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# Linking taxation and social protection: Evidence on redistribution and poverty reduction in Ethiopia

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## **Summary**

The reduction of poverty, and more recently inequality, are pressing concerns in many low- and middle-income countries, not in the least as a result of the Sustainable Development Goals committing countries to significant improvements by 2030. Redistribution is important for reaching these goals, and is shaped by countries' tax and welfare systems. Despite redistribution resulting from the simultaneous effect of revenue collection and public expenditures, policies and analyses of their distributional effects have largely been undertaken from narrow and singular perspectives. In this paper, we aim to jointly assess the distributional effect of taxes and transfers (through social protection) using Ethiopia as a case study. We find that currently Ethiopia's flagship social protection programme is more effective than income taxation in achieving poverty reduction, while neither policy achieves a sizeable reduction in overall inequality. Overall, our findings provide support for the common belief that social spending is more suitable than taxation to achieve redistribution. We also assessed whether Ethiopia would have the capacity to achieve the desired level of redistribution by applying higher marginal rates on relatively high incomes. Our results suggest that Ethiopia does not currently have the capacity to close the poverty gap, or to fully fund its main safety net programme using domestic income sources alone.

**Keywords:** Ethiopia, equity, social protection, income tax, micro-simulation

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**JEL classification:** O23, H22, D63

**Tables and figures:** presented at the end of the paper.

**Note:** The STATA program code (do & log files) can be downloaded from [https://dl.dropboxusercontent.com/u/13406311/ET\\_tax\\_sp\\_analysis.zip](https://dl.dropboxusercontent.com/u/13406311/ET_tax_sp_analysis.zip).

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# 1 Introduction

There is an increased acknowledgement of the importance of joint assessments of tax policy and social protection to understand the overall progressivity of public policies and the extent to which they contribute to reductions in poverty and inequality (Engel et al. 1999; Bird and Zolt 2005; IMF 2011). The existing evidence from low-income countries suggests that social protection is effective in reducing poverty and inequality (Bird and Zolt 2005; Gemmill and Morrissey 2005). Taxation is seen to be less effective due to large informal sectors and heavy reliance on indirect taxes that are often only mildly progressive or even regressive (Muñoz and Cho 2003; Bird and Zolt 2005; Emran and Stiglitz 2005; Bastagli 2015). Moreover, there is mounting evidence from the African continent showing that tax systems that are proportional or progressive on paper may still end up being regressive in practice (Mascagni and Mengistu 2016; Mascagni et al. 2016). In terms of the progressivity of expenditures, an expanding evidence base speaks to the effectiveness of social protection, and particularly cash transfers, to tackle poverty and inequality (Cornia and Martorano 2012; Roelen et al. 2016). The common policy prescription is therefore that taxation should mostly focus on generating revenue for social spending (Bird and Zolt 2005).

This narrative is largely based on literature that studies redistributive impacts of taxation and social expenditures separately. Meanwhile, the evidence on the *joint* distributional effect of tax and social protection in low-income countries remains limited—although progress has recently been made using the Commitment to Equity methodology (Lustig and Higgins 2013).<sup>1</sup> Taxation has redistributive effects related to the way in which revenues are both collected and spent. Similarly, social protection is, at least partly, funded through taxes that can boost or decrease its net effect on poverty and inequality. Moreover, the sustainability of social protection requires a stable resource base, particularly in light of efforts to scale up social protection programmes and systems (Devereux et al. 2015). Tax revenue is already one of the most important revenue bases for social protection (Bastagli 2015). It is also the only source of financing that would make these programmes viable in the context of long-term independence from foreign aid (Niño-Zarazúa et al. 2012).<sup>2</sup> However, most low-income countries often do not have the capacity to fund their own development programmes, most notably the eradication of poverty, with taxation alone (Ravallion 2010).

Against this background, this paper attempts to contribute to the literature in two ways. First, we aim to analyse and compare the effectiveness of income taxes and social protection on redistribution and poverty reduction in Ethiopia. Using a relatively simple microsimulation model, we evaluate both current and reformed policies. Second, building on Ravallion (2010), we critically assess the potential and limitations of taxation as a sustainable source of funding for poverty reduction, through and beyond social protection. By doing this, we aim to establish

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<sup>1</sup> The Commitment to Equity (CEQ) methodology takes a more comprehensive view of the fiscal system and is used to analyse the redistributive effect of taxation and social spending in countries (Lustig and Higgins 2013). For example, Inchauste et al. (2015) find taxes and transfers to be progressive in South Africa, reducing inequality by 0.14 units (or 14 percentage points) in 2010/11. Similar impacts are found in Argentina, with the Gini coefficient reducing by 0.12 units (or 12 percentage points) after taking into account indirect subsidies, taxes and in-kind transfers (Lustig et al. 2012). By contrast, while cash transfers in Bolivia and Brazil were found to significantly reduce poverty, the regressivity of consumption taxes offset any distributional impact (Lustig et al. 2013). Based on the same method, a recent World Bank study shows that in Ethiopia the combination of taxes and transfers reduces the Gini coefficient only by 0.02 units (or 2 percentage points) (World Bank 2015a).

<sup>2</sup> The Addis Tax Initiative, launched in July 2015 and signed by a number of low-income countries together with donors, acknowledges this importance of domestic revenue collection for development. The initiative aims to improve transparency, effectiveness, and efficiency of tax systems in the participating low-income countries. More information can be found at [www.addistaxinitiative.net](http://www.addistaxinitiative.net).

a link between taxation and social protection that we believe is still largely under-researched in the literature.

Ethiopia offers an interesting location for this case study. First, it is a low-income country that has experienced fast economic growth—annual GDP growth averaging 10 per cent over the last decade (World Bank 2015b).<sup>3</sup> This growth was led by a strong performance of the agricultural sector and, as a result, poverty rates declined rapidly, though, in absolute terms, still remain high (World Bank 2015b).<sup>4</sup> Moreover, while income inequality has remained low (World Bank 2015b), the ongoing structural transformation of the economy<sup>5</sup> (Martins 2014; World Bank 2015b) is expected to widen the income distribution in the country (Seid et al. 2015). Therefore, redistribution is likely to have an important role in the future if Ethiopia is to maintain its low-income inequality and track-record in reducing poverty.<sup>6</sup>

Our analysis focuses on two policy tools in Ethiopia: personal income taxation and the Productive Safety Net Programme (PSNP). The focus on income taxation is motivated by a recent reform, approved by the Ethiopian Parliament in July 2016 that involves substantial changes in the progressive structure of rates. It is therefore timely to assess its redistributive potential compared to the previous tax system. In terms of spending, the PSNP represents one of the largest social protection schemes in sub-Saharan Africa (Slater and McCord 2013). Based on the PSNP's success (see Berhane et al. 2014), the programme has recently undergone a substantial geographical expansion. These features make Ethiopia a particularly topical case study for assessing the redistributive role of taxes and social protection, both considering their current form and future reforms.

The simulation results suggest that both taxation and social protection have a negligible role on the overall income distribution, as measured by the Gini index. This finding is consistent with other studies that show limited changes in the Gini index deriving from social grants (e.g. Samson et al. 2004, for South Africa) or even the fiscal system as a whole (see Chu et al. 2000, using a sample of developing and transition countries; see World Bank 2015a, for Ethiopia). Our further analysis shows that closing the poverty gap in Ethiopia is beyond the potential of the tax system, given the current income distribution. Results from the simulation model also show that income taxes can have non-negligible adverse effects on the poor, even when they are designed to be progressive. On the other hand, the PSNP has a substantial role to play in poverty reduction, both in its current form and, even more so, in a potentially expanded version of the programme.

## 2 Background

### 2.1 Income taxation in Ethiopia

Tax revenue mobilization in Ethiopia is a key policy priority, as the country still has a tax to GDP ratio (13 per cent in 2013/14) lower than other low-income countries (about 15 per cent on average) (See Figure A1 in Appendix A). Direct taxes represent 35 per cent of the total tax take, although personal income taxes contribute only a third of that share, or about 11 per cent of total revenue (see Table A1 in Appendix A). Personal income taxes are applied to wage

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<sup>3</sup> Based on national accounts data on GDP at constant prices.

<sup>4</sup> In 2000, 56 per cent of the population fell below the US\$1.25 poverty line. In 2011, 31 per cent were deemed poor using the same poverty metric (World Bank 2015a).

<sup>5</sup> Structural transformation refers to re-allocation of labour in the economy. Historically, as countries become rich labour moves out of agriculture into more productive sectors of the economy (Chenery and Syrquin 1975).

<sup>6</sup> This is well acknowledged by the government of Ethiopia. Its large-scale public investment programmes on agriculture, education, health and food-security (PSNP) have a strong redistributive role (World Bank 2015a).

earners and the self-employed.<sup>7</sup> This paper focuses on personal income taxation for two reasons. The first one is that income taxes are the key tax policy tool to address equity and redistribution. Income taxes are more progressive than indirect taxes by design, because the rate at which they are levied increases with income. However, the debate on the distributional effects of indirect taxes, particularly the VAT, is not yet settled (see Emran and Stiglitz 2005). This major tax has been shown to be less regressive than its critics argue (Bird and Zolt 2005; IMF 2011) and indirect taxes are generally progressive in Ethiopia (Muñoz and Cho 2003; World Bank 2015a).<sup>8</sup> Nonetheless, further substantial improvements in equity through indirect taxes may be difficult to achieve.<sup>9</sup> Differentiated rates for VAT are normally not advised to avoid complexity, distortions, and even adverse effects on equity (IMF 2011).<sup>10</sup> As far as trade tax reform is concerned, several considerations other than equity are at play—not least Ethiopia’s current negotiations to access the WTO. In this context, further increases in the already high taxes on imported goods seem unlikely. Therefore, in this paper we focus on income taxation as a policy tool to achieve greater equity and redistribution in the economy.

The second reason to focus on income taxation is the new law that was adopted in July 2016, making it timely to assess its likely effects on progressivity and redistribution. The pre-2016 income tax system was based on laws from 2002 (Proclamation 286/2002 and Regulation 28/2002) that have been updated only marginally since then. In the past 14 years, the thresholds for personal income tax, applicable both on wage earners and the self-employed,<sup>11</sup> were dramatically eroded by inflation—an effect known as *bracket creep*. These thresholds should have increased five-fold to retain the real value they had in 2002. Most strikingly, the pre-2016 exempt threshold of 1,800 birr is well below the poverty line<sup>12</sup> and the lowest government wage. The old, pre-2016, progressive income tax structure is summarized in Table 1.

Responding to increasing concerns about the equity and appropriateness of the old income tax structure, the government adopted a new income tax law in July 2016. Among other provisions,<sup>13</sup> the new law dramatically increased all income tax thresholds (see Table 2). The exempt threshold increased four-fold and it is now well above the poverty line. Other thresholds also increased substantially, but proportionally less. By doing this, the reform aimed to relieve the poorest from paying income tax and to generally decrease the tax burden for all, especially those on lower incomes. Moreover, it can also improve the perceived equity of the system, thus potentially encouraging compliance. Despite its important merits, however, it is worth noting that the 2016 reform fell short of substantially simplifying the income tax system, which still presents a more complex structure than other similar countries.<sup>14</sup>

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<sup>7</sup> Note that the self-employed include individual businesses, such as sole proprietorships, that can be large firms even if they are not incorporated.

<sup>8</sup> This progressivity is achieved thanks to VAT exemptions for basic food items as well as higher excises and custom duties for goods that are consumed proportionally more by higher-income households, such as commercial alcohol products and imported cars.

<sup>9</sup> However, tax administration can be much improved, with potential implications on overall equity. For example, the threshold for VAT registration, set at 500,000 birr since 2003, could be increased to exempt small businesses from cumbersome administrative procedures.

<sup>10</sup> Exemptions or differential rates are justified by the fact that the poor spend a greater proportion of their income on such goods. However, higher income households still receive a larger subsidy as the amount they spend on any good is larger than for poor households.

<sup>11</sup> Corporate businesses are subject to a flat 30 per cent tax rate and taxes on other types of income (e.g. from interest payments or capital gains) are also subject to flat rates.

<sup>12</sup> The Ethiopian national poverty line was estimated at 3,781 birr in 2010/11 (MoFED 2013). Due to high inflation over the last years, the current poverty line adjusted for inflation would be considerably higher.

<sup>13</sup> The new income tax proclamation represents a broad modernisation of the income tax system, with more detailed provisions on international taxation, changes in loss carry-forward provisions and reporting requirements, amongst several other innovations. In addition, the income tax proclamation will be issued along with a tax administration proclamation.

<sup>14</sup> For example, Ethiopia currently applies a structure of seven progressive rates, including the zero rate for the lowest incomes. Other countries in the region have fewer rates: Uganda has four and Kenya and Tanzania five while Rwanda has three rates.

## 2.2 Productive safety net of Ethiopia

Ethiopia's social protection efforts form a core part of the country's response to food insecurity, poverty, and vulnerability. Ethiopia's national social protection policy indicates that, although the country does not operate a comprehensive and integrated system, it does implement many social protection interventions. These are listed to cover social insurance programmes (pensions), access to basic social services (fee waivers), national nutrition programme and the Food Security Programme (MoLSA 2012). The latter includes PSNP, which can also be considered the cornerstone of social protection in Ethiopia. The programme has been in place for a decade and is one of the largest social protection interventions in sub-Saharan Africa (Slater and McCord 2013).

The Government of Ethiopia started the implementation of the PSNP in 2005 with the support of international donors. The programme was developed in response to widespread food insecurity and continual need for emergency food relief by providing food-insecure households with a transfer in lean times to avoid asset depletion and protect livelihoods (Slater and McCord 2013; van Uffelen 2013; Devereux et al. 2014). The two main components are a public works programme for households with labour capacity and a direct support element that provides direct cash or food transfers to households without labour capacity (Hoddinott et al. 2013). Since its inception, the programme has been widely expanded,<sup>15</sup> has undergone a number of reforms and has been subject to rigorous mixed methods programme evaluations (Wiseman et al. 2010).<sup>16</sup> Currently the programme operates in selected food-insecure rural districts in six regions of the country: Afar, Amhara, Oromia, Somali, Southern Nations, Nationalities and Peoples' Region and Tigray.<sup>17</sup>

The redistributive impacts of the social protection programmes such as the PSNP depend on two aspects: targeting and its impact on the beneficiaries. These two criteria are met in the PSNP. First, a number of different studies of PSNP's implementation process indicate that the targeting is accurate (Coll-Black et al. 2012; Berhane et al. 2013; Berhane, Hirvonen, Hoddinott, et al. 2016; Simons 2016) meaning that transfers are generally received by households with fewer assets and at a higher risk of suffering food insecurity in areas in which the PSNP operates. The World Bank (2015a) estimates that 66 per cent of direct transfers are concentrated in the bottom 40 per cent of the income distribution. This 66 per cent is well above the targeting performance in the average anti-poverty programme reported in Coady et al. (2004). However, there is scope to improve the *geographical* targeting of the programme: Hill and Porter (as cited in World Bank, 2015a) estimate that more than 50 per cent of the poor in Ethiopia reside in districts (*woredas*) in which the PSNP is not operational.

Second, while the evaluations of the first phase of the programme showed little impact on the beneficiaries (Gilligan et al. 2009), the more recent evaluations show that the programme has reduced household food insecurity and distress sale of assets and increased household expenditures and uptake of agricultural inputs (Hoddinott et al. 2012; Berhane et al. 2014;

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<sup>15</sup> The population covered by the PSNP was 5.2 million in 2005, 7.2 million in 2006–07, 7.8 million in 2010 and 8.3 million in 2014. (Rahmato 2013; World Bank 2016).

<sup>16</sup> The programme is currently embarking on its fourth implementation phase. This new phase will bring considerable changes in organisational and implementation structures. In addition, the programme will expand to new areas and reach up to 10 million people (World Bank 2014). One of the key new features is nutrition-sensitivity, focused on behavioural change and care practices, with the aim of contributing to better health and nutrition outcomes (GFDRE 2014a, 2014b). The total budget for PSNP-4 will approximate US\$3.6 billion with contributions from the Government of Ethiopia and 11 development partners: United Kingdom's Department for International Development (DfID), Irish Aid, the European Union, Canadian International Development Agency, Swedish International Development Agency, the Netherlands, Danish International Development Agency, the United States Agency for International Development, UN Children's Fund, the World Food Program and the World Bank. (World Bank 2014).

<sup>17</sup> Currently the programme does not operate in the Benishangul-Gumuz, Gambella and Harar regions, nor in the two urban administrative areas: Addis Ababa and Dire Dawa.

Berhane et al. 2016).<sup>18</sup> Moreover, using panel data estimation techniques, census data and multiple rounds of nationally representative household data for Ethiopia, Vargas Hill and Tsehaye (2014) estimate that since its implementation in 2005, the PSNP has reduced poverty by 0.5 percentage points each year.<sup>19</sup> We are not aware of studies that look at PSNP's impact on overall inequality in the country.

### 3 Data and methods

We construct a simple and static micro-simulation model to analyse the redistributive effects of income taxation and social protection in Ethiopia. The model is simple in at least two respects. First, it only simulates changes in personal income taxation (specifically, employment and self-employment incomes) and social protection. We do not vary any other tax or subsidy, therefore assuming that they remain the same while our policies of interest are adjusted. A more comprehensive incidence analysis of the whole fiscal system of Ethiopia can be found in World Bank (2015a). Second, our simple model does not incorporate behavioural responses to changes in tax or social protection policies.<sup>20</sup> For example, it may well be that decreased effective tax rates lead to less tax evasion. Similarly, the removal of social protection benefits from households may encourage them to seek alternative income sources. Our model is not able to capture such second-round effects and incorporating them is not within the scope of this paper.

Total income is formed of seven components: agricultural and non-agricultural wages, crop income, livestock income, income from self-employment, transfers and other income (e.g. incomes received from land and non-land assets). The tax reform simulations apply taxes on non-agricultural wages and incomes from self-employment. The total incomes are then recomputed using the net wage incomes and net incomes from self-employment, together with the other non-adjusted income components. The final step consists of re-computing the inequality and poverty measures using this new income aggregate. In what follows, we use the three different scenarios described in section 2.1: base scenario (gross incomes), pre-2016 reform scenario and 2016-reform scenario. Since the survey (described below) does not allow us to distinguish between formal and informal incomes, the tax system is applied to all—with the implicit assumption of zero evasion. However, we do not apply taxes to agricultural wages, assuming that they would, legally or illegally, be largely untaxed.<sup>21</sup>

The social protection simulations follow a similar idea. We first calculate the total income that each household receives from PSNP. These incomes are then deducted from household total incomes. We then re-compute the inequality and poverty measures using this income net of PSNP. Finally, we also consider another scenario in which all PSNP funds captured in the survey are distributed equally among the poor in the country.<sup>22</sup>

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<sup>18</sup> The PSNP programme also has positive spillover effects to the non-recipient households as well as to rest of the economy. Using Local Economy-Wide Impact Evaluation (LEWIE) and Computable General Equilibrium (CGE) methods, Filipinski et al. (2016) estimate that the annual contribution of the PSNP to the real GDP is between 0.7 and 1.4 per cent. These spillover effects are mainly due to the public works component that builds and restores community assets (thereby increases agricultural yields) as well as through the income transfers to the recipients (that are used to buy food and non-food products).

<sup>19</sup> This estimate represents the direct effect of the safety net component of the programme. The authors' regressions control for the sectoral composition of growth that capture the productive elements of the programme (see the previous footnote).

<sup>20</sup> Micro-simulation models that ignore behavioural responses of the economic agents are sometimes called arithmetical models in the literature (see Bourguignon and Spadaro 2006).

<sup>21</sup> Our results are almost identical when, instead of assuming zero taxation on agricultural incomes, we assume zero taxation in rural areas regardless of whether the income is generated in the agricultural or non-agricultural sector.

<sup>22</sup> It should be noted that the overall goal of the PSNP is to reduce food insecurity in the country, not poverty reduction—although these two often go hand in hand.

Table 3 summarizes the different simulation scenarios regarding the adjustments on different income components. Appendix B provides a more formal description of this.

Our data come from the Ethiopian Socioeconomic Survey (ESS). ESS is a longitudinal survey conducted by the Central Statistics Agency of Ethiopia (CSA) and the World Bank Living Standards Measurement Study—Integrated Surveys on Agriculture (LSMS-ISA) team (CSA and the World Bank 2013, 2015). We use the second round (2013–14) of this panel survey that covered 5,469 households from all 11 administrative regions. The survey has a number of features that make it particularly suited for our task at hand. First, the survey includes detailed income modules that attempt to measure household incomes as accurately as possible. Second, the data set provides information about the social protection benefits that households receive. Finally, the survey is nationally representative covering both rural and urban areas of the country.<sup>23</sup> Together these features permit us to conduct an integrated analysis of the tax and social protection policies in the country.

Still, the usual caveats common to any household survey data apply. First, measuring income in a context where large part of the (agricultural) production is based on subsistence farming is difficult and subject to a large margin of error (Deaton 1997: 29–32). In addition, household surveys have a tendency to under-estimate incomes and altogether to miss top income earners in the society (Atkinson et al. 2011). These factors mean that incomes are measured with considerable error. These are serious concerns that make the use of income data less appealing also in our application. It is for these reasons that most low-income countries, including Ethiopia, rely on consumption data for their poverty and inequality estimates.

In our case, the challenge of using consumption data is that the tax simulations require applying taxes on different income components.<sup>24</sup> We attempt to solve this issue in the following way. First, we estimate the share of household total income coming from different income sources listed in Table 3. Second, we multiply these shares by the household's total consumption dividing the household consumption into the seven components. Finally, we then apply taxes on the wage and self-employment components before re-constructing the total household consumption variable.<sup>25</sup>

Our consumption variable is based on the consumption aggregate constructed by the LSMS-ISA team.<sup>26</sup> For income, we utilize the income aggregates constructed by the Rural Income Generating Activities (RIGA) project—a collaboration between the FAO, the World Bank and American University in Washington DC (Quiñones et al. 2009). All income and consumption values are expressed in per adult equivalent terms.

The redistributive effects are measured through Gini coefficient and different poverty indices.<sup>27</sup> The Gini coefficient is a widely used measure of income inequality. The Gini coefficient computes the difference between all available income pairs in the data and calculates the total of all absolute differences. This total is then normalized by dividing it by population squared times mean income. The Gini coefficient ranges between 0 and 1, where 0 means perfect

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<sup>23</sup> We use survey weights provided with the ESS data to make our estimates nationally representative.

<sup>24</sup> In Ethiopia, taxes are calculated separately for different types of incomes, such as wage and self-employment, rather than being applied to the aggregate income amount. The implication is, for example, that a taxpayer with two types of income will be able to benefit from the exempt amount twice.

<sup>25</sup> Note that, by doing this, we might overestimate the total tax payments for those households that have more than one wage earner and/or one self-employed. By taxing those incomes at the household level as a sum, rather than separately, we apply a higher marginal rate and only one exempt threshold. However, the majority of households in our data have only one wage earner and/or one self-employed.

<sup>26</sup> The total household consumption is measured using detailed food and non-food consumption-expenditure modules. The recall period in the food module was the last seven days while for non-food expenditures it was either the last month or the 12 months, depending on the item. Before totalling, all individual consumption-expenditure values are expressed in annual terms.

<sup>27</sup> We use the user-written 'egen\_inequal' (Lokshin and Sajaia 2006) and 'fastgini' (Sajaia 2007) routines in Stata 14 to compute our poverty and inequality (Gini coefficient) measures, respectively.

equality (all individuals earn the same) and 1 refers to maximum inequality (1 person earns all the income in the country). We also use Lorenz curves to present the overall income inequality under the various simulation scenarios. The graphical presentation of the Lorenz curve involves a vertical axis that measures cumulative income and a horizontal axis that captures cumulative population in the country. A 45-degree line in this graph represents perfect equality; the Gini coefficient equals 0. In contrast, a Lorenz curve that lies flat over the horizontal axis until the last person and vertical for the last person in the population is called the line of perfect inequality. This is the case when the Gini coefficient equals 1. Typically, the estimated Lorenz curve lies between these two extremes. As the foregoing suggests, the Lorenz curve and the Gini coefficient are inter-linked: the Gini coefficient is the ratio of the area between the 45-degree line and the estimated Lorenz curve and the area between the 45-degree line and the line of perfect inequality.

The disadvantage of the Gini coefficient is that it only measures overall inequality in the country. Policy makers in low-income countries are often more interested in the poorest segment of the society. This motivates us to also simulate impacts on poverty. For this, we use the Foster et al. (1984) class of poverty measures, namely the poverty head count index, the poverty gap index, and the poverty severity index. Poverty head count (P0) captures the fraction of individuals that fall below the poverty line. The poverty gap index (P1) measures the aggregate poverty deficit of the poor relative to the poverty line. Finally, the poverty severity index (P2) captures the (squared) proportional shortfall from the poverty line. The key to this exercise is how the poverty line is defined.<sup>28</sup> This is somewhat problematic as the ESS survey was not originally designed to accurately measure poverty in the country.<sup>29</sup> We solve this issue by calibrating our poverty line so that the poverty headcount in the data matches the official estimate (GFDRE 2012)—30 per cent.<sup>30</sup>

## 4 Results

Table 4 provides the results based on the consumption data, while those based on income data are reported in Table A2 in Appendix A. Each Gini coefficient and poverty estimate is reported with respect to the base scenario—that is before taxes and after social protection payments. Column 1 shows the estimated impacts of the pre-2016 tax scheme. About 27 per cent of the population (19 per cent of the rural and 80 per cent of the urban population) is subject to income taxes under this scheme. According to our simulation estimates, the previous tax scheme had little redistributive impact: the Gini coefficient falls by 0.016 points but poverty does not decrease. In contrast, the headcount poverty rate is estimated to increase by one percentage point. This is a sizeable increase in poverty, likely due to out-dated thresholds that were set in the income tax law of 2002 and never revised until the 2016 reform. Under the old system, the exempt threshold was 1,800 birr (annual income), which is well below both the official and our calibrated poverty line. This means that the poor were still liable to pay income taxes—a result consistent with the findings of the fiscal incidence analysis of the World Bank (2015a). This World Bank study shows that, although income taxes are more progressive than indirect taxes, the poor in Ethiopia are still taxed more heavily than in other countries. Most importantly, according to the World Bank estimates, one in ten households is impoverished as a result of the combined effect of taxation and the benefit system. In those

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<sup>28</sup> The calculation of the official poverty line in Ethiopia is based on the cost of basic needs method and takes into account both food and non-food requirements (GFDRE 2012).

<sup>29</sup> The Household Consumption Expenditure Survey (HCES) serves as the official source for poverty statistics in the country. The consumption modules in the HCES are much more extensive than in ESS. As a result, the aggregate consumption values may not be entirely comparable.

<sup>30</sup> More specifically, this calibration is done by sorting the population by consumption (or income) and selecting the consumption (income) level capturing the 30th percentile in the (weighted) sample as the poverty line. This automatically yields a poverty headcount rate of 30 per cent.

households, taxes are larger than benefits, therefore pushing them into poverty or making those who are already poor, even poorer (World Bank 2015a). Higgins and Lustig (2016) document similar *fiscal impoverishment* in a number of other low-income countries.

Column 2 in Table 4 reports the estimated impacts of the July 2016 income tax scheme. According to our survey data, nearly 18 per cent of the population (11 per cent of the rural and 74 per cent of the urban population) is subject to income tax under this scheme. This is a considerable decrease in the number of taxpayers, from 27 per cent under the pre-2016 scenario. This reduction is mostly due to the four-fold increase in the exempt threshold, which resulted in relieving the poorest from paying any income tax at all. Similar to the previous scheme, this scenario also yields negligible redistributive effects in terms of change in the Gini coefficient. Moreover, Figure 1 shows that the Lorenz curves lie virtually on top of each other under each scenario (base, pre-2016 and post-2016). The adjustment in the first tax bracket means that we no longer see such a drastic increase in the poverty headcount rate as under the previous scheme. Therefore, it seems that the reform successfully corrected the distortions of the previous system and re-aligned income taxation with the broad policy objective of poverty reduction.

The attention now shifts to the social protection analysis. About 10 per cent of the population receive PSNP benefits in our data.<sup>31</sup> Column 3 shows the estimated effect of removing PSNP on overall inequality and poverty. Our models suggests that PSNP has considerable effect on poverty, reducing it by 0.9 percentage points.<sup>32</sup> This figure, taken together with the tax simulation, implies that the poverty reducing effect of the PSNP was essentially cancelled out by the pre-2016 tax system that increased poverty by a similar amount. However, our simulations show that the programme results in no change in the Gini coefficient.

The last column of Table 4 reports the estimates based on a scenario in which all PSNP funds are distributed equally among those who fall below the poverty line. This hypothetical redistribution makes two changes with respect to the PSNP, as currently implemented in Ethiopia. First, by re-assigning all funds to the poorest, we assume perfect targeting based on income. Although the PSNP has performed well in terms of targeting (see section 2.2), its limited geographical coverage means that many poor households are not covered by the programme (Hill and Porter, as cited in World Bank, 2015a). As a result, our hypothetical redistribution involves re-channelling PSNP funds also to the districts where it is not currently operational. This perfect re-targeting of the PSNP suggests considerable poverty impacts, as the programme now reaches the poor regardless of their location. Indeed, according to our model estimates, the re-allocated PSNP results in a fall of the headcount poverty rate by 1.5 percentage points, a larger change than the current programme (see Column 3). However, the estimated change in overall inequality (Gini coefficient) remains small. This finding is further supported by the Lorenz curves that lie perfectly on top of each other under the base and different PSNP scenarios (Figure 2). This is possibly due both to the relatively small per capita amounts involved in the programme and to a relatively small number of beneficiaries that can be reached based on current financing.<sup>33</sup>

Finally, using income instead of consumption data yields qualitatively very similar results (see Table A2 in Appendix A), thus confirming the robustness of our results.

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<sup>31</sup> This is close to official figures according to which 8.29 million individuals (out of the total population of 89 million) benefitted from PSNP in 2014 (World Bank 2016).

<sup>32</sup> Of note is that this estimate is somewhat higher than the one by Vargas Hill and Tsehaye (2014) according to which, since its implementation in 2005, the PSNP has reduced poverty by 0.5 percentage points per year.

<sup>33</sup> Note that we are simply re-targeting current PSNP resources, therefore all the simulations assume a constant overall PSNP budget.

## 5 Ethiopia's capacity for redistribution and poverty reduction through income taxation

Our simulation results suggest that taxation post-2016 has no impact on poverty, while it actually had adverse effects pre-2016. In contrast, social protection holds more promise in terms of poverty reduction. Still, taxation has an important role in two respects. First, the tax system needs to be kept updated, to avoid adverse effects similar to those resulting from bracket creep under the pre-2016 system. Second, it is an important source of revenue for social protection, both currently and potentially. This leads us to wonder whether the current tax scheme would be, in theory, able to actually generate enough revenues to finance PSNP without donor support. This section attempts to respond to this question. Moreover, following Ravallion (2010), we also assess Ethiopia's capacity to close the poverty gap through taxation.

The PSNP budget was 3.9 billion birr<sup>34</sup> in 2013/14—the year of our analysis. The PSNP is currently financed almost entirely by donors (99 per cent), with a small contribution from domestic revenues. The PSNP budget compares with total domestic revenue<sup>35</sup> of about 106 billion birr in the government budget for the same year.<sup>36</sup> Therefore, if the PSNP were fully funded through domestic revenue, it would absorb 3.7 per cent of such budgeted revenue. The government budget has increased at a high pace in recent years, with an approved budget for the fiscal year 2016/2017 of over 274 billion birr (nominal). Although full domestic financing of the PSNP would certainly require a substantial additional expense and re-allocations across expenditures, it may not seem completely unrealistic. However, a more accurate assessment requires closer consideration of the revenue generating capacity of specific tax types, which we attempt to provide next.

To assess the distributive capacity of Ethiopia, we follow the method proposed by Ravallion (2010). Essentially, he asks whether countries that are currently aid recipients would have enough capacity for redistribution to tackle poverty entirely through domestic redistribution—quite aside from whether they would have the political will to do so. The measure for redistribution capacity is the marginal tax rate that would need to be applied on the rich<sup>37</sup> to obtain sufficient revenue to either close the poverty gap or finance a basic income scheme. If the necessary marginal rate would be 'too high', then that country does not have enough capacity for redistribution without aid. Clearly, there is no clear threshold for 'too high', although most high-income countries apply top marginal rates well below 60 per cent. Ravallion (2010) shows that in most low-income countries the marginal rate to cover even half of the poverty gap would indeed be prohibitive, while it may be more feasible in middle-income countries.

We build on Ravallion's method, but depart from it to adapt it to the Ethiopian context and make it more relevant to policy makers in the country. In terms of revenue needs, we consider both poverty eradication and the current PSNP financing. Moreover, we evaluate Ethiopia's capacity for redistribution based on incremental changes on the current tax system (post-2016), with two implications. First, although we adjust the top rate, incomes under the top threshold are still taxed according to the post-2016 schedule. As a result, the overall tax burden in our case is higher than in Ravallion (2010). Second, we only consider *additional* revenue compared to post-2016 reform, rather than the total tax take. We think this is more

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<sup>34</sup> The total annual PSNP costs according to the Government Budget (2006 Fiscal Year in Ethiopian Calendar – 2013/14 in Gregorian calendar) are 3,906,449,780 birr. Total annual PSNP flows (public works + direct support payments) estimated from the ESS data are 2,501,495,568 birr.

<sup>35</sup> Total domestic revenue includes tax and non-tax revenue, but excludes foreign loans and grants.

<sup>36</sup> Total domestic revenue in the budget proclamation for EFY 2006 is 105,919,265,400 birr.

<sup>37</sup> The 'rich' in Ravallion (2010) are defined as those who would not be considered poor by rich countries.

realistic and policy-relevant, since the government would still have to fund all other existing commitments in the budget, in addition to the transfer needed for the PSNP or for eliminating poverty.

Based on this adaptation of Ravallion's method, we start by calculating the necessary amount of revenue that would be required to close the poverty gap, as we already know the total PSNP budget (3.9 billion birr). Based on our consumption data and our calibrated poverty line, we calculate the cost of eliminating poverty as follows. We first multiply the poverty gap index by the poverty line, thus obtaining the per capita average gap in monetary terms. This number is then multiplied by the number of people in Ethiopia. This yields a total cost of eliminating poverty of about 24.6 billion birr.<sup>38</sup>

Based on these numbers, we assess whether there would be a feasible top marginal rate to cover the poverty gap (24.6 billion birr) and the PSNP budget (3.9 billion birr) in Ethiopia. Using the survey data and our simple microsimulation model, we estimate the revenue gains that would be obtained by applying various top marginal rates to the higher bracket in the post-2016 tax system (above 130,000 birr).<sup>39</sup> Figure 3 shows the revenue gains resulting from increasing the top marginal rate above the current 35 per cent, calculated as additional revenue from the post-2016 scenario. However, in doing this we are abstracting from the cost of the 2016 reform that, by decreasing the effective tax rate on everyone, generates some revenue losses—which may, however, be counterbalanced by behavioural responses.<sup>40</sup>

Figure 3 shows that, based on consumption data, Ethiopia could cover the cost of PSNP by applying a top rate slightly below 70 per cent, on incomes above 130,000 birr. Covering the poverty gap instead is impossible as even halving poverty would require top rates that are well above 100 per cent. If we use income data as an alternative for this analysis, no top rate would be sufficient to generate sufficient revenue for either target (see Figure A2 in Appendix A).<sup>41</sup> The conclusions using our two variables therefore seem to differ to some extent. However, we argue in the next paragraphs that the key message would be the same, namely that full domestic financing is not feasible. This is because a top rate of 70 per cent is far from realistic in practice, for a number of reasons.

First, it is useful to put the top threshold of 130,000 birr in perspective. This amount is currently equivalent to less than US\$6,000 per year, which corresponds to PPP US\$51 per day.<sup>42</sup> This value is substantially higher than the new World Bank's poverty line of PPP US\$1.9 per day. Following Ravallion (2010), it is worth noting that this value is also above the US poverty line of US\$16.<sup>43</sup> However, a household of four relying only on one wage of 130,000 birr would still be below the US poverty line ( $51/4 = \text{PPP US\$13}$ )—thus raising concerns about setting a high

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<sup>38</sup> The per capita cost of eliminating poverty is calculated based on our consumption variable. The total cost is obtained as: Poverty Gap Index \* Poverty line \* Total population = 25,301,477,020 birr. The equivalent figure based on income data is 24,589,709,884 birr (see Table A2 in Appendix A for full results using income).

<sup>39</sup> As noted in other parts of this paper (for example, see section 3), this exercise comes with at least two caveats. First, we make the unrealistic assumption of no informal sector and no evasion. This would result in overestimating the revenue gains. Second, since the survey misses the rich and generally underestimates incomes, the revenue gains may be underestimated. These two caveats operate in different directions so it is hard to know how the real picture differs from the simulations. For this reason, this is not a prediction of what would happen by increasing the top rate, but rather a discussion on hypothetical capacity to fund redistribution domestically, under assumptions that we fully recognize as unrealistic.

<sup>40</sup> Behavioural responses to a decrease in the effective tax burden would increase tax revenue, for example by decreasing evasion and avoidance.

<sup>41</sup> While with consumption the two targets were hypothetically achievable with a 70 and 90 per cent top rate, using income there is no feasible top rate. This difference in the consumption (Figure 3) and income (Figure A2) results are likely due to the fact that income is grossly under-reported in the survey data, especially at the top part of the income distribution (see the discussion in Section 3).

<sup>42</sup> 130,000 birr correspond to PPP US\$18,665, based on the World Bank PPP conversion factor tables available at <http://data.worldbank.org/indicator/PA.NUS.PPP>. Therefore:  $18,665 / 365 = 51$  birr per day.

<sup>43</sup> This is the per capita daily poverty line for a family of four in 2014, based on the guidelines of the US Department of Health and Human Services.

tax rate on incomes that may still accrue to households can be considered middle-income or even poor by international standards. Second, a top marginal rate of 70 per cent would imply a jump of 40 percentage points moving to the top threshold. This would create considerable incentives for taxpayers to bunch just below that threshold—a behaviour documented in the literature even with much smaller discontinuities in the tax system (Saez 2010; Almunia and Lopez Rodriguez 2015). As a result of such behavioural responses, the real revenue gains of increasing the top rate would be likely to be substantially smaller. Third, the rate needed to cover the PSNP would be higher than the ones applied in most rich countries, which are typically below 60 per cent (Immervoll 2004). In the specific context of Ethiopia, there would be an additional political and historical connotation to such prohibitive rates, as the socialist military regime known as the Derg, which ruled the country until 1991, applied rates as high as 89 per cent (Griffin 1992; Chole 2005). Furthermore, high tax rates would almost certainly be politically unfeasible and would go against the efforts of many countries, particularly in Africa, to be fiscally competitive. Additionally, due to our assumptions on the informal sector, the revenue gains estimated here should be taken as an upper bound.

For all these reasons, we believe that Ethiopia does not currently have the capacity to fund poverty eradication or the PSNP with income taxation alone. This is consistent with the broader result for low-income countries presented by Ravallion (2010).

However, it is worth noting that increases in tax revenue do not necessarily need to come from higher marginal rates on wages and the self-employed. Taxpayers in these two categories still represent a relatively small share of the labour force in many low-income countries, which typically rely much less on personal income taxes than high-income countries. There are other taxes whose potential is still untapped. Most notably, incomes related to real estate are largely untaxed in many low-income countries, including in Ethiopia (see Goodfellow 2015). However, they are an important way to generate income and store wealth, particularly in countries with limited financial development. Moreover, corporate tax holidays that are generously granted to investors in Ethiopia, as in many other low-income countries, generate large revenue losses despite being of doubtful effectiveness (Kinda 2014). A detailed discussion of these taxes is beyond the scope of this paper.

## 6 Concluding discussion

This paper aimed to address two related questions. First, we ask: what is the comparative effectiveness of income taxation and social protection in addressing poverty and inequality in Ethiopia? We find that currently the PSNP is more effective than income taxation in achieving poverty reduction, while neither policy achieves any sizeable reduction in overall inequality (measured through the Gini coefficient). Overall, our findings provide support for the common belief that social spending is more suitable than taxation to achieve redistribution. However, our results present a more nuanced picture that partly challenges this common belief. By analysing the pre-2016 tax system, we show that income taxation can actually have substantial adverse effects on poverty. In Ethiopia, this resulted from the combined effect of high inflation and a lack of revision of tax thresholds for 14 years, which led to a gradual and sustained increase in effective tax rates without corresponding increases in real income. This adverse effect, pre-2016, completely cancelled out the poverty reduction effect of the PSNP. Therefore, while our analysis reinforces the importance of social protection, it also shows that taxation can have a direct redistributive effect, not necessarily positive, in addition to being a key generator of domestic revenue.

Second, we asked whether Ethiopia would have the capacity to achieve the desired level of redistribution by applying higher marginal rates on relatively high incomes. Building on the method used by Ravallion (2010), we argue that Ethiopia does not currently have the capacity

to close the poverty gap or fund the PSNP using domestic redistribution alone. Although some of our calculations would suggest that a top tax rate of 70 per cent could generate enough revenue to fund the PSNP, we argue that these revenue gains could be counter-productive and would be unlikely to actually materialize in practice (see section 5).

This study has some important limitations. The first one is related to the data. Although we use alternative measures of income from our survey, we are aware of the limitations described in section 3. Nonetheless, we believe these data can still be used as a sufficiently realistic representation of reality to carry out our simple simulations. However, the analysis presented here should be taken more as a conceptual exercise, rather than generating specific and actionable policy recommendations. The second limitation lies in the simplicity of our microsimulation model, which only considers two specific policies, rather than the fiscal system as a whole, and excludes behavioural and second round effects. Therefore, the estimated changes in inequality or poverty rates should not be interpreted as representing causal effects of changing tax or social protection policies. Finally, since we do not have information on whether incomes are formal or informal, we have to make the assumption of no evasion and no informal sector. We fully recognize that this assumption is unrealistic, in a context like Ethiopia where the informal sector is estimated to represent over 35 per cent of the economy (Schneider and Williams 2013). However, by looking at *variations* under different scenarios, we believe we can still draw some general conclusions and insight into the potential of tax and social protection policies.

Notwithstanding these limitations, our results are in line with the findings of similar studies in the literature, which also support the validity of our analysis. First, the PSNP seems to perform well and it could be usefully expanded to areas that are currently excluded. Our basic simulations show that even re-targeting to the population below the poverty line, while keeping the same total budget, can increase its effectiveness towards poverty reduction. Second, our analysis suggests that income taxation may turn regressive if the tax brackets are not regularly adjusted to keep up with inflation. This is particularly important in countries characterized by high inflation, such as Ethiopia.

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## TABLES AND FIGURES

Table 1: Progressive tax structure pre-2016 reform (2002 laws)

Bracket	From birr	To birr	Rate
0	0	1,800	Exempted
1	1,801	7,800	10%
2	7,801	16,800	15%
3	16,801	28,200	20%
4	28,201	42,600	25%
5	42,601	60,000	30%
6	Over 60,000		35%

Note: Thresholds of yearly income.

Source: Federal Negarit Gazeta of the Federal Democratic Republic of Ethiopia (2002) Proclamation 286/2002

Table 2: Progressive tax structure in the 2016 reform

Bracket	From birr	To birr	Rate
0	0	7,000	Exempted
1	7,001	19,300	10%
2	19,301	37,750	15%
3	37,751	62,350	20%
4	62,351	93,100	25%
5	93,101	130,000	30%
6	Over 130,000		35%

Note: Thresholds of yearly income.

Source: MoFED (n.d.) Federal Income Tax Proclamation No/2016.

Table 3: Description of the simulation scenarios

	(0)	(1)	(2)	(3)	(4)
Income component / scenario	Base	Pre-2016 tax	Post-2016 tax	No PSNP	Re-targeted PSNP
Agricultural wages	X	X	X	(3)	(4)
Non-agricultural wages	X	(1)	(2)	X	X
Crop income	X	X	X	X	X
Livestock income	X	X	X	X	X
Income from self-employment	X	(1)	(2)	X	X
Transfers	X	X	X	(3)	(4)
Other income	X	X	X	X	X

Note: X = As it is estimated from the survey. (1) = net of taxes (pre-2016 scheme). (2) = net of taxes (post-2016 scheme). (3) = net of direct support and public works payments. (4) = PSNP redistributed equally among those who fall below the poverty line.

Source: Authors' illustration.

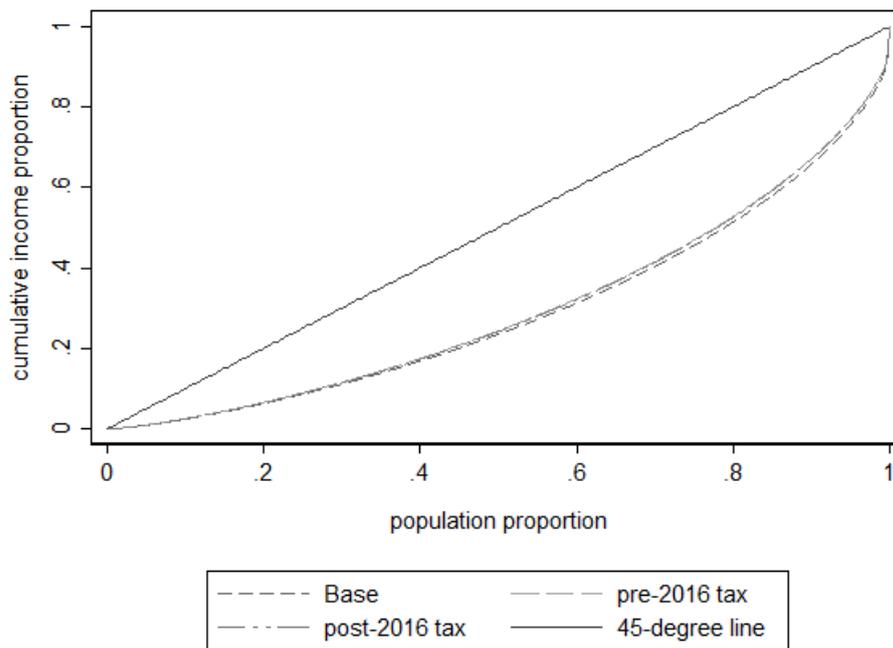
Table 4: The estimated impacts under each scenario with respect to the base scenario using consumption data

	(1)	(2)	(3)	(4)
	Pre-2016 tax	Post-2016 tax	No PSNP	Re-targeted PSNP
Gini coefficient	-0.016	-0.013	0.003	-0.005
Pov 0	1.0 %p	0.2 %p	0.9 %p	-1.5 %p
Pov 1	0.3 %p	0.1 %p	0.4 %p	-0.8 %p
Pov 2	0.1 %p	0.0 %p	0.3 %p	-0.5 %p

Note: %p refers to percentage point.

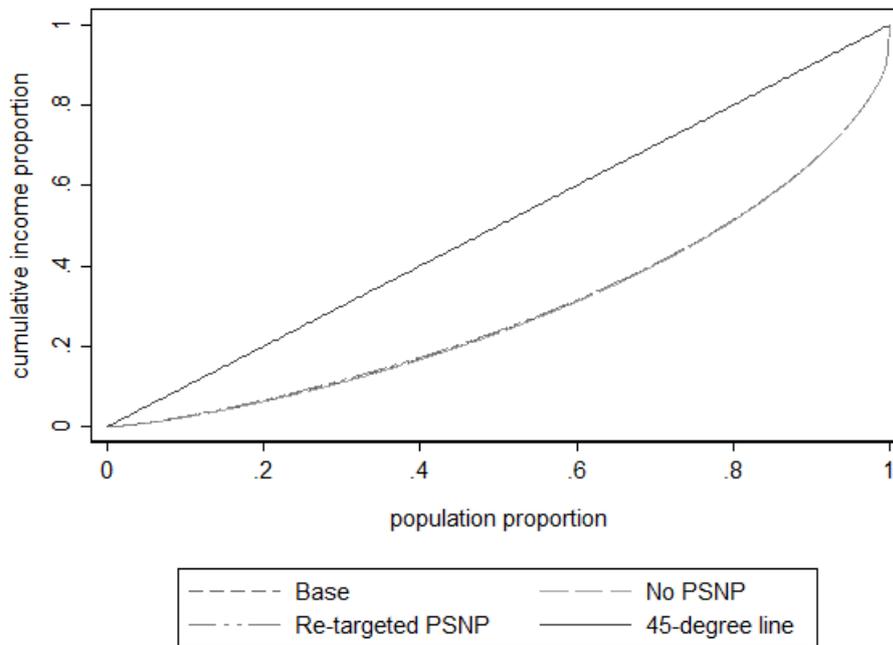
Source: Authors' calculations based on the ESS-LSMS 2013/14 survey.

Figure 1: Lorenz curves under base, pre-2016 and post-2016 scenarios



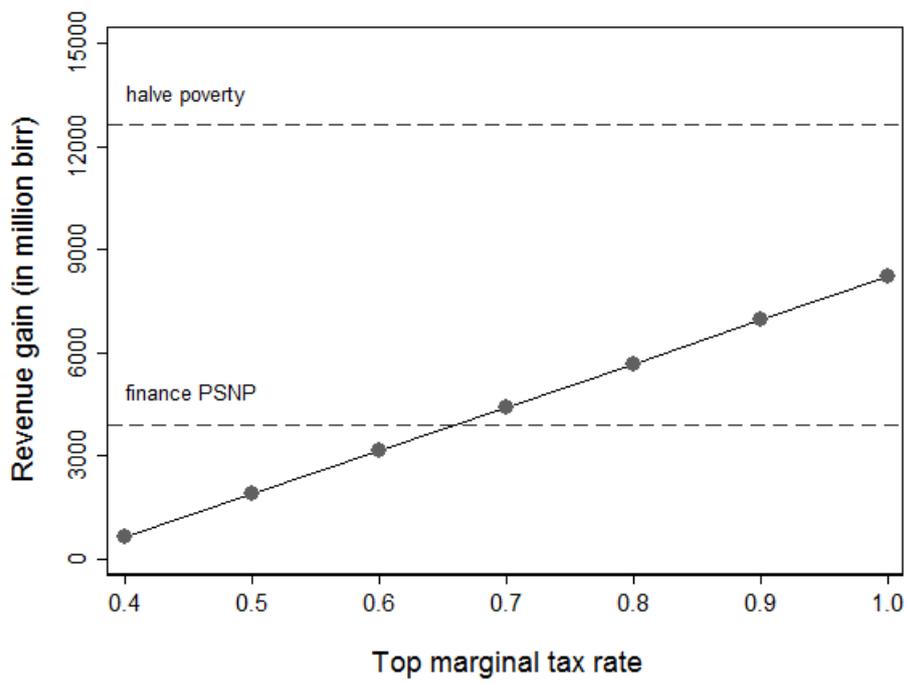
Source: Authors' calculations based on the ESS-LSMS 2013/14 survey.

Figure 2: Lorenz curves under base, pre-2016 and post-2016 scenarios



Source: Authors' calculations based on the ESS-LSMS 2013/14 survey.

Figure 3: Top marginal rate needed to eliminate poverty or fund the PSNP

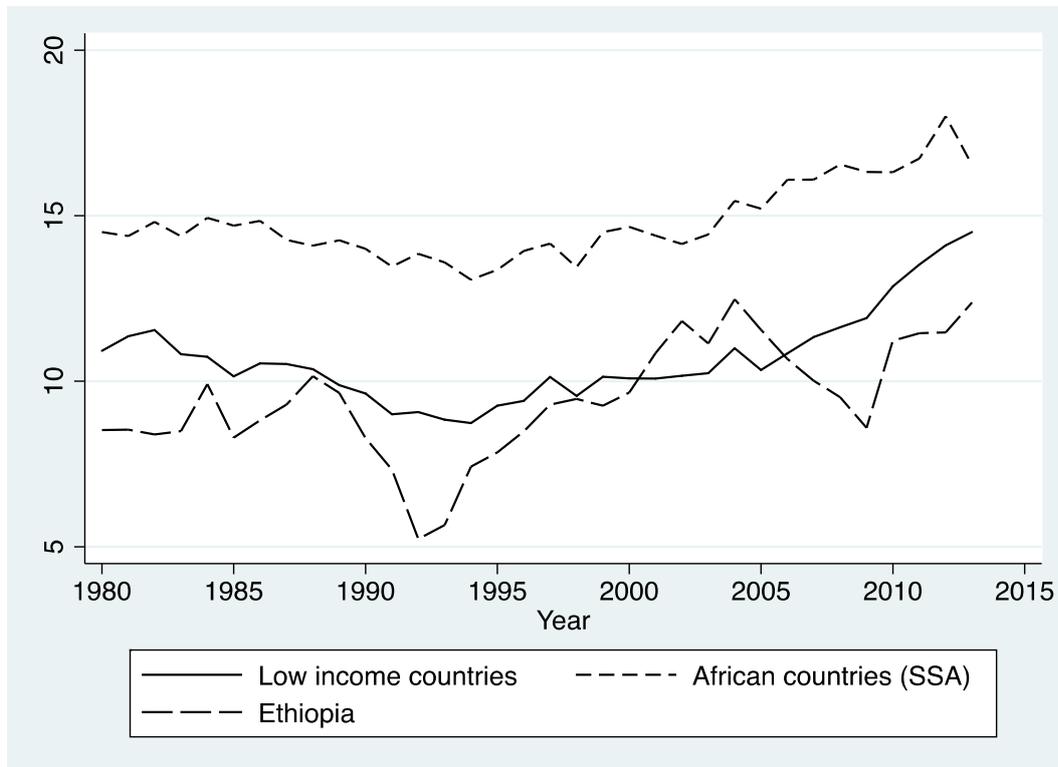


Note: The revenue gains in this figure are calculated based on our consumption variable.

Source: Authors' calculations based on the ESS-LSMS 2013/14 survey.

## APPENDIX A: ADDITIONAL TABLES AND FIGURES

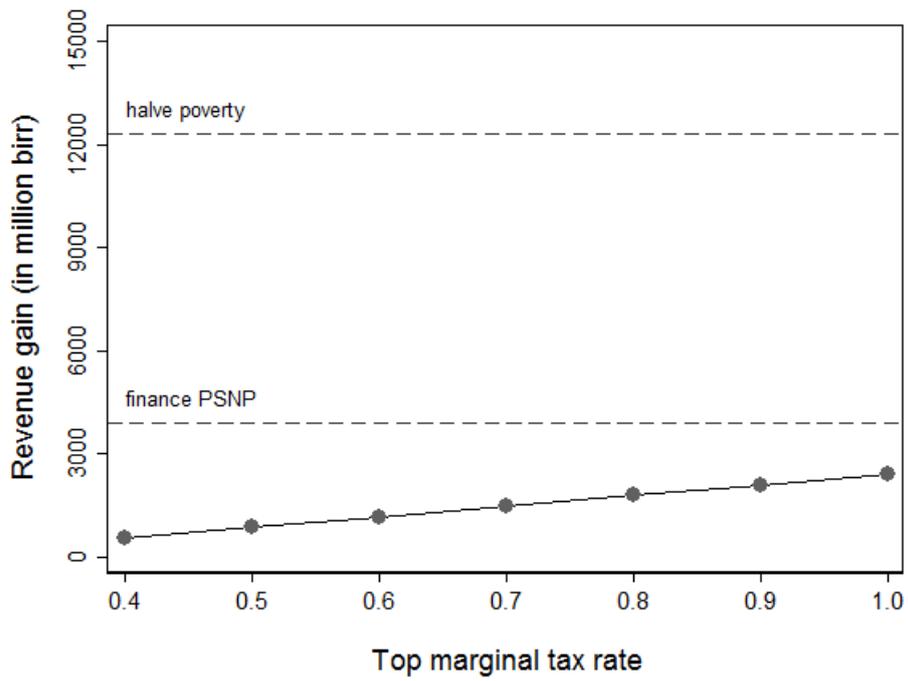
Figure A1: Tax to GDP ratio comparisons



Note: The vertical axis measures the tax to GDP ratio.

Source: Authors' calculations based on the ICTD GRD dataset (May 2016).

Figure A2: Top marginal rates and revenue gains using income data



Note: The revenue gains in this figure are calculated using income data.

Source: Authors' calculations based on the ESS-LSMS 2013/14 survey.

Table A1: Tax composition in 2013/2014

Tax type	% total tax	% direct tax	% indirect tax	% trade tax
Business profits	21.5	61.9		
Sales/excise/VAT on trade	17.6			49.7
Sales/excise/VAT on services	15.5		52.1	
Sales/excise/VAT on goods	13.7		45.8	
Custom duties	11.3			31.9
Personal income taxes	10.2	29.3		
Surtax on imports	6.6			18.5
Land fees	1.0	2.8		
Other income	0.9	2.6		
Stamp duties	0.6		2.1	
Rental income	0.6	1.6		
Interest income	0.3	0.8		
Agricultural income	0.2	0.7		
Capital gains	0.1	0.3		
	100	100	100	100

Source: Authors' calculations based on macroeconomic data from the Ministry of Finance and Economic Cooperation.

Table A2: The estimated impacts under each scenario with respect to the base scenario using income data

	(1)	(2)	(3)	(4)
	pre-2016 tax	2016 scheme	no PSNP	PSNP, re-targeted
Gini coefficient	-0.025	-0.017	0.005	-0.005
Pov 0	0.1 %p	0.0 %p	1.0 %p	-1.7 %p
Pov 1	0.1 %p	0.0 %p	0.7 %p	-1.1 %p
Pov 2	0.0 %p	0.0 %p	0.6 %p	-1.1 %p

Note: %p refers to percentage point, P0 to Poverty head count, P1 to poverty gap index (P1) and P2 to poverty severity index.

Source: Authors' calculations based on the ESS-LSMS 2013/14 survey.

## APPENDIX B: FORMAL PRESENTATION OF THE VARIOUS SIMULATION SCENARIOS

### **‘Base’ scenario:**

Total income (totinc) is formed of agricultural (agwages) and non-agricultural wages (nonagwages), crop income (cropinc), livestock income (lsinc), income from self-employment (seinc), transfers (transf) and other income (othinc). The total income for the base scenario (i.e. before taxes and after PSNP) is estimated from the survey data as:

$$(1) \text{ totinc} = \text{agwages} + \text{nonagwages} + \text{cropinc} + \text{lsinc} + \text{seinc} + \text{transf} + \text{othinc}.$$

### **‘Pre-2016 tax’ scenario:**

In this scenario, we study the progressivity of the pre-2016 tax structure (see Section 2.1). To do this, we apply the tax structure (described in Table 1) on non-agricultural wages and income from self-employment:

$$(2) \text{ totinc}^{(a)} = \text{agwages} + \text{nonagwages}^{(a)} + \text{cropinc} + \text{lsinc} + \text{seinc}^{(a)} + \text{transf} + \text{othinc},$$

where  $\text{nonagwages}^{(a)}$  and  $\text{seinc}^{(a)}$  refer to non-agricultural wages and income from self-employment *after* taxes based on the pre-2016 tax structure, respectively. Finally,  $\text{totinc}^{(a)}$  is the total income *after* taxes under pre-2016 tax structure.

### **‘Post-2016 tax’ scenario:**

In this scenario, we study the progressivity of the post-2016 tax structure (see Section 2.1). To do this, we apply the tax structure (described in Table 2) on non-agricultural wages and income from self-employment:

$$(3) \text{ totinc}^{(b)} = \text{agwages} + \text{nonagwages}^{(b)} + \text{cropinc} + \text{lsinc} + \text{seinc}^{(b)} + \text{transf} + \text{othinc},$$

where  $\text{nonagwages}^{(b)}$  and  $\text{seinc}^{(b)}$  refer to non-agricultural wages and income from self-employment *after* taxes based on the post-2016 tax structure, respectively. Finally,  $\text{totinc}^{(b)}$  is the total income *after* taxes under post-2016 tax structure.

### **‘No PSNP’ scenario:**

In this scenario, we study what happens if PSNP is removed (see Section 2.2). To do this, we remove PSNP transfers from the data:

$$(4) \text{ totinc}^{(c)} = \text{agwages}^{(c)} + \text{nonagwages} + \text{cropinc} + \text{lsinc} + \text{seinc} + \text{transf}^{(c)} + \text{othinc},$$

where  $\text{agwages}^{(c)}$  and  $\text{referstransf}^{(c)}$  refer to agricultural wages net of PSNP public works payments and all transfers received by households net of PSNP direct support payments, respectively. Finally,  $\text{totinc}^{(c)}$  is then the total income *net of PSNP*.

### **‘Re-targeted PSNP’ scenario:**

In this scenario, we study what happens if PSNP payments are re-distributed equally among those who fall below the poverty line. To do this, we again remove all PSNP payments from the data but now re-distribute these funds equally among those who fall below the poverty line:

$$(5) \text{ totinc}^{(d)} = \text{agwages}^{(d)} + \text{nonagwages} + \text{cropinc} + \text{lsinc} + \text{seinc} + \text{transf}^{(d)} + \text{othinc},$$

where  $\text{agwages}^{(d)}$  and  $\text{referstransf}^{(d)}$  refer to agricultural wages and public and private transfers after the re-targeting of PSNP, respectively. Finally,  $\text{totinc}^{(d)}$  is then the total income after the *re-targeting of PSNP*.



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