub-divisions of the total sample by decomposing the FGT measure in the following way (Bhorat 1999: 4):

$$P = \frac{\sum_{j=1}^{m} P_j n_j}{n} \qquad (3)$$

Where the *j* individuals are summed by the *m* sub-groups in the sample and then weighted by the total sample, *n*, to derive the composite P_1 value[2]. Once this has been defined, the nature of the transfer can then be specified and estimated, and Kanbur (1987) provides two such examples – an additive and multiplicative transfer.

An additive income transfer would amount to an absolute transfer independent of the income earned by the recipient; for example, one could think of an increase of R500 to all *q* agents. A multiplicative grant on the other hand, would be set at a fraction or percentage of the recipients given income, implying that the absolute amount would differ across agents. In terms of the additive case, and assuming that we account for the entire income distribution, an increase in everybody's income in fishing communities of an absolute amount, Δ_i, will mean that equation (1) takes the form:

$$P_a = \int_0^{\Delta}\left(\frac{z-y-\Delta}{z}\right)^a f(y)dy \qquad (4)$$

Hence each agent would get a transfer in each scheme of Δ_i, while the total cost of the scheme would be Δ. The marginal impact on poverty, as measured by P_1, would be calculated as (Kanbur 1987):

$$\frac{dP_a}{d\Delta} = -\frac{a}{z}P_{a-1} \qquad (5)$$

This presents the unit change in poverty as measured by P_a, given a unit change in the transfer value Δ_i to each agent in the sample. Here, an increase of Δ_i to each agent in the sample would

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[2] *The value for the minimum financial commitment by* m *sub-groups will therefore be equal to* $nz\sum_{j=1}^{m}\frac{P_j n_j}{n}$*, the weighted expenditure estimates.*

cause poverty to fall by a calculable value proportional to P_{a-1}. Using P_1 as a guideline, it is therefore possible to see that an increase of Δ_i would cause a parallel downward shift in the poverty deficit curve associated with P_1. In this way, the change in poverty could be measured in relation to the poverty line z, and the headcount index P_0 (or more generally P_{a-1}).

As far as the multiplicative transfer is concerned, the respective equations are:

$$P_a = \int_0^{z/(1+\Delta)} \left[\frac{z - y(1+\Delta)}{z} \right]^a f(y)dy \qquad (6)$$

$$\frac{dP_a}{d\Delta} = -\frac{a}{1+\Delta}\left[P_{a-1} - P_a\right] < 0 \qquad (7)$$

Here, it is the weighted difference between P_a and P_{a-1} that calculates the degree to which poverty falls after a transfer that is multiplicative in nature.

3.2. Adapting the Equations to the Fishing Industry

In the subsistence-fishing sector, a transfer can be either additive or multiplicative depending on the property rights regime, resource availability, eligibility to harvest those resources (and compliance with the rules governing eligibility), the potential realisable value of those resources, and the levels of access to capital among the *q* population and the (1-*q*) population (that is all others in the sample)[3]. We can examine the monetary implications associated with the additive and multiplicative cases empirically using Kanbur's (1987) formulae (namely (5) and (7) above).

However, before we discuss the transfer, we need to understand the implications of such a transfer with reference to the biological capacity of an individual fish species. Here it should be noted that the allocation of fisheries is based on the principle of the maximum sustainable yield (MSY), which implies that, in any given year, the total quantity of fish that can be caught must not exceed the rate at which the population can reproduce itself to maintain its total population levels at the MSY point in the following year. The MSY point can be further understood by equating the biological reproduction rate with the rate of exploitation exerted by fisher-folk. Biologically, the reproduction rate of any given fish species can be represented as follows (Shone1997: 460):

$$\frac{ds}{dt} = f(s) = rs\left(1 - \frac{s}{k}\right) \qquad (8)$$

Here we assume that the growth rate of the fish stock, denoted by *ds/dt*, is related to the biomass (the stock level), denoted by *s*. Although stock mass is related to time, for the purposes of static consistency (required in order to equate the outcome with the rate of exploitation of the fish stock) we omit the possibility of temporal variation. Thus, the instantaneous growth process can be represented by $f(s) = rs(1-(s/k))$, where r is the intrinsic instantaneous growth rate of the biomass and k is the carrying capacity (or saturation level) of the biomass that the environment

[3] *It is important to at least consider the role of the (1-q) population (though a detailed empirical analysis is beyond the scope of this paper). An example will perhaps be the best form of elaboration. Recently, the CD: MCM zoned certain areas of the coast for subsistence use only. These zones are regulated under the conditions stipulated by the department, but more generally represent common property resources. Not all valuable resources are located in deep waters, making the zoning potentially lucrative to those who can exploit it. Here, those with greater access to capital will be able to harvest greater quantities of resources, and these people, in all likelihood, will not be part of the q population in our sample. Hence, the dynamic implications imply that the potential income of all q agents may decline due to individuals outside of that population (that is the 1-q population) harvesting in these areas, and thereby reducing the absolute quantity of resources available to the q population. To understand this process empirically, it would be necessary to simulate the harvesting patterns of both the q agents and the (1-q) agents concurrently.*

can support. From (8), it then follows that the stock size will be at a maximum when *ds/dt = 0*, that is, when $s = k$ The growth function thus reaches a maximum at the MSY point, which, holding both *r* and *k* constant, is solved by differentiating the growth curve and setting it equal to zero (*ibid*: 461). Thus:

$$\begin{aligned} & f'(s) = rs\left(-\frac{1}{k}\right) + r\left(1 - \frac{s}{k}\right) = 0 \\ & -rs + r(k - s) = 0 \\ & s_{msy} = \left(\frac{k}{2}\right) \\ & f\left(\frac{k}{2}\right) = \frac{rk}{4} \end{aligned} \qquad (9)$$

Hence, the MSY for a particular species (s_{msy}) is exactly half of the carrying capacity of the stock level of that species, and the biological growth function is thus symmetrical about the MSY point.

As far as the rate of exploitation of a given fish species is concerned, we can define this as the rate of change of the quantity of fish harvested (*q*) (expressed in tons nominal mass) with respect to exerted effort (*e*) (which could be defined as a finite number of boats or a finite number of nets). For this purpose, we again set s_{msy} to be symmetrical to the rate of exploitation, implying that once total effort exceeds s_{msy}, the quantity harvested will decline because the regeneration capacity of the species would have been exceeded. Here, effort would act as the limit on the growth of s as opposed to k in (9), though it should be noted that e and k are not directly substitutable in this instance. The rate of exploitation of the fish stock can thus be equated to the biological growth function in the following way:

$$\frac{dq}{de} = 0 \Rightarrow s_{msy} \Rightarrow \frac{ds}{dt} = 0 \qquad (10)$$

Thus, when *dq/de>0*, the rate of exploitation is below s_{msy}, and when *dq/de<0*, the rate of exploitation is greater than s_{msy}. From a management perspective, and because subsistence fishing is increasingly managed through zonal allocation (designated common property), the state must ensure that all transfers of fish species to subsistence communities (implicit in a zonal system) do not compromise the respective MSY points for each species. In what follows below we make this assumption, which is reasonable in a hypothetical exercise given that the MSY's for each species are exogenously determined. In practice of course, this assumption would rarely hold.

Given this, we can now specify the nature of the resource transfer (Δ) with greater precision, but before doing so, it is necessary to qualify the harvesting characteristics of subsistence fisher-folk and identify pertinent factors associated with the resource transfer. In this regard, it should firstly be noted that individuals already harvest a certain quantity of fisheries, yet despite this, there will still be numerous individuals that fall below our chosen poverty line *z*. When discussing a resource transfer, it is therefore with reference to an amount of resources greater than that which is currently harvested.

Secondly, we need to calculate the unit value of each species in order to immediately ascribe a Rand value to a given quantity of resources. This can be determined by dividing the total known quantity of each species caught in a given year by the total landed or processed value of that species obtained in the corresponding year. From this discussion, it should now be clear that the nature of Δ in this exercise is never absolute but relative. Furthermore, because members of the *q* population have different levels of access to capital, which implies that they have a differential capacity to harvest resources, the nature of Δ cannot be additive in this case, only multiplicative[4].

Understanding the potential contribution of fisheries to the income levels of subsistence communities is thus dependent on both the existing quantities of fisheries harvested (that is part of current income), plus the potential realisable value of any future quantities of access rights granted to these communities (that is part of future income). This can be expressed in the general form as:

$$Y_F = \sum_{f}^{F} \left[b_{0f} + b_{1f} \left(\frac{P_f}{Q_f} \right) \right] \qquad (11)$$

Where Y_F is the total income attributable to fisheries, F is a population parameter of all species of fish harvested in a given area (ranging from f_1, f_2, ..., F), b_{0f} is a constant denoting current income derived from harvesting a given fishery f, b_{1f} is a quantity parameter for a given fishery, and P_f / Q_f is the unit value of that fishery expressed in Rands per kilogram or Rands per ton. The equation thus tells us that the contribution of fisheries to the income of subsistence communities is equal to the sum of the current value of resources harvested plus the future value of all resources allocated (that is the quantity of all new fisheries made available multiplied by their unit values). We therefore implicitly assume that subsistence fishers have both the means and opportunity to sell any further quantities of access rights granted to them.

When applying this to a discussion of resource transfers, we make the assumption that b_0 constitutes part of the current income of an individual agent in our sample, and thus exclude it from the calculation of Δ. Hence, an additional resource transfer will take the form:

$$\Delta = \sum_{f}^{F} b_f \left(\frac{P_f}{Q_f} \right) \qquad (12)$$

Here, Δ is the given resource transfer expressed in Rands. The marginal impact on poverty is thus:

$$\frac{dP_a}{d\Delta} = -\left[a / 1 + \left[\sum_{f}^{F} b_f \left(P_f / Q_f \right) \right] \right] \left[P_{a-1} - P_a \right] < 0 \qquad (13)$$

Once we have run these simulations, we then extend the analysis of the impacts of these transfers on poverty by analysing the q population inequality levels as income increases in accordance with the transfer (Δ). We employ Gini Coefficients for this purpose, and modify the equations to account for q population inequality levels only, as opposed to total population (n) inequality, which we know will decrease as public expenditure targeted to the bottom end of the income distribution increases. We thus formulate the Gini equation in the following way (adapted from Deaton 1997: 139):

$$? = \frac{1}{\mu\, q(q-1)} \sum_{i>j} \sum_{j} \left| y_i - y_j \right| \qquad (14)$$

[4] This reasoning is consistent as long as the assumption that the resource transfer elicits no behavioural responses from recipients remains active. As soon as this assumption is violated, which is very likely under a regime of common property resource allocation, the nature of the transfer will become both additive and multiplicative, owing to the fact that new individuals would want to capitalise on the opportunity to exploit the resource (following the logic of Hardin's "Tragedy of the Commons").

Where γ is the Gini coefficient, q is the total poor population, μ is mean income, $y_{i(j)}$ is the income of agent *i (j)* (where *i*=1,..., *q*), and $\sum_{i(j)}$ is the sum over agent *i (j)* (where *i*=1,..., *q*). In this way, we are also able to correlate the impact of intermediate resource transfers (that is below poverty eradication transfers) with intermediate changes in inequality in the *q* population.

4. A Note on Data

This Section describes some of the challenges that we encountered when trying to reconcile the empirical aspects of the FGT technique with the data sources available in South Africa. Three primary definitional tasks confronted us in this regard, including:

- Choosing an appropriate sample of subsistence fishing communities.
- Proxying subsistence fishers themselves given imperfect definitions in the data.
- Identifying the income levels of these individuals.

The sample of subsistence communities used throughout the analysis is based on a list of 87 known subsistence-fishing communities in South Africa, obtained from the CD: MCM. We then traced these communities in the Census (1996), and were able to obtain data on population and categories of income for all individuals living in those communities. Although the data is not a true sample of all South Africa's subsistence communities, it is to the best of our knowledge the most comprehensive account of them to date. Having noted this, it is important to state that there are several limitations with the data – both with respect to the definition of subsistence fishers and their income characteristics.

As far as the definition of subsistence fishers is concerned, it became evident that when the communities were found in the Census, the population numbers reflected individuals who had nothing to do with subsistence fishing. Consequently, we had to decide on a suitable second-best method to proxy the sample, and so present the results by economic sector at the one digit S.I.C. level (we were unable to disaggregate beyond the one-digit level due to constraints within the Census itself). Thus, the analysis is based on the population of all individuals in the Agriculture, Hunting, Forestry and Fishing sector in the 87 fishing communities defined as our subsistence sample from the Census.

As far as the income characteristics of these communities is concerned, it should be noted that income in the Census is defined categorically, which meant that we were unable to run the FGT index of poverty measures with this source. It also meant that our choice of poverty line was dictated by the income categories (here, the poverty line of R1000.00 per month was chosen). In order to simulate the PG measures, we therefore had to use data on a selection of fishing communities from the OHS95. Here, we were only able to find nine fishing communities (see Appendix 1 for a description of both the Census and OHS sample of subsistence communities), of which the income characteristics were used in order to run the PG simulations. However, the nine fishing communities of the OHS are not defined at the one digit SIC level because there are too few observations. Consequently, we had to weight the population numbers in the OHS95 with the Census sample in order to obtain values more reflective of the total subsistence population (proxied by the Census sample).

Because of these limitations, the discussion in Section 5 should be viewed as a first step to understanding how the FGT class of poverty measures can be applied in this context.

5. Simulations for Fishing Communities

This Section applies the methodology outlined in Section 3. We commence with a discussion of the poverty headcount index before proceeding to analyse poverty gaps, inequality levels and the opportunity costs of the transfer.

5.1. A Poverty Headcount for Fishing Communities

A poverty headcount (PH) is simply the number (or proportion) of individuals within a given sample living below a chosen poverty line. In this case, our choice of poverty line was dictated by the data. As mentioned previously, the income variable in the Census (1996) is a categorical one, which thus dictated what our poverty lines could be. We chose a R1000.00 per month poverty line (this is the second lowest income category above R0.00 in the Census), and the entire analysis hereafter is based on this figure.

We then analysed the PH percentages for the subsistence sample and compared them to the total (national) sample[5] for each poverty line. As noted above, both the national and the subsistence samples were disaggregated according to industrial sector, and only the figures for the Agriculture, Hunting, Forestry and Fishing sector in each sample were analysed. The PH for fishing communities in presented in Table 1.

Table 1: Poverty Headcount for Subsistence and National Sample

Variables		% Below R1000 Poverty Line	
		Subsistence Sample	**National Sample**
African	Male	72.36	90.34
	Female	90.43	93.95
	% Sample	**78.37**	**91.39**
Coloured	Male	59.29	88.46
	Female	75.08	93.68
	% Sample	**64.96**	**90.29**
Asian	Male	30.43	26.97
	Female	42.86	49.9
	% Sample	**32.08**	**30.61**
White	Male	12.59	13.29
	Female	23.02	24.53
	% Sample	**14.29**	**15.32**

Source: Census (1996) and own calculations.

Table 1 shows the percentage of each sample below the R1000 poverty line, disaggregating the figures by population group and then by gender. The % Sample column is the percentage of each population group below the poverty line. An interesting interpretive aspect of each distribution displayed above is the point that the % Sample figure lies between the range of the male and female figures, which gives us an indication of the relative sample size of each covariate and how it has influenced the aggregated figure. Here, a larger sample of males relative to females would pull the % Sample figure down, closer to the male figure. Of course, the converse applies to the female case. For example, for the African population in the subsistence sample, there are more males than females, which accounts for the % Sample figure being closer to the corresponding male figure. We can see that this trend is prevalent across all races in both samples, reflecting the male bias to the data.

[5] *The national sample is calculated as all individuals in the Agriculture, Hunting, Forestry and Fishing Sector in South Africa (also taken from the Census).*

Generally, we can also see that there are identical distributive poverty trends between the fisheries and national samples with respect to the gender and racial distribution of poverty. Here, it is evident that the figures for the percent below the poverty line for males are always less than the same for females, and African and Coloured poverty rates are considerably higher than the same for Asians and Whites, corroborating similar evidence found in related research on South Africa (Bhorat and Leibbrandt 1999). Despite this however, the inter-sample degree of variation per race suggests that African and Coloured males are at least 20 percent wealthier in the subsistence sample compared to the National sample. Indeed, this trend is evident for both males and females in the Coloured population, while in the Asian and White populations there are almost equal distributions of poverty between the samples. On the whole, it can therefore be concluded that the subsistence sample is a wealthier one.

This is a very significant finding as it has long been theorised that, owing to traditional inter-generational knowledge transfers, subsistence fisher-folk are very skilled at harvesting resources from the sea. Because of these skills, it is thus reasonable to assume that they positively contribute towards income levels when compared to poor people in other communities.

The intra-sample magnitude of poverty also reveals some interesting trends. In the subsistence sample, Africans and Coloureds have far more acute gender-based poverty ranges, with males being at least 16 percent more wealthy than females. When compared to the national sample, this range is considerably lower at approximately three and five percent for Africans and Coloureds respectively, though this does not hold for the Asian and White populations. Thus, relative to men, women are more disadvantaged in the subsistence sample when compared to national trends.

It is also revealing that the absolute magnitude of poverty in both samples is exceedingly high. Notwithstanding the fact that each sample contains a certain percentage of zero earners, these figures represent the income of the employed workforce in the Agriculture, Hunting, Forestry and Fishing sector, and we would expect that the incidence of poverty in the population would be lower. The revealing attribute of the sector is thus where low wage rates possibly combined with above-average levels of in-kind support ultimately leave individuals with very little monetary income.

5.2. Poverty Gaps in Fishing Communities

In this Section we are concerned with the application of the FGT index of poverty measures to our fisheries sample, which we then need to link to the range of species harvested in different communities across the coastline. Table 2 presents the poverty gaps for fishing communities.

The P_1 estimates in Table 2 denote the magnitude of poverty. Here, a value of zero would indicate that there are zero individuals living below the poverty line and a value of one would indicate that all individuals are living below the poverty line. Note that even though Asian Females have a P_1 value of 0.0000, they still have a positive value owing to their positive q numbers, which implies that the value of P_1 is positive but lower than four decimal places. Also, because the P_1 values are decomposed by population group relative to the total q population, they are materially affected by the value of q. The Expenditure Per Annum column quantifies the total expenditure necessary to raise all individuals below the poverty line to the poverty line, and the Percentage of Total Expenditure column quantifies the proportionate contribution of each covariate to nzP_1.

From Table 2, it is again evident that Africans and Coloureds have the greatest percentage of people living in poverty, translating into the need for the majority of poverty alleviation expenditure to be spent on these populations. An interesting trend is that Asians have lower poverty rates than Whites, though this is perhaps partly due to the small sample size of the Asian population in the sample population. Males require a greater percentage of expenditure in every population group, reflecting their larger population size. Lastly, it should also be noted that even though this is an inexact method, it is a powerful one because it calculates a money metric and then a value to the level of expenditure needed to eradicate poverty. Having said this, however, it by no means implies that a corresponding expenditure would necessarily eradicate poverty, owing to the fact that the figures do not quantify the administrative costs necessary to implement such a scheme.

Table 2: Minimum Poverty Alleviation Expenditure for OHS95 Sample (R1000)

Variables		n	q	P_1 Weighted	Exp. p.a. (nzP_1)	% of Total Exp.
Consolidated Total		**5867**	**3542**	**0.2972**	**20,924,069**	**108.2 (Error: 8.2%)[6]**
African	Sub-Total	1604	1247	0.1361	9,585,504	45.81
	Male	1071	769	0.0765	5,388,844	25.75
	Female	533	478	0.0534	3,762,767	17.98
Coloured	Sub-Total	3356	2164	0.1741	12,258,797	58.59
	Male	2152	1268	0.0832	5,856,883	27.99
	Female	1204	896	0.0796	5,607,269	26.80
Asian	Sub-Total	53	17	0.0002	11,639	0.06
	Male	46	14	0.0001	7,673	0.04
	Female	7	3	0.0000	1,974	0.01
White	Sub-Total	854	114	0.0111	783,972	3.75
	Male	715	84	0.0049	346,632	1.66
	Female	139	30	0.0029	207,499	0.99

Source: Census (1996); OHS (1995) and own calculations.

5.3. Developing a Proxy for the Value of Resources Required to Alleviate Poverty

Now that we are able to quantify the total expenditure needed to eradicate poverty, it is necessary to identify the role and contribution that fisheries can make towards this required expenditure. In order to do this, we need to know which fisheries are currently harvested in these regions as well as the unit values of these fisheries. A general typology of known subsistence fisheries is presented in the Table 3.

Table 3 has two important columns with respect to unit values (expressed in R/kg) – the LV/L and FOB/L values. Ordinarily, subsistence communities would harvest fish for their own consumption, but would also engage in selling a portion of their catch. When they did sell, they would more likely be selling at prices similar to the LV/L values, reflecting the fact the fish, when sold, is done so directly after being caught, rather than being processed in any way first before selling, which would resemble values more closely related to the FOB/L values. Subsistence fishing is therefore characterised by low value creation.

When applied in the context of expenditure per annum estimates for poverty alleviation discussed in Section 5.2, it is now possible to see how fisheries may contribute towards poverty alleviation. Any number of resource transfers are possible, but a few broad comments are necessary in this regard. It is evident from Table 3 that the two fisheries with the greatest values (at both LV/L and FOB/L prices) are WCRL and abalone, followed distantly by squid. Prawns and

[6] Because the data in Table 1 was weighted by population according to the Census sample size and distribution, an 8.2 percent error was introduced into the calculations. We keep this error in the tables, however, because it more accurately reflects the defined population of subsistence communities. For the unweighted comparison and a description of the weighting process, see Appendix 2.

mussels both have high FOB values, but no data is available for the landed value of either fishery, and the figures in the table represent the prices for cultivated mussels and prawns only, which is not a subsistence form of fishing. However, subsistence fishers do harvest both mussels and prawns more generally, but their lack of access to markets prevent them from selling much of their catch. Similarly, a lack of capital (such as basic refrigeration equipment and sanitary work places) has the same effect. Lower value fisheries include handline fishing and small net fishing, where any of a number of fisheries are caught, some more lucrative than others (for example kingklip relative to hake).

Table 3: Unit Values (1995 Rands per kilogram) for Selected Fisheries

Fishery	Landed Value (LV) R'000	FOB Value* (FOB) R'000	Landings (L) (Tons)	R/Kg [LV/L]	R/KG [FOB/L]
Abalone	13245	54054	616	21.50	87.85
Handline Fishing	28737	35209	4929	5.83	7.14
Mussels (rock/sand)	-	16195	1680	-	9.64
Oysters	515	1431	160	3.22	8.94
Prawns (sand/mud)	-	2572	77	-	33.40
Redbait	-	54	9	-	6.00
West Coast Rock Lobster (WCRL)	54264	121190	1859	29.19	65.19
Seaweed	1439	4215	1250	1.15	3.37
Small net fishing	2110	3895	1338	1.58	2.91
Squid	58021	102390	6826	8.50	15.00

Source: Stuttaford 1997: 39 and own calculations.

Note: * Wholesale Processed (Free On Board) Values.

From the point of view of using fisheries to alleviate poverty, it would be a logical step to ensure that subsistence communities have greater access to higher value species. Given this, the expenditure per annum values for poverty eradication will be reached faster and with lower quantities of resources. Because fisheries are allocated by the state, this would amount to a commitment to provide these communities with greater quantities of WCRL and abalone for example. Any such allocation would thus represent the values for Δ in the FGT class of poverty measures[7]. Having noted this, we do need to establish whether fisheries can in fact fully eradicate poverty in the sample. This can be achieved by comparing annual poverty eradication expenditure (nzP_1 in Table 3) with the total combined value of fisheries harvested by subsistence communities, presented in Table 4.

Table 4: Comparison of Total Value of Selected Fisheries (from Table 3) and Expenditure Per Annum Estimates (from Table 2)

Total Landed Value (R)	Total FOB Value (R)	Exp. p.a. (weighted) (R)	% Landed Value	% FOB Value
158,331,000	341,205,000	20,924,069	16.69	6.12

Source: Stuttaford 1997: 39 and own calculations.

The data shows that in order to fully eradicate poverty, it would require 16.7 percent of the landed value or 6.12 percent of the FOB value of known subsistence fisheries. Thus, poverty could indeed be eradicated in subsistence communities given a corresponding allocation of resources.

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[7] *That is, following the logic of equation (12):* $\Delta = \sum_{f}^{F}\left[b_f\left(\frac{P_f}{Q_f}\right)\right]$

5.4. The Impact of Income Transfers on the q Population

We now have a good idea of the minimum expenditure necessary to eradicate poverty in subsistence communities. However, it is also important to understand how transfers below this value will affect poverty. We discuss these implications by focussing on two, related elements:

- The impact of four, below nzP_1 expenditure per annum resource transfers on the q population.
- The effect of these transfers on inequality within the q population.

When considering the transfer, we evaluate only the multiplicative case due to the fact that not everyone in the q population will have equal access to capital; thus, some will benefit more than others (that is the possession of capital allows for greater harvesting potential). The multiplicative simulation accounts for this in a simplistic manner, for it implies that all q individuals will have their income multiplied by a given factor or percentage. Thus, the individuals that will benefit most from the transfer will be those in the q population whose income levels are closer to the poverty line of R1000.00 per month (or, more generally, if $y_i > y_j$, y_i will benefit proportionately more than y_j in each resource transfer). Once the values of these transfers are estimated, we then calculate the impact on inequality, and so may generally assess who are more likely to benefit from the transfer.

In Table 5, the effects of four multiplicative resource transfers are estimated; these include a:

- 34 percent increase in total monthly income.
- 134 percent increase.
- 234 percent increase.
- 334 percent increase.

(which amounts to existing income multiplied by 1.34, 2.34, 3.34 and 4.34, respectively).

The rationale for the selection of the transfers is based on the fact that the median income in the q population is R300, and, accordingly, R700 is required to lift this individual out of poverty. This translates into a required increase in total monthly income of 234 percent (or factor 3.3333... 3.34). The balance of the transfers simply takes the median factor and decreases (increases) it by 1 (2 in the case of the 34 percent increase). These transfers are simulated to estimate the effects of two below- and one above-median related resource transfers on P_1.

Table 5 decomposes the results by total *(q)* population and race. In each transfer, we compare the original P_1 estimates taken from Table 1 with the revised P_1 estimates after the four transfers. We can see that a multiplicative transfer that lifts the median individual out of poverty (that is increases their income by R700) reduces total poverty by 33.38 percent. In the 34 percent and 134 percent simulations, the corresponding figures are 13.63 and 29.41 percent, respectively. On the other hand, an above median related transfer of 334 percent reduces poverty by 35.3 percent.

As far as determining which population group will benefit the most from the transfer is concerned, it is clear that Asians are the greatest beneficiaries, so much so that poverty within the group is almost entirely eradicated after the lowest income transfer of 34 percent, and is entirely eradicated in the 134 percent simulation and every simulation thereafter. This suggests that they are the wealthiest group of individuals in the sample. Besides the Asian population, the groups that will benefit the most in the below-median transfers are Coloured people in the 34 percent simulation and White people in the 134% simulation, while Coloureds are also the greatest beneficiaries in the 334 percent simulation. Conversely, in all four simulations African people have the lowest reduction in poverty, implying that, even amongst the general poor, they are the most chronically impoverished and have the lowest income levels. It follows then that the percentage change in poverty is dependent on the distribution of q agents' incomes, where the closer the mean of income in each sub-sample is to the poverty line *(z)*, the greater the reduction in poverty as the value of the transfer increases.

Table 5: Incremental Changes in Poverty as P_1 Increases

Sub-Group	Old P_1w	New P_1w	% Change	Sub-Group	Old P_1w	New P_1w	% Change
Multiplicative Transfer of 34% (Y*1.34)				**Multiplicative Transfer of 234% (Y*3.34)**			
Total	0.2972	0.2567	-13.63	**Total**	0.2972	0.1980	-33.38
African	0.1361	0.1224	-10.07	**African**	0.1361	0.0985	-27.64
Coloured	0.1741	0.1431	-17.83	**Coloured**	0.1741	0.1041	-40.20
Asian	0.0002	0.0000	-76.06	**Asian**	0.0002	0.0000	-100.00
White	0.0111	0.0092	-16.73	**White**	0.0111	0.0067	-39.28
Multiplicative Transfer of 134% (Y*2.34)				**Multiplicative Transfer of 334% (Y*4.34)**			
Total	0.2972	0.2098	-29.41	**Total**	0.2972	0.1923	-35.30
African	0.1361	0.1039	-23.67	**African**	0.1361	0.0957	-29.65
Coloured	0.1741	0.1115	-35.93	**Coloured**	0.1741	0.1008	-42.08
Asian	0.0002	0.0000	-100.00	**Asian**	0.0002	0.0000	-100.00
White	0.0111	0.0068	-38.63	**White**	0.0111	0.0066	-40.86

Source: OHS (1995) and own calculations

Further insight can be obtained with respect to who benefits from a resource transfer by examining the *q* population inequality levels before and after a multiplicative grant. For this purpose we employ Gini Coefficients, the results of which are presented in Table 6 for the identical simulations to Table 4 (that is factor 1.34, 2.34, 3.34, 4.34).

Table 6: Change in *q* Population Inequality and Numbers as D Increases

Change in Gini Coefficient					
Sub-Group	**Existing Y**	**Y*1.34**	**Y*2.34**	**Y*3.34**	**Y*4.34**
Total	0.5484	0.6157	0.7838	0.8638	0.8914
African	0.6259	0.6725	0.795	0.8721	0.889
Coloured	0.47	0.5548	0.759	0.849	0.8947
Asian	0.0789	0	0	0	0
White	0.4871	0.5334	0.8124	0.8556	0.8779
Change in Weighted Poor Population Numbers					
Sub-Group	**Existing Y**	**Y*1.34**	**Y*2.34**	**Y*3.34**	**Y*4.34**
Total	5867	2853	1999	1735	1662
African	1604	1077	836	729	710
Coloured	3356	1601	1008	860	800
Asian	53	6	0	0	0
White	854	94	53	48	46

Source: Census (1996); OHS (1995) and own calculations.

From Table 6, it is clear that inequality will increase across most races and in the total sample as the value of the transfer increases (at any of the four simulations). The anomaly to the rule is the Asian population, who, due to the weighting formulae (see Appendix 2), are all ascribed identical income values because there is only one individual below the poverty line in the unweighted simulation (accounting for the zero Gini Coefficients observed despite there being 6 people left in the weighted *q* population).

It is also evident from Table 6 that the inequality progression increases more rapidly at first before tapering off[8]. This suggests that a greater proportion of the *q* population across all races initially move beyond the poverty line, but the rate at which this occurs steadily decreases as the poorer members of the income distribution start biasing the extent to which poverty can be eliminated under multiplicative conditions. Thus, the rate of change in inequality decreases as larger resource transfers are provided because the numbers of *q* agents are decreasing proportional to the increase in income. Following this logic, it would suggest that there is a logarithmic progression of inequality levels as resource transfers increase in a multiplicative manner until one individual had an above-zero, below poverty-line income, and the balance had zero (which would, of course, never increase beyond zero under multiplicative conditions). This would then yield a Gini Coefficient of one (the coefficient of perfect inequality), but as soon as this individual was lifted above the poverty line, the Gini would be zero – the coefficient of perfect equality.

By way of summary then, we can conclude that a greater allocation of resources to subsistence fishing communities will steadily decrease the number of individuals living in poverty, but concurrently increase the inequality levels within the poor population. We can therefore deduce that there is a perfectly negative correlation between the number of poor agents and the level of inequality amongst the poor population as income rises in a multiplicative manner. Thus, rising inequality in the *q* population is an acceptable static outcome of resource transfers (given the limitations associated with zero earners in a such a simulation). However, the fact that inequality will rise amongst poor people does raise the propensity for conflict within these communities, especially given the clear racial bias to the progression implied in Table 5 (and Appendix 3). It is therefore incumbent upon the state to mitigate this likelihood through, for example, targeted outreach programmes and other educational activities.

5.5. The Opportunity Costs of Supporting Subsistence Fishing

We now know that it is possible to eliminate poverty in the sample through resource transfers, and we also have a fairly nuanced view of the likely impacts these transfers will have on the poor population. However, the opportunity costs of eliminating poverty provides an interesting dilemma from a public policy perspective, that is, should a greater or lesser resource transfer be authorised? In this regard, it is important to note that subsistence fishers could never generate returns comparable to those of commercial enterprises, which represents a revenue loss at the aggregate level and therefore an opportunity cost associated with supporting the subsistence sector. This loss can be quantified by calculating the difference between landed values and FOB wholesale processed values, and by assuming that subsistence fishers sell their catch at landed as opposed to FOB values (with the converse applying to commercial enterprises). To aid the discussion, we present the ratios of the unit differences per fishery in Table 7.

From Table 7, it is possible to see that in several fisheries, the wholesale processed value is at least double the landed value, and in the case of Abalone, the figure is over four times greater. The loss in value terms therefore corresponds to these ratios, which are material indeed. It follows

[8] *This is not immediately evident from Table 5 due to our aim of simulating the transfers around the median individual's income level, which has necessitated a simulation of factor 3.34 and related factors. For the purposes of analysing the inequality progression, all of the median-related simulations become problematic because they do not allow for a consistent rate of change in income levels relative to factor 1.00. However, we have tested this relationship under more robust conditions in Appendix 3, where we increase the transfer sequentially from factor 1.00 to factor 10.00. Here we evaluate the rate of change of inequality as the resource transfer increases, and find that the logic generally holds under these conditions, hence the evidence is corroborated.*

then that the greater the percentage of resources allocated to subsistence communities, the lower the potential value creation at the aggregate level.

Table 7: Value Differences for Various Fisheries

Fishery	R/kg [LV/L]	R/kg [FOB/L]	Ratio (FOB/L : LV/V)
Abalone	21.50	87.75	4.08
Handline Fishing	5.83	7.14	1.23
Mussels (rock/sand)	-	9.64	-
Oysters	3.22	8.94	2.78
Prawns (sand/mud)	-	33.40	-
Redbait	-	6.00	-
WCRL	29.19	65.19	2.23
Seaweed (other)	1.15	3.37	2.93
Small net fishing	1.58	2.91	1.85
Squid	8.50	15.00	1.76

Source: Stuttaford 1997: 39 and own calculations.

However, while this is certainly the case in a static context, it ignores the dynamic implications of such a transfer. Here it is important to realise that the encouragement of subsistence fishers could yield disproportionately large economic results relative to other poverty alleviation schemes, owing to their existing knowledge of the industry and its normal biological fluctuation within their communities. Moreover, this competitive skill advantage implies that the propensity for successful micro-enterprise development is great indeed. Thus, an initial resource transfer may ultimately stimulate endogenous micro-level economic development, which could be further encouraged by inter-departmental government intervention in the sector (the Department of Trade and Industry's micro-finance programmes). This scenario could therefore offset the short-term value-losses associated with supporting the subsistence sector, and in fact lead to net economic gains at both the micro and macro levels in the medium-term.

Following from this, any calculation of the multiplier effects of a resource transfer would need to factor in the propensity for endogenising further local economic development through micro-enterprise growth. Hence, the multiplier effects would be defined as the sum of the direct and indirect expenditure coefficients of the resource transfer on the one hand, plus a disproportionately large coefficient for the induced effect of the transfer on the other. These induced effects would need to be commensurate with the added propensity for micro-enterprise development. Thus, this question can only be resolved by evaluating the net costs of the value loss relative to the net benefits of micro-enterprise development. Future research in this area should be devoted to clarifying the net implications of a resource transfer by, for example, using a dynamic social cost-benefit methodology.

6. Conclusion

This working paper has shown that it is possible to use the FGT class of poverty measures to understand how income transfers (expressed in values of fisheries) affect subsistence-fishing communities. Here we saw that poverty can be entirely eradicated (relative to a R1000 poverty line) by allocating approximately 16.69 percent of the landed value or 6.12 percent of the wholesale processed (FOB) value of known subsistence fisheries to these communities. An analysis of the post-income transfer effects then suggested that several important consequences had occurred. By focussing on inequality levels for example, we were able to quantify how a multiplicative transfer affects income among poor individuals, noting that they increased proportional to the value of the resource transfer and the number of poor agents above R0.00.

It should now be possible to see that the nature of the income transfer (Δ) allows for the FGT class of poverty measures to be linked to a broad range of poverty alleviation strategies. The critical ingredients are to obtain data (preferably longitudinal) on the sample population and to understand how given income transfers are manifested within the case study. In this example, we have used a selection of species harvested by subsistence communities at the national level, but there is no reason why this cannot be reproduced for any bio-geographic zone of South Africa's coastline, making the estimations more sensitive to locational variance. Similarly, with more valid information on the sample population, a considerably greater degree of accuracy could be attained in the estimations of P_1 than have been presented in this working paper. Once this has been established, a fairly precise static estimate of poverty alleviation can be made. Here the decomposability properties of the P_1 estimates are instructive, and can be used to determine the extent of poverty alleviation among population and gender groups. Thus the method is both scalable and decomposable, and these properties make it ideal for planning purposes within the public domain.

This analysis has also shown that while the merits of an income transfer using fisheries are great, the opportunity costs of doing so must be evaluated with reference to both the value foregone in such a transfer and the dynamic potential of the fisher-folk themselves given the transfer. With respect to the former, we proxied the value loss using a fairly simple methodology, and in so doing were able to demonstrate the magnitude and heterogeneity of the loss in Rand terms for different species. As far as the latter is concerned, this working paper has argued that because subsistence fishers possess a comparative skill advantage, their propensity for successful micro-enterprise development given greater resource transfers is indeed material. Reconciling these opposing dynamic characteristics of income transfers is thus imperative when attempting to quantify the net implications of a given policy choice, and greater attention to should be devoted to quantifying this trade-off in future analyses.

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Appendix 1: Sample of Subsistence and OHS Communities

Sample of 87 Subsistence Communities taken from the Census

Port Nolloth	Hawston	Swartkops	Qatywa
Hondeklip Bay	Hermanus	Colchester	Mdikana
Ebenhaeser	Gansbaai	Bushmans River Mouth	Zitulele
Papendorp	Struisbaai	Marselle	Ndungunyeni
Doringbaai	Waenhuiskrans & Arniston	Port Alfred	Mtentu
Elandsbaai	Witsand & Port Beaufort	Keiskammahoek	Mnyameni
St Helenabaai	Stilbaai	Chalumna	Thongasi
Paternoster	Gouritzmond	Kidd's Beach	Thundeza
Vredenburg	Vleesbaai	Cove Rock	South Broom
Saldanha	Mossel Bay	East London	Ramsgate
Hopefield TLC	Hartenbos	Gonubie	Fairview
Yzerfontein TLC	Groot Brakrivier	Kei Mouth	Mfazazane
Mamre	Knysna	Qolora	Turnton
Cape Central	Hornlee	Debese	Phoenix Industrial
Llandudno	Plettenberg Bay	Kobonqaba	Verulam
Hout Bay Harbour	Wittedrift	Maxambeni	Tongaat Beach
Ocean View	Covie	Mazeppa	Tinley Beach
Masiphumelele	Stormsrivier	Ngala	Groutville
Steenberg	Jeffreys Bay Informal	Xanini	Nonoti
Macassar	Loerie	Nqabarana	Tugela Mouth
Gordons Bay	Seaview	Ntubeni	Nkundisi
Kleinmond	PE-Central	Hobeni	-

Sample Size of Census Communities

Population Group	Male	Female	Total
African	1071	533	1604
Coloured	2152	1204	3356
Asian	46	7	53
White	715	139	854
Total	3984	1883	5867

Sample of 9 Subsistence Communities taken from the OHS

Hermanus	Mossel Bay	Vredenburg	Keiskammahoek
Knysna	Strand	Cape Town	East London
Port Elizabeth	-	-	-

Sample Size of OHS Communities

Population Group	Male	Female	Total
African	265	231	496
Coloured	292	271	563
Asian	20	17	37
White	241	182	423
Total	818	701	1519

Appendix 2: A Description of the Population Weighting Process

It should be noted that there are two weighting procedures used in the P_1 tables: weighting by population and weighting P_1 by equation (3) above. This Section describes the former process only as the latter has already been explained in the methodology. The data in the poverty gap (PG) tables was weighted by population numbers according to the Census (1996) subsistence sample. This meant that we took the list of OHS communities and the disaggregated sample size and weighted the OHS distribution by a factor commensurate with the ratio of the Census and OHS race and gender sub-samples and total sample. This resulted in the following population weights:

The Weighting Procedure between the Census and OHS Samples

Co-Variates		Sample Size (N & Q)				Weight	
		OHS-N	Census-N	OHS-Q	Census-Q	Census-N / OHS-N	Census-Q / OHS-Q
Consolidated Total		**1519**	**5867**	**684**	**3542**	**3.86240948**	**5.178363**
African	Sub-Total	496	1604	337	1247	3.23387097	3.700297
	Male	265	1071	162	769	4.04150943	4.746914
	Female	231	533	175	478	2.30735931	2.731429
Coloured	Sub-Total	563	3356	292	2164	5.96092362	7.410959
	Male	292	2152	131	1268	7.36986301	9.679389
	Female	271	1204	161	896	4.44280443	5.565217
Asian	Sub-Total	37	53	3	17	1.43243243	5.666667
	Male	20	46	2	14	2.3	7
	Female	17	7	1	3	0.41176471	3
White	Sub-Total	423	854	52	114	2.01891253	2.192308
	Male	241	715	17	84	2.96680498	4.941176
	Female	182	139	35	30	0.76373626	0.857143

By doing this, we introduced an 8.2 percent error into the calculations of P_1, reflecting the differences in the proportion of each co-variate to total *q* and *n* between the two samples. We have accepted this error in the main text, but present the unweighted population figures and their impact on P_1 in the table below.

Poverty Gaps (R1000) for Subsistence Sample in OHS95 (Unweighted)

Co-Variate		N (un-weighted)	Q (un-weighted)	P_1w	nzP1	Exp. p.a. (nzP1)	% of Total Exp.
Consolidated Total		**1519**	**684**	**0.2972**	**451446.8**	**5417362**	**99.99**
African	Sub-Total	496	337	0.1626	247008	2964096	54.71475
	Male	265	162	0.0731	111114.5	1333374	24.61298
	Female	231	175	0.0895	135897.3	1630767.6	30.10261
Coloured	Sub-Total	563	292	0.1128	171377.2	2056526.4	37.96177
	Male	292	131	0.0436	66225.6	794707.2	14.66963
	Female	271	161	0.0692	105175.1	1262101.2	23.29734
Asian	Sub-Total	37	3	0.0004	677.1	8125.2	0.149984
	Male	20	2	0.0002	278	3336	0.06158
	Female	17	1	0.0003	399.5	4794	0.088493
White	Sub-Total	423	52	0.0213	32359.5	388314	7.167954
	Male	241	17	0.0064	9736.4	116836.8	2.15671
	Female	182	35	0.0149	22640.8	271689.6	5.015164

Appendix 3: The Effect of Sequential Resource Transfers on Inequality Levels

Change in Inequality (Gini Coefficients)

Y Transfer	Total Popn	African	Coloured	Asian	White
Existing Y	0.54840000	0.62590000	0.47000000	0.07890000	0.48710000
Y*2	0.70726395	0.73448694	0.66930771	0.00000000	0.67705345
Y*3	0.83985138	0.84986341	0.81808239	0.00000000	0.85555553
Y*4	0.88525641	0.88547599	0.88367063	0.00000000	0.87792206
Y*5	0.93262482	0.94499356	0.91500014	0.00000000	0.90172416
Y*6	0.94239360	0.95367229	0.92897195	0.00000000	0.90172416
Y*7	0.96188647	0.97780126	0.94484115	0.00000000	0.90172416
Y*8	0.97355640	0.97780126	0.97938144	0.00000000	0.90172416
Y*9	0.98596489	0.98823529	0.97938144	0.00000000	0.00000000
Y*10	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000

Rate of Change in Inequality (%)

Y Transfer	Total Popn	African	Coloured	Asian	White
Y*1-Y*2	28.96862691	17.34892794	42.40589574	-100	38.99680764
Y*2-Y*3	18.74652737	15.70844405	22.22814376	0	26.36454773
Y*3-Y*4	5.406317246	4.190388665	8.017314735	0	2.614269818
Y*4-Y*5	5.350812427	6.721534031	3.545383193	0	2.711186002
Y*5-Y*6	1.047450142	0.918390386	1.526973537	0	0
Y*6-Y*7	2.068442528	2.530111261	1.708253947	0	0
Y*7-Y*8	1.213233616	0	3.655671644	0	0
Y*8-Y*9	1.274552763	1.067091077	0	0	-100
Y*9-Y*10	-100	-100	-100	0	0

Changes in Weighted *q*

Y Transfer	Total Popn	African	Coloured	Asian	White
Existing Y	3542	1247	2164	17	114
Y*2	2284	929	1186	0	66
Y*3	1807	759	904	0	48
Y*4	1678	714	815	0	46
Y*5	1574	662	778	0	44
Y*6	1554	655	763	0	44
Y*7	1517	636	749	0	44
Y*8	1497	636	719	0	44
Y*9	1476	629	719	0	39
Y*10	1455	622	704	0	39