

Climate Change Adaptation In Ethiopia: To What Extent Does Social Protection Influence Livelihood Diversification?



Zerihun Berhane **Weldegebriel**
Martin **Prowse**

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Instituut voor Ontwikkelingsbeleid en -Beheer
Institute of Development Policy and Management
Institut de Politique et de Gestion du Développement
Instituto de Política y Gestión del Desarrollo

Postal address:	Visiting address:
Prinsstraat 13	Lange Sint-Annastraat 7
B-2000 Antwerpen	B-2000 Antwerpen
Belgium	Belgium

Tel: +32 (0)3 265 57 70
Fax: +32 (0)3 265 57 71
e-mail: iob@ua.ac.be
<http://www.ua.ac.be/iob>

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Zerihune Berhane **Weldegebriel***
Martin **Prowse****

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* Zerihun Berhane Weldegebriel is Lecturer in the Department of Sociology, University of Gondar, Ethiopia. He is an alumnus of IOB and is currently studying for a Ph.D. at the International Doctoral School in Local Development and Global Dynamics, University of Trento, Italy.

** Martin Prowse is a Research Associate at IOB. He works as Assistant Professor, Environment and Society in Developing Countries Research Group, Department of Geosciences and Natural Research Management, University of Copenhagen, Denmark.

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ABSTRACT

Ethiopia is vulnerable to climate change due to its limited development and dependence on agriculture. Social protection schemes like the Productive Safety Net Programme (PSNP) can play a positive role in promoting livelihoods and enhancing households' risk management. This article examines the impact of the PSNP by using Propensity Score Matching to estimate the effect on income diversification. The results show receiving transfers from the PSNP, on average, increases natural resource extraction (one component of off-farm income). While these results should be treated with caution, they suggest the PSNP may not be helping smallholders diversify income sources in a positive manner for climate adaptation. The article concludes by arguing for further investigation of the PSNP's influence on smallholders' adaptation strategies.

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1. INTRODUCTION

Climate change is expected to have adverse impacts on Ethiopia, particularly on the agricultural sector – a key source of livelihoods for many citizens. It could exacerbate current food insecurity: both chronic and transient insecurity are widespread and severe, particularly in the moisture deficit North-East Highlands and pastoral areas. As these areas are likely to experience higher temperatures and less or unpredictable rainfall patterns, food security in these regions may become precarious (Haakansson, 2009).

For the last two decades, Ethiopia has relied on emergency food-based interventions to meet national food deficits (PASDEP, 2006).¹ However, such interventions were ineffective due to recurrent droughts leading to a gradual deterioration of households' food security status (see Barrett and Maxwell, 2005). As a response, proactive social protection measures were introduced to break the cycle of hunger and food-based emergency assistance (FDRE, 2004). One such measure is the Productive Safety Net Programme (PSNP) initiated by the Government of Ethiopia and a joint donor group in 2005.² The programme is designed to address the needs of food insecure households through multi-year predictable resource transfers rather than emergency humanitarian aid. It aims to provide transfers to the food insecure population in chronically food-insecure districts to prevent asset depletion at the household level and to create assets at the community level (FDRE, 2004). However, the projected impacts of climate change pose important questions for the implementation of such measures (see Davis et al., 2009; Conway and Schipper, 2011). For example, the extent to which such schemes influence households' diversification strategies.

Livelihood diversification can help households manage risk and is an important autonomous adaptation strategy to climatic variability (Ellis, 2000; Barrett et al., 2001; Prowse and Scott, 2008; Sabates-Wheeler et al., 2008). Like many agrarian economies, most rural households in Ethiopia diversify as farming on its own rarely provides a sufficient means of survival (Degefa, 2005). Our analysis here attempts to estimate the impact of a social protection scheme (the PSNP) on households' autonomous adaptation activities.

The data used in this study comes from a household survey in four regions of Ethiopia (namely, *Tigray*, *Amhara*, *Oromia* and *SNNPR*). The survey was conducted for the *Trends in PSNP Transfers within Targeted Households* study by Devereux et al (2008). It generated statistics on 960 households in eight PSNP districts. A multi-stage sampling procedure was followed which involved region and *woreda* selection, *Kebele*³ selection, village selection and household selection. The sampled households were stratified by PSNP beneficiary status: cash beneficiaries; cash-for-work beneficiaries; free cash beneficiaries; food beneficiaries; food-for-work beneficiaries; free food beneficiaries; and non beneficiaries. Apart from basic household/demographic characteristics, variables included household annual income, household asset value, land (owned, and/or used), household spending, food shortages and coping mechanisms. However,

[1] Currently, a considerable proportion of Ethiopia's population is living under food insecurity, exhibited in terms of recurrent food crises. For instance, according a recent document on humanitarian requirement released by the Joint Government and Humanitarian Partners' on 2 February 2010, an estimated 5.23 million people will require emergency food assistance through December 2010.

[2] The joint donor group includes the Canadian International Development Agency (CIDA), the UK Department for International Development (DFID), Development Co-operation Ireland, the European Commission (EC), and the US Agency for International Development (USAID), World Food Program (WFP) and the World Bank.

[3] Kebele refers to the lowest administrative unit in Ethiopia while Woreda is a larger administrative classification. Woredas roughly correspond to districts.

the data did not have information on income from labour migration and remittances (perhaps because the eight districts are not close to the areas where rural households typically migrate in search of wage labour, like the North-Western Lowlands, the Awash Valley and major urban centres). Thus, it was not possible to assess the role of migration as a diversification strategy.

The rest of the paper is structured as follows: the second section discusses the relevance of diversification as an autonomous adaptation strategy to climate change and gives a brief review of the literature on diversification in Ethiopia. Section 3 describes conceptual links between social protection and climate adaptation. The fourth section presents the methodology used in estimating the programme's impact and discusses the impact of the PSNP on farm, non-farm and off-farm incomes. Section 5 offers concluding remarks and outlines future research avenues.

2. CLIMATE CHANGE ADAPTATION AND LIVELIHOOD DIVERSIFICATION

The IPCC's Fourth Assessment Report indicates the majority of countries in sub-Saharan Africa are likely to experience a higher increase in mean temperatures and greater variability in rainfall patterns than other regions this century (IPCC, 2007). Coupled with low adaptive capacity and heavy reliance on agriculture, such changes are likely to increase poverty (UNFCCC, 2007). Ethiopia has diverse climatic conditions with considerable variation in altitude and location. The mean annual rainfall distribution in the country ranges from a maximum of over 2000 mm in the South-Western Highlands to a minimum of around 300 mm over the South-Eastern and North-Western Lowlands. Similarly, mean annual temperatures vary considerably: from below 15°C in the highlands to over 25°C over the lowlands (FDRE, 2007). Such variability contributes to the classification of the three climatic seasons in the country: the dry season (*Bega*) from October to January; the short rainy season (*Belg*) from February to May and the long rainy season (*Kiremet*) from June to September. The impact of climate change on Ethiopia can therefore be explained in terms of how temperature (which has been increasing gradually in recent decades) and precipitation (which has shown some signs of greater variability) are likely to unfold in coming decades (Conway and Schipper, 2011). Using a Multi-Model Dataset (MMD) with the moderate A1B scenario, the National Meteorological Agency of Ethiopia indicates mean annual temperature is likely to increase significantly when compared to the 1961-1990 level, by a maximum of 1.1°C by 2030, 2.1°C by 2050 and 3.4°C by 2080 (see Figure 1) (FDRE, 2007).⁴ Conway and Schipper (2011) concur with multi-model averages of 1.2°C in the 2020s, 2.2°C in the 2050s and 3.6°C in the 2080s.

Turning to precipitation, the IPCC's projections indicate a 7% increase for East Africa in the last decade of this century compared to the same period in the previous century. However, the Ethiopian National Meteorological Agency reports the average countrywide annual rainfall pattern remained constant between 1951 and 2006 and is likely to show little change in the future (FDRE, 2007; see also Conway and Schipper, 2011).⁵ Most importantly, the impact of climate change on Ethiopia will largely be determined by the distribution of precipitation over the land surface.⁶ For instance, Haakansson (2009), citing a recent study by Kassahun (2008),

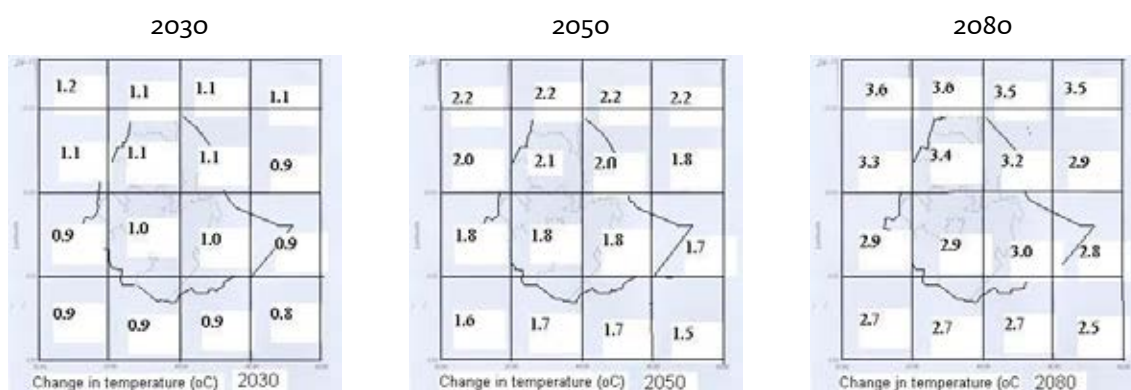
[4] The Multi-Model Dataset involves the use of various individual simulation models in order to arrive at more reliable projections through triangulation (IPCC, 2007). The A1B scenario works with the assumptions of rapid economic growth alongside environmental protection in a world of more integration or homogeneity.

[5] Some studies indicate that rainfall distribution has exhibited high variability with dramatic reductions in the *Belg* (short) rainy season in East and South-East parts of the country after 1997 and that this is related to "anthropogenic warming in the Indian ocean" (Fung et al., 2005 cited in Oxfam, 2010:18).

[6] There is a lot of uncertainty with regards to how rainfall patterns unfold following climate change in Ethiopia. This is due to the lack of robust climate model simulations that arises from the complex interaction of various phe-

indicates that the Northern, North-East and South-East areas of the country are likely to receive less rain. Given these areas are already prone to drought, such changes are likely to exacerbate food insecurity. In contrast, Central Ethiopia is projected to experience an increase in rainfall. A more recent overview concurs that considerable sub-national variation in precipitation is likely (Conway and Schipper, 2011).

Figure 1 – Composite (average of 19 GCMs) change in temperature ($^{\circ}\text{C}$) relative to 1961-1990 normal for A1B emission scenario.



Source: FDRE, Ministry of Water Resources and National Meteorological Agency, 2007

2.1. Autonomous adaptation to climate change

Adaptation measures in poor countries are a vital response to climate change as efforts to reduce emissions are more or less bounded by tortuous political negotiations (Pielke et al., 2007). Autonomous adaptation refers to actions taken by individuals in the face of changing climatic conditions, such as a shift in rainfall and can be contrasted with national-level planned measures that invest in technology and infrastructure across sectors (Prowse and Scott, 2008; Pelling, 2011). Autonomous adaptation involves *ex ante* risk management, which in the livelihoods literature is distinguished from *ex post* coping strategies. For example, Ellis (2000:45) asserts that *ex ante* risk management refers to “the way households respond over the long term adverse events, cycles and trends” while coping strategies involve spontaneous and often desperate reactions to unforeseen circumstances. Similarly, Scoones (1998:6) asserts *ex ante* risk management reflects “long-term shifts in livelihood strategies while coping is temporary adjustments in the face of change” (*ibid*). Ellis (1998:13) states risk management involves a premeditated decision to diversify income sources to avoid harm to household wellbeing in the event of income failure in one activity, whilst coping is “ex-post consumption management in the wake of crisis”. This distinction between risk management and coping strategies is important as it frames our discussion of livelihood diversification as an adaptation strategy.

nomina like sea surface temperature, moisture sources and atmospheric particulates (Conway and Schipper, 2011).

2.2. Livelihood diversification

Livelihood diversification is often defined as the process by which rural households construct an ever more diverse range of activities to survive and improve their standard of living. It involves the maintenance and continuous shifting of a range of activities and occupations. Diversification also refers to the balance between different sources (Ellis, 2000).

According to Barrett et al. (2001), diversification is mostly measured by using income earned from different activities/sources (although activities can also serve the same purpose). Income allows a clear interpretation of results as it comprises both cash and in-kind contributions to household welfare derived from activities. Components include crop and livestock sales, wages, rents and remittances. The in-kind consumption of income refers to the consumption of own-farm produce, payments in-kind (e.g. food) and transfers or exchange of consumption items that occur between households within rural communities or between urban and rural households (Ellis, 2000).

Total household income is disaggregated into categories and sub-categories which reflect the different features of the resources required to generate them, their seasonality, accessibility and location. Clearly, within communities different households possess different entitlements to access alternative activities (*ibid.*). A basic division is between natural-resource based activities and non natural-resource based activities or income sources.⁷ Following Ellis (1998, 2000) this article utilises the following diversification schema (see Figure 2):

Farm Income: Income generated from one's own farming, whether on owner-occupied land or leased land. Farm income broadly defined includes livestock as well as crop income and comprises both consumption of own farm output as well as the cash income obtained from output sold.

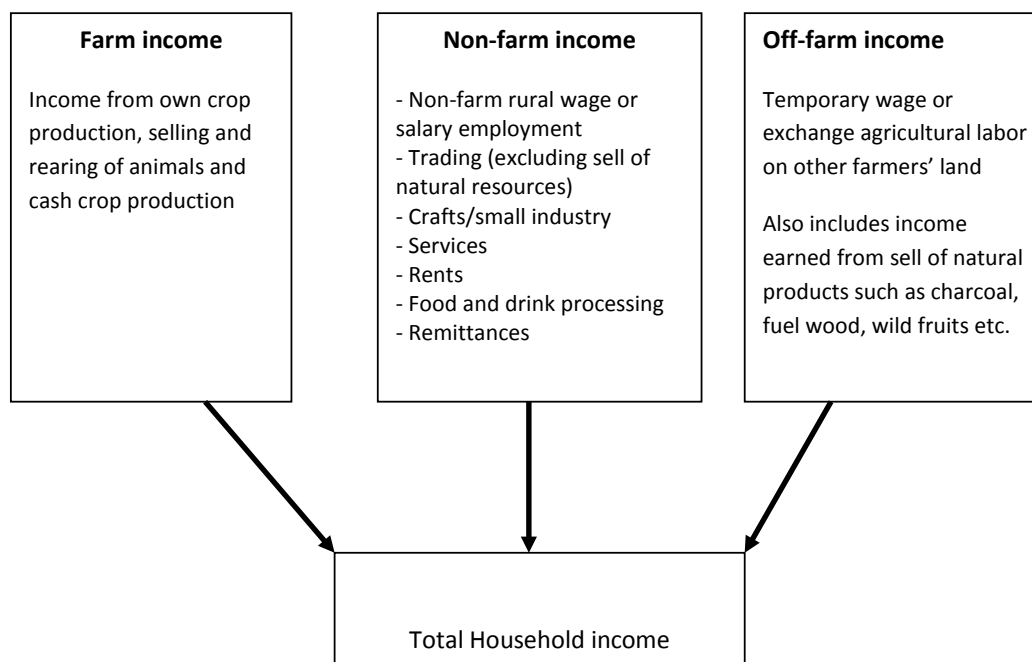
Off-farm Income: Off-farm income partly refers to temporary "wage or exchange labour on other farms within agriculture" (Ellis, 1998:5). This, in most instances, involves working on others farms for wages or other arrangements such as share-cropping or the exchange of labour in kind. Off-farm income is strictly defined as income generated from working outside of one's own farm through participating in agricultural activities such as ploughing, weeding or harvesting on another farmer's land. Moreover, as discussed by Ellis (2000), we also consider income from local environmental resource extraction such as firewood collection, charcoal production and gathering of wild fruits as off-farm income.

Non-farm Income: Non-farm income refers to non-agricultural income sources. According to Barrett et al (2001), this involves making sectoral distinctions such that non-farm income comes from activities in secondary and tertiary sectors. Non-farm income also includes salaries or remittances from formal (rural) employment (Ellis, 1998). This paper uses Ellis's (2000) classification to account for typical non-

[7] Natural-resource based activities include collection or gathering, food cultivation, non-food cultivation (e.g. export crops), livestock keeping, and pastoralism. It also includes non-farm activities that depend on natural resources such as brick making, weaving, thatching and so on (Devereux et al, 2003; Degefa, 2005). Non natural-resource based activities or income sources include rural trade (marketing of inputs and outputs), other rural services (e.g. vehicle repair), rural manufacturing, remittances (urban and international), and other transfers such as pensions deriving from past formal employment.

farm activities that are pursued by rural households in Ethiopia: non-farm rural salaried employment; non-farm rural self-employment (sometimes called business income); rental income obtained from leasing land or property; urban to rural remittances arising from within national boundaries; other urban transfers to rural households (e.g. pension payments and international remittances arising from cross-border migration).⁸

Figure 2 – Classification of income by livelihood activities



Source: Ellis (2000)

[8] Migration is recognized as one of the most important form of diversifying income for rural livelihoods (Ezra and Kiros, 2001). However, there seems to be a lack of consistency in the terms used to classify migration in the literature. For instance, some writers consider migration as a diversification strategy in its own right separate from the categories outlined above (Sabates-Wheeler et al., 2008), while others directly or indirectly treat it as part of non-farm activities (Reardon, 1997; Ellis, 1998). For analytical purposes, this paper leans towards the latter classification and treats migration as part of non-farm activities. However, and as stated above, the dataset used here does not include sufficient information on income from labour migration and remittances.

2.3. Diversification in Ethiopia

Although agriculture remains the main source of income and employment, rural non-farm income has been gaining importance in most rural areas in developing countries in the past two decades. As a result, 35–40% of rural incomes were attributed to the rural non-farm economy in developing countries at the start of the new millennium (Haggblade et al., 2002). A figure frequently cited for Ethiopia is 36% (Degefa, 2005) and a recent report by the World Bank estimates 25% of rural households participate in the non-farm sector (World Bank, 2009).⁹The importance of non-farm activities varies by region (Carswell, 2002). For instance, results from a survey conducted in five regions (Amhara, Tigray, Oromiya, SNNPR and the sedentary farming areas of Afar) shows that while 44% of households were engaged in temporary agricultural work (an off-farm activity) or non-farm activities in previous years, the average contribution to total household income was only 10.2% (MOLSA, 1997 cited in Sharp et al., 2003). However, in Wollo (a North-Eastern province frequently hit by drought) only 26% of households had a second occupation such as petty trading, daily labouring or handicrafts (see Sharp et al., 2003). Such low earnings from off- and non-farm activities suggest the existence of substantial entry barriers.

2.4. Diversification and adaptation

Diversification can have both positive and negative impacts: positive if livelihoods are more secure and if the adverse impacts of seasonality are reduced. For example, consumption smoothing, risk reduction, complete use of available household labour and skills, and cash generation for investment in human or physical capital. However, diversification can result in negative effects if it increases households' vulnerability (Ellis, 1998). Regarding adaptation, a common argument is that diversifying into non-farm activities is preferable to activities tied to farming (see Sabates-Wheeler et al., 2008). For example, most non-farm activities have different risk profiles than farming (such as trade, or remittances from migration) and can improve food security as they provide income during lean seasons caused by weather variability (World Bank, 2009). The positive role of non-farm activities and income is also evidenced by Bryan et al.'s (2008) study on the determinants of adaptation to climate change in Ethiopia and South Africa. Next to basic household and demographic characteristics (mainly education and age), non-farm income is identified as having the most positive effect in encouraging adaptation options in agricultural livelihoods. A more extreme version of this argument is that "diversification within natural-resource use may be regarded as reinforcing vulnerability to climate change" (Thomas and Twyman, 2003:118). But such a position doesn't account for changing practices within natural-resource use, such as within farming.

Following a frequent distinction between diversification for necessity and diversification by choice (Hart, 1994, cited in Ellis, 1998), we define the relationship between diversification and climate adaptation in a tripartite manner. We view increased non-farm income as positive adaptation. Second, we view increased farm income as a neutral form of adaptation (as greater income from farming tells us nothing of diversification or commercialisation within farming). For example, greater income from farming can either increase or decrease exposure to climate variability. Finally, by applying a strict definition of off-farm activities as temporary farm wage or in-kind employment, as well as collection of natural resources, we consider an increase in off-farm income as an indicator of distress and therefore a negative form of adaptation. Such a categorisation is only intended to assess adaptive capacity in the very short term. Clearly, more severe medium- and long-term climatic changes easily render such a schema obsolete (Betts et al., 2011).

[9] These figures are likely to include off-farm activities as the literature on diversification lacks a standard way of classifying non-farm and off-farm activities (see Barrett et al 2001).

3. SOCIAL PROTECTION AND THE PRODUCTIVE SAFETY NET PROGRAMME

Social protection can be defined as an intervention involving a range of activities carried out by public and private entities to reduce the vulnerability of the poor to livelihood risks through transfers (Devereux and Sabates-Wheeler, 2004). Such activities include old age pensions, food subsidy programmes, public works (for food or cash), emergency cash transfers, urban food distribution programmes, school feeding programmes and input subsidies. It has been suggested social protection programmes are effective ways of adapting to climate change as they can reduce vulnerability to climate-induced shocks (for example, see Davis et al. 2008:1). Thus, it is suggested adaptive capacity can be promoted through social protection measures. This is highlighted by Devereux's (2006:2) explanation of how different social protection schemes address specific types of entitlement failure:

1. *Production-based entitlement failure* - Agricultural risks such as harvest failures or persistent food production deficits can be the sources of production-based entitlement failure. The suitable social protection response is provision of transfers in the form of fertilizer subsidies and starter packs. Such forms of support increase farm income and enhance production entitlements.
2. *Labour-based entitlement failures* - Limited employment opportunities coupled with the decline in real wages can trigger labour-based entitlement failures. Possible policy responses include public works as well as setting minimum wage legislation.
3. *Trade-based entitlement failure* - Market failure and decline in the terms of trade can cause the failure of exchange entitlements. Here pricing policies, such as food price subsidies, as well as resolving market failures, can be considered. Trade-based entitlement can be enhanced by farm, non-farm and off-farm diversification strategies.
4. *Transfer-based entitlement failure* - The failure of informal safety nets, emergency food aid or absence of social protection can be major sources of vulnerability. Social protection responses include the provision of food aid, or cash transfers.

3.1. The PSNP: an overview

The PSNP is the largest social protection arrangement in sub-Saharan Africa with an estimated 7.2 million participants, roughly accounting for 11% of Ethiopia's population and covering 262 of the total 500 districts in the country (Devereux and Guenther, 2009; DFID, 2009).¹⁰ It has two components: labour intensive public works and direct support. Households with able-bodied adults participate in public works to enhance community assets, such as building schools, health posts, and roads before receiving the transfers. The public works programme pays individuals from targeted beneficiary households 6 birr (\$US 0.61) per day or food of equi-

[10] Chronically food insecure *woredas* (districts) are defined as those *woredas* that had been significant recipients of food aid between 2002 and 2004. A report by USAID released in March 2010, indicates the government is planning to reach approximately 8.3 million beneficiaries by its newly launched 2010-2014 PSNP including people in pastoral regions of Afar and Somali which were not part of the program in the first phase (USAID, 2010).

valent value (at 2005 prices) (Hoddinott et al., 2011).¹¹ Households with little labour (the aged, disabled, chronically ill, etc.) are exempted from public works and receive direct transfers either in the form of food or cash (FDRE, 2004).

The program is targeted to serve households identified on the basis of the following criteria (World Bank, 2011: 7):

- Chronically food insecure households that had continuous food shortages (three months of food gap or more) in the previous three years and who had received food assistance;
- Households that, in the last one or two years, suddenly became more food insecure as a result of a severe loss of assets and were unable to support themselves; and
- Households without family support and other means of social protection and support.

Currently, the majority of the beneficiaries of the programme (86.1%) are public works participants (DFID, 2009). In the public works component, households are in principle allocated a labour quota of up to 30 days of work per year. The PSNP is also designed to be accompanied by a number of food security interventions that form the Other Food Security Programme (OFSP) including credit, extension, irrigation and water harvesting schemes (Hoddinott et al., 2011).

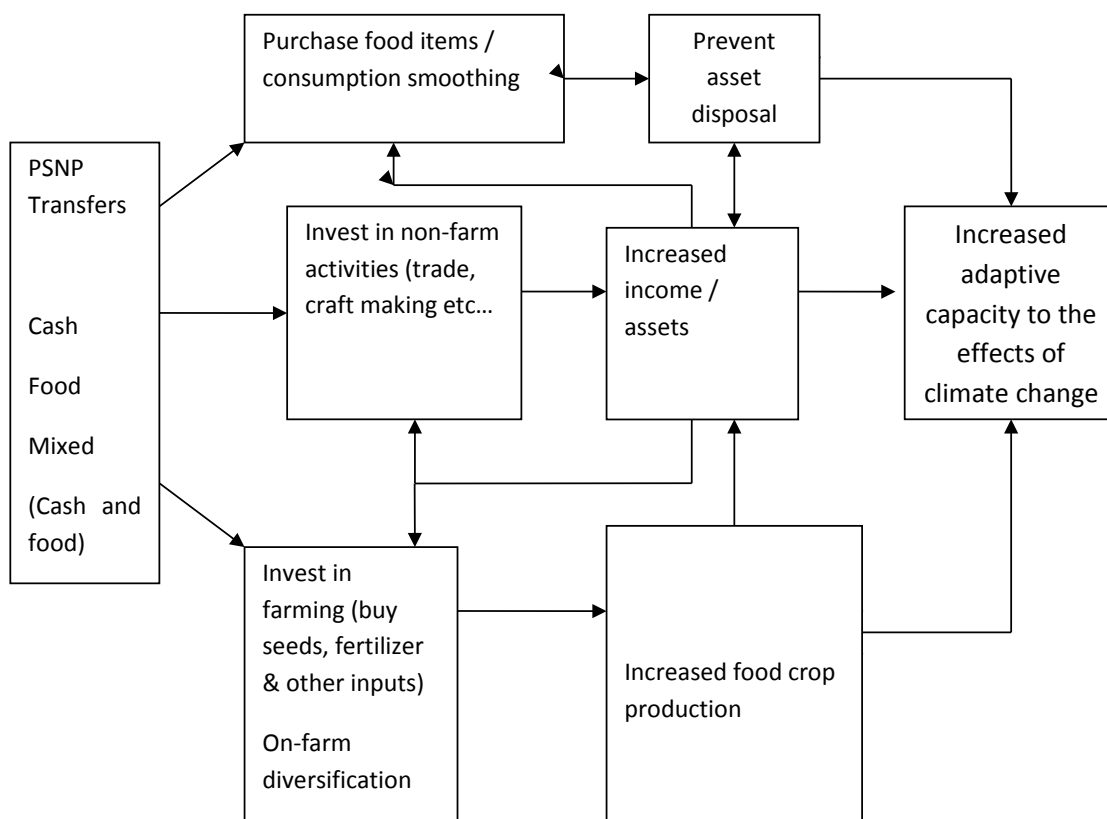
In view of the above, the PSNP appears to be designed to address transfer-based and labour-based entitlement failures, for different types of rural households (Sabates-Wheeler and Devereux, 2010). Devereux and Guenther (2009) identify both direct and indirect positive effects of the PSNP on livelihoods. The direct effects of PSNP are felt through the creation of employment as well as rural infrastructures such as “small-scale irrigation, micro-dams and soil and water conservation” that have the potential to increase agricultural productivity and incomes (ibid: 9).

The indirect effect of PSNP largely hinges on the regular and predictable nature of cash transfers. Such transfers, according to Devereux and Guenther (2009), raise the consumption levels of households, enhance their risk managing ability, increase investment in agriculture and facilitate the development of rural markets. All these direct and indirect effects of PSNP can enable households to diversify activities. Thus, income earned from participation in public works can be invested into improving one’s agricultural output by using more inputs such as improved seeds and fertilizers (intensification) or by renting in extra land for farming (extensification). Participation in the PSNP can also facilitate non-farm activities through availing a predictable stream of income that underwrites risks in small businesses. Thus, PSNP can serve as insurance and encourage smallholders to take more risks in certain non-farm activities such as trading and craft making (Andersson et al., 2009).¹² The possible channels through which the PSNP can impact on livelihood diversification is illustrated in Figure 3.

[11] From early 2008 on, the public work programme pays individuals from targeted households 10 Birr per day or food of equivalent value (FAO/WFP, 2009).

[12] Moreover, PSNP can influence household decisions on migration. For example, Johnson and Krishnamurthy (2010) mention the role of transfers in covering household and labour migration expenses during agricultural slack seasons as one way by which social protection help to promote domestic and international migration. Since migration is a major source of non-farm income in some parts of Ethiopia, it follows that the program could promote seasonal labour migration and can open-up new income earning opportunities (not least as migrants could afford to travel longer distances).

Figure 3 – Analytical framework on the possible impacts of PSNP on livelihood diversification in Ethiopia



Source: Adapted from Devereux (2002)

3.2. The Productive Safety Net Programme and its Impact on Diversification

As households enrolled into the PSNP are selected on the basis of predefined criteria, this rules out the use of randomization to evaluate the programme. Propensity Score Matching (PSM) is a quasi-experimental technique to overcome selection bias by controlling for relevant observable characteristics (Abadie and Imbens, 2006). Various comparisons made between experimental methods and PSM have suggested that PSM can produce reliable and low-bias estimates if (1) treatment and control groups are drawn from the same data source; (2) treatment and control groups are exposed to similar economic incentives such as access to markets; and (3) there are enough variables that can be used to explain outcomes and identify programme participation (Heckman et al., 1998).

PSM involves constructing a counterfactual comparison group in order to address the evaluation problem. It uses a probit model to generate the probability of each household participating in the programme (the propensity score). It then matches beneficiary and non-beneficiary units who have similar propensity scores. Specifically, PSM estimates the average impact of programme participation on participants by constructing a statistical comparison group on the basis of the probability of participating in the treatment T conditional on observed

characteristics X , given by the propensity score: $P(X)=Pr(T=1/X)$ (Khandker et al., 2010:55).

The approach operates with the following two assumptions:

$$E(Y_0 | X, T = 1) = E(Y_0 | X, T = 0), \text{ and} \quad (1)$$

$$0 < P(X) < 1 \quad (2)$$

The first assumption, conditional mean independence, is that after controlling for X , mean outcomes of non-beneficiaries would be identical to outcomes of beneficiaries if they had not received the programme. The second assumption is the assumption of ‘common support’ given by expression (2). Common support ensures there is sufficient overlap in both treatment and control propensity score distributions (Khandker et al., 2010). Units that fall outside of the region of common support area are dropped.

Our analysis fulfils the conditional independence assumption by including variables in the probit model that cover the eligibility criteria for the programme (especially food insecurity) but which cannot be directly affected by programme participation (see Table 1). Moreover, in order to control certain community and district level characteristics that might affect programme participation, such as access to markets, eight *Woreda*-level dummy variables are used in the probit model. Results are presented in Table 2. They show household size, food insecurity in 2005 and annual income (excluding any transfers or payments from the PSNP) have statistically significant coefficients. Out of the eight *Woreda* dummy variables, *Derashe*, *Borcha* and *Enderta* show statistical significance.

The assumption of common support is also fulfilled by dropping units whose propensity scores lie outside the area of overlap between treatment and control groups after performing a balancing test. Since the nature of the data used in this study is such that there are more participants than non-participants, a Kolmogorov-Smirnov test for equality of distributions of the variables in both treated and control groups was implemented. This test was made in order to ascertain the similarities of the mean distributions of variables between control and treatment groups before running the probit model. The distribution of the final propensity scores among the treatment and comparison groups are depicted in Figure 4. All results presented are based on specifications that passed balancing tests.

Table 1 – Probit estimations of variables used in the PSM

	PSNP Participation
Household Size	-0.136* (-2.08)
Age of household head (age squared)	-0.102 (-1.22)
Man power status	0.00953 (0.10)
Gender of household head (F=1, M=0)	0.129 (0.96)
Household's life (in years)	0.011 (1.76)
Drought shock dummy	0.0868 (0.66)
Flood shock dummy	0.0844 (0.62)
Highest grade completed	-0.0382 (-1.32)
Livestock loss dummy	-0.109 (-0.85)
Bugna district dummy	-0.134 (-0.66)
Derashe district dummy	-1.116*** (-6.07)
Borcha district dummy	-0.457* (-2.46)
Chiro district dummy	-0.328 (-1.66)
Fedis district dummy	-0.309 (-1.52)
Enderta district dummy	0.712*** (3.39)
The number of dependents in the HH	0.147 (1.39)
Dependency ratio	-0.0771 (-0.83)
Shortage of food in 2005 dummy	0.842*** (5.54)
Total annual income in 2007 (excluding public works income)	-0.130*** (-3.46)
_cons	1.763*** (2.94)
N	798

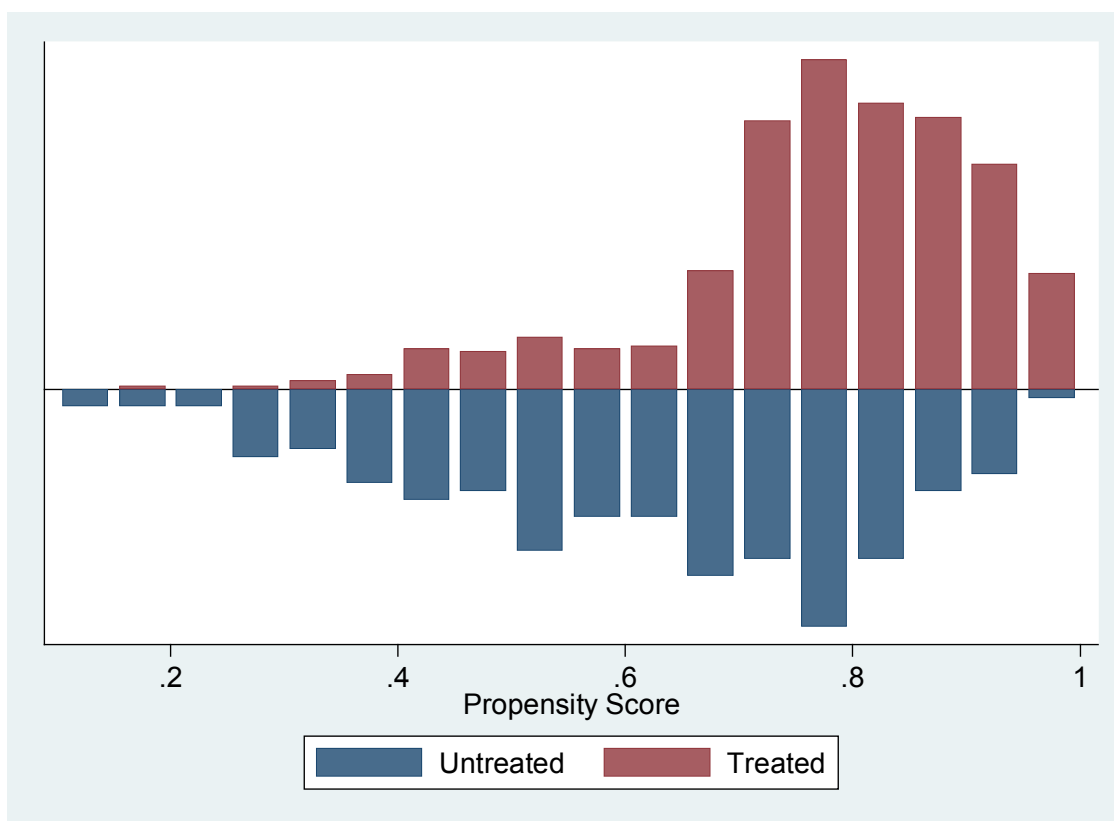
t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Kalu district dummy is dropped

Source: Authors' calculation PSNP 'Trends in Transfers' dataset, 2008

Figure 4 – Propensity score distribution among treatment and comparison observations



Source: Based on PSNP 'Trends in Transfers' dataset, 2008

3.3. Indicators of average impact of PSNP on diversification

To estimate the effect of the PSNP on household diversification, we utilise three outcome variables constructed from 45 livelihood activities:

1. *Annual farm income*: Income derived from crop production and rearing and selling of animals. This also includes income earned from commercial woodlots and beekeeping. We view increases in farm income as a neutral adaptation strategy.
2. *Annual off-farm income*: As indicated, this paper follows Ellis's (2000) categorization and considers income from temporary wage or exchange of labour on another farmer's land, and from the sale of natural products, as off-farm income. It is viewed as an indicator of distress and a negative adaptation strategy.
3. *Annual non-farm income*: This includes income earned from group of activities such as salaried employment, trading, crafts/small industry, services and food and drink processing. It is viewed as a positive adaptation strategy. Income from remittances and migration are not included. Income from public works is separated from other non-farm income sources and is not included.

Based on 960 households in the dataset, Table 2 shows the amount of income derived from farm activities exceeds other types of income (45%). The contribution of non-farm income (19%) to total household income is less than from public works (30%). This figure for non-farm income is also less than national figures estimating the contribution of non-farm income (25%) in rural areas of Ethiopia. Off-farm income constitutes the remaining 6%.

Table 2 – Summary of rural income data, 2008 (all units are given in Birr)

Source of income	Mean Annual income	Share of income from total (%)
Farm	1269.95	44.8
Off-farm	172.4	6.1
Non-farm	549.14	19.35
Public works	846.1	29.8
Total	2837.5	100

Source: PSNP 'Trends in Transfers' dataset, 2008

The analysis utilized three matching methods: Nearest Neighbour Matching; Radius Matching and Kernel Matching. Nearest Neighbour matches each treatment unit to a comparison unit with the closest propensity score (which is then unavailable for further matches). Radius Matching is where for each treatment unit, the mean figure for the impact variable is used for a number of comparison units within a pre-defined radius of the treatment unit. For Kernel Matching, again a mean figure for the impact variable is used for the number of control units within a pre-defined radius, but this time each unit within this radius is allocated a weight inversely proportional to the distance from the treatment unit.

In order to check the robustness of the mean estimates, Direct Nearest Neighbour Matching was also performed. This is a nonparametric estimate which does not need to rely on the probit model used in estimating the propensity score (see Gilligan et al., 2008).¹³ In the following sections, both the PSM and Direct NNM results are reported on each of the outcome variables.

3-4- Impact of PSNP on farm income

The PSM estimators suggest that, on average, the PSNP is likely to decrease farm income. The three matching methods show a range of 36.5 to 44.7%, with the Kernel estimate significant at the 10% level. Direct NNM also suggests that the average estimated impact of the programme on farm income based is negative (see column 3 of Table 4), and that it decreases farm income by 61.3 percent, significant at the 5% level.

Importantly, the lower farm income among participants could be explained by the lack of certain variables in the matching procedure. For example, since the PSM did not account

[13] The method is basically the same with PSM as it shares the assumptions of conditional mean independence and common support.

for crucial assets such as landholding size and draft power like oxen, the result could reflect their absence as such assets are crucial in determining farm production. These results on farm income need to be interpreted with caution.

That said, the results are broadly consistent with the previous studies carried out on the PSNP. For instance, Devereux et al. (2006), using the 2006 PSNP dataset that generated information from the same households, indicate cash transfers had limited impacts on on-farm investment in terms of the purchase of inputs. For instance, Devereux et al. (2006) state that out of 768 participants surveyed in 2006, 11.5% used the cash transfers to purchase seeds while only 3.4% purchased fertilizers.¹⁴ Moreover, the reduction of farm income could also be explained by demand for household labour in public works reducing availability for other activities – the crowding out effect (Andersson et al., 2009). Competition for labour between public works and farm activities is especially grave if the timing for both activities overlap. Some empirical evidence suggests the PSNP can interfere with household labour for both farm and non-farm activities (for example, see Sharp et al., 2006; Slater et al., 2006). A more recent study by Devereux et al. (2008), reported a continuation of the same problem in *Chiro, Fedis Kalu, Lasta and Kilde Awlalo woredas* in which there is a direct overlap in the timing between agricultural work season and the provision of public works.

The timing of public works can reduce the supply of labour for other activities and make households more dependent on the PSNP (decreasing the stream of income they earn from wider activities). Moreover, since farm income is the most crucial determinant of investment in non-farm activities (as it often provides start-up capital, see Woldehanna, 2002), the reduction in farm income could influence non-farm income streams.

[14] Devereux et al. (2006) suggest that the main reasons for such low investment in agriculture include the low value of cash transfers and the increasing cost of food items (leaving little for investment in agriculture).

Table 3 – Average impact of the PSNP on income diversification

Matching method	Estimated Impact on Diversification outcomes				
	Farm income	Non-farm income	Off-farm income	Sale of natural resources	Temporary agricultural labour
ATT (Nearest neighbor %)	-36.5	-4.5	21.6	43.7****	-20.0
N treated	643	643	643	643	643
N control	152	152	152	152	152
Standard error	0.325	0.396	0.217	0.126	0.181
t	-1.124	-0.113	0.997	3.454	-1.103
ATT (Radius%)	-37.2	-29.9	39.0**	34.2***	4.8
N treated	344	344	344	344	344
N control	154	154	154	154	154
Standard error	0.293	0.359	0.192	0.128	0.147
t	-1.269	-0.833	2.032	2.662	0.328
ATT(Kernel%)	-44.7*	-17.9	26.7	33.6***	-5.5
N treated	643	643	643	643	643
N control	215	215	215	215	215
Standard error	0.232	0.331	0.169	0.111	0.123
t	-1.927	-0.542	1.580	3.028	-0.444

Statistically significant at the * 10%, ** 5%, *** 1% and **** 0.1% level

Source: Authors' calculation from PSNP 'Trends in Transfers' dataset, 2008.

3.5. Impact of PSNP on non-farm income

The PSM matching methods indicate a reduction in non-farm income ranging from 4.5% to 29.9% but these reductions are not statistically significant. Nor are the Direct NNM estimates showing annual non-farm income is reduced by 37.9%. However, such suggestive findings still highlight how the programme may not be increasing smallholders' engagement in non-farm activities despite the intention of promoting livelihood diversification by availing predictable and regular transfers.

Similar findings have also been reported in Devereux et al's (2008) study where only 2% of PSNP beneficiaries invested in business activities, compared to 16 % that used the cash transfer to pay off debts. Possible factors for the lack of investment in non-farm activities include the existence of entry barriers in the form of capital and skills, the small amount of cash transfers, high food prices and the general inflationary pressure in the Ethiopian economy (Kebede, 2006; Devereux et al., 2008; Sabates-Wheeler and Devereux, 2010).

3.6. Impact of PSNP on off-farm income

The impact of PSNP participation on off-farm income is found to be positive and range from 21.6 to 39%, with the Radius estimate significant at the 5% level. Direct NNM shows an increase of 8.6% but without significance. However, when off-farm income is decomposed into income from temporary wage labour and the collection and sale of natural products the results are much more striking. They show increased income from the sale of natural resources from 33.6 to 43.7%, significant from the 5% to 0.1% level for all matching methods including DNNM. Income from agricultural wage labour showed mixed results with no significance. As PSNP beneficiaries are generally poorer than non beneficiaries, these results support the assertion environmental resources can make significant contribution to the incomes of poor households and at times serve as safety nets (e.g. Reddy and Chakravarty, 1999; Cavendish, 1999).¹⁵

Table 4 - Average impact of the PSNP on income diversification: Direct Nearest Neighbour Matching

	(1) Annual farm income	(2) Annual non-farm income	(3) Annual off-farm income
SATT	0.613* (-2.26)	-0.379 (-0.97)	0.0859 (0.34)
N	798	798	798

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Source: Authors' calculation - PSNP 'Trends in Transfers' dataset, 2008.

Table 5 – Effect of PSNP participation on beneficiaries' off-farm income: Direct Nearest Neighbour Matching

	(1) Income from sale of natural products	(2) Income from agricultural wage labour
SATT	0.398** (2.08)	-0.290* (-1.65)
N	798	798

t - statistics in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$, **** $p < 0.001$

Source: Author's calculation; PSNP 'Trends in Transfers' dataset, 2008

[15] To check the robustness of findings, authors conducted the same matching procedures with a sub-sample of public work participants. Analysis with this restricted dataset showed no significant changes for farm and non-farm income, but continued to show striking and significant increases in income from the sale of natural products for all matching methods.

4. DISCUSSION

Recent studies show even though the PSNP has been effective in protecting people from hunger, it has not brought any lasting impact on promoting livelihoods (Devereux et al., 2008; Gilligan et al., 2008; Devereux and Guenther, 2009; Andersson et al., 2009). For instance, Andersson et al. (2009) found that participation in the PSNP does not appear to help households when faced with major climatic shocks since households tend to sell livestock due to a lack of alternative income sources. Similarly, Devereux and Guenther (2009) indicate that during critical shocks, or during the hungry season, the PSNP does not seem to keep many households from selling productive assets (as the small transfers and late deliveries do not meet households' needs in time). Our results concur with the argument that the PSNP may protect households in the short term, but is not building resilience to risks in the longer term.

Our results suggest the PSNP does not appear to be promoting investments in agriculture. According to our schema, where an increase in farm income reflects a neutral adaptation strategy, the reduction in farm income presented is neither a weakening nor strengthening of adaptive capacity: what is more important is the nature of agricultural production. Moreover, our results do not provide any evidence on the positive adaptation option of diversifying into non-farm activities. The main finding from our analysis is the surprising and striking increase in off-farm income from natural resource collection. Whilst households only generate 6% of income from off-farm sources, the recourse to natural resource extraction can only be interpreted as a negative adaptation strategy and one that may increase households' vulnerability in the longer term.

5. CONCLUSIONS

Following the ‘adaptive social protection’ framework discussed by Davies *et al* (2008), it can be argued that the PSNP needs to meet the following two conditions at least if it is to contribute to climate change adaptation. These conditions are:

1. A focus on transforming productive livelihoods along with protecting, and adapting to changing climate conditions as opposed to merely reinforcing coping mechanisms.
2. A long-term perspective that takes into account the changing nature of shocks and stresses.

The first condition requires that the program needs to move much of its attention from livelihood protection to helping households to invest in productive ventures. In the context of the findings of this paper, this condition becomes all the more necessary since it appears the program is reinforcing coping mechanisms as shown through the increase in the sale of natural resources. The second condition stipulates the need to fully incorporate climate change risks in the PSNP or other future social protection programs in Ethiopia. Incorporating climate change adaptation in social protection requires more positive forms of income diversification than we have found in this analysis.

Finally, as in the case for every research output, the specific methodology employed is likely to influence findings. Extending this work could help to overcome one of the inherent trade-offs when using quasi-experimental approaches: that in attempting to eliminate one methodological problem (namely, selection bias) researchers invariably introduce others (in our case, the possible exclusion of core variables in probit models). We believe the results from our initial analysis merit further investigation. For example, triangulating panel data analysis with qualitative methods, and utilising other indicators of diversification, such as numbers of farm, non-farm and off-farm activities and distribution of income across activities.

Table 6 - Descriptive statistics for variables used in the PSM (full sample)

Variable	Obs	Mean	Std. dev.	Min.	Max.
Participation	960	.7552083	.4301877	0	1
Household size	960	5.294792	2.417691	1	15
Age of household head	959	48.53646	15.6532	13	98
Man power status	960	3.282292	.7423569	1	7
Household head is female	948	.3386076	.473486	0	1
Household life span in years	956	32.68201	14.85622	9	85
Highest grade completed	960	1.804438	.7489583	0	12
Number of dependents	960	3.11875	1.767055	0	9
Dependency ratio	883	1.584156	1.09011	0	7
Total asset in ETB	751	3365.9	4148.4	0	34719
Annual income in 2007 (ETB)	960	2837.4	2899.5	0	30900
Annual income – public work income	960	1991.45	2673.823	0	28500
Loss of crops dummy	954	.3637317	.481325	0	1
Drought shock dummy	956	.5753138	.494554	0	1
Flood shock dummy	959	.1835245	.3872979	0	1
Illness shock dummy	956	.291841	.4548475	0	1
Loss of livestock dummy	956	.2039749	.4031615	0	1
Shortage of food in 2005 dummy	960	.85625	.3510189	0	1
Kalu district dummy*	960	.125	.3308913	0	1
Derashe district dummy	960	.125	.3308913	0	1
Borcha district dummy	960	.125	.3308913	0	1
Chiro district dummy	960	.125	.3308913	0	1
Fedis district dummy	960	.125	.3308913	0	1
Enderta district dummy	960	.125	.3308913	0	1
Wikro district dummy	960	.125	.3308913	0	1
Bugna district dummy	960	.125	.3308913	0	1

*Kalu district, dummy was dropped in the PSM. Dependency ratio could not be calculated due to missing data. Source: Author's calculation; PSNP 'Trends in Transfers' dataset, 2008

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