Tax and transfer microsimulation modeling: GHATAX and ETHTAX

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Introduction

Background

- Tax policy aims at raising sufficient revenue in ways that are equitable, efficient and fair with the least distortionary effects

- Understanding the distributional impact of tax and benefit policies on different types of households is crucial for achieving this

- Different tools are available for evaluating various impacts of tax policy

  1. Revenue → revenue forecasting, policy costing

  2. Wider economic effects → programme evaluation, general equilibrium modelling

  3. Distributional impacts → microsimulation

Microsimulation

Modelling at a "micro level"

- Looking at households and individuals

- Focusing on the revenue and distributional effects of policy

- Microsimulation is able to integrate many interacting elements of the tax and benefit system

- Allows one to ask questions like:

  - What would be the impact of broadening the VAT base and increasing the generosity of cash transfers?

  - How much would poor households benefits from abolishing fuel duties?

GHATAX model

GHATAX is a microsimulation model built to facilitate analysis of the distributional impacts of tax policies in Ghana

It covers over three quarters of Ghanaian tax revenues and other important payments made by households

- Income tax
- Social security contributions
- VAT and NHIL
- Import duties
- Excise duties
- CST

- Fuel Taxes:
  - Road Fund Levy
  - Special Petroleum Tax
  - Energy Fund Levy
  - EDRL and PSRL

...and cash benefits paid by the government

- State pension
- Social security benefits

- LEAP
- Hypothetical cash transfer

GHATAX analysis

Revenue and expenditure

- For each modelled system, by source and overall

- Impact of reform relative to user-chosen baseline system

The impact on households

- Changes in taxes and benefits, in both cash and proportional terms

- Across income/spending distribution: how are poorer and richer households affected?

- Analysis by region, rural vs urban, household composition etc

- Poverty headcounts, gaps and effect on inequality measures (e.g. Gini)

Example: Income Tax

Income (GH₵)	Tax rate
0 – 2,592	0%
2,592 – 3,888	5%
3,888 – 5,700	10%
5,700 – 38,880	17.5%
38,880 +	25%

Example: Income Tax

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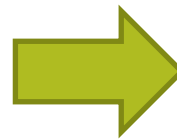
Income (GH₵)	Tax rate
0 – 3,051	0%
3,051 – 4,576	5%
4,576 – 6,709	10%
6,709 – 45,762	17.5%
45,762 +	25%

Increasing all income tax thresholds by 2015 CPI inflation at 17.7%

- Estimated revenue cost of GH₵ 232 million (£38 million), or 6.3% of PIT revenue

Example: Income Tax

Change in net income

Legend:
- % of income (bar)
- Cash gain (line)

X-axis: Poorest, Decile 2, Decile 3, Decile 4, Decile 5, Decile 6, Decile 7, Decile 8, Decile 9, Richest

Left Y-axis (% change in net income): 0.00%, 0.10%, 0.20%, 0.30%, 0.40%, 0.50%

Right Y-axis (Cash change in net income): GHC 0, GHC 40, GHC 80, GHC 120, GHC 160, GHC 200
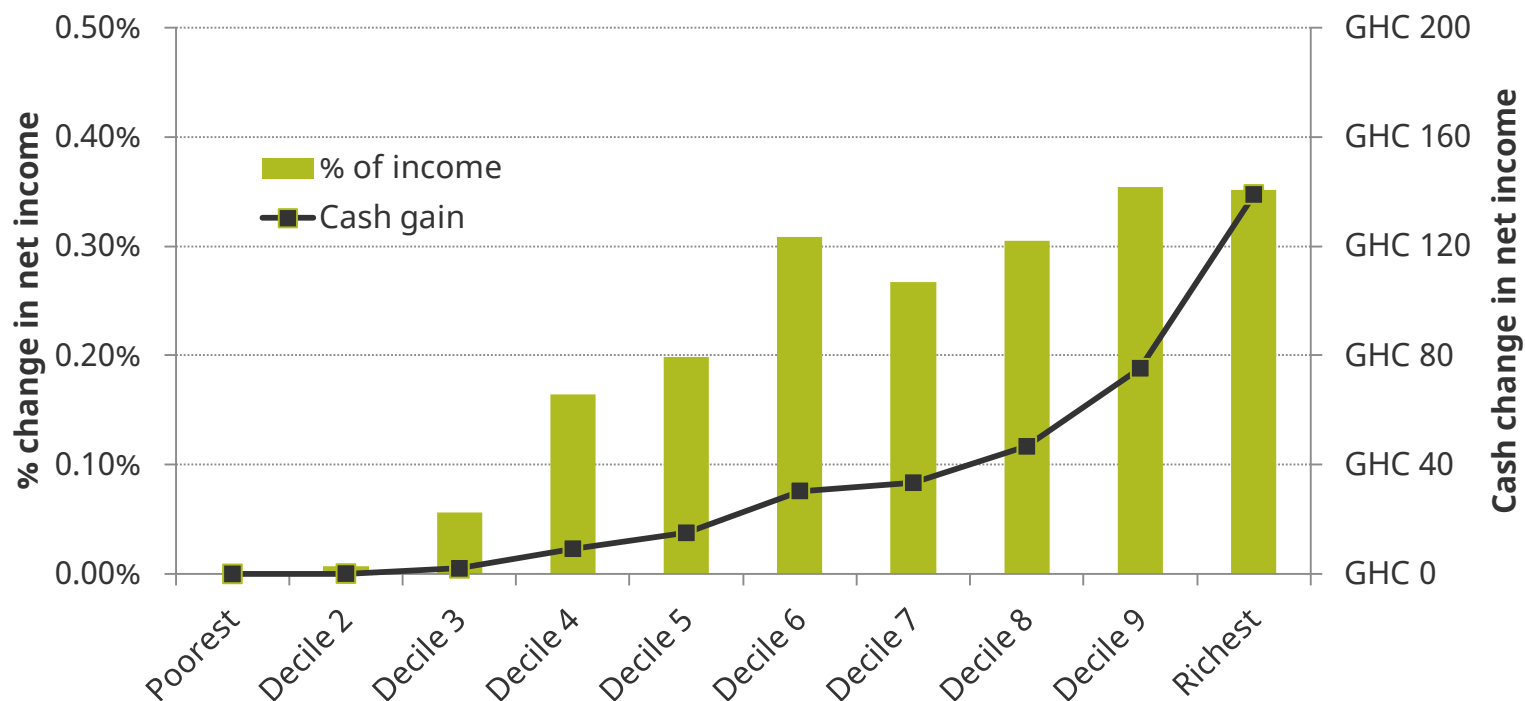
Note: Households ranked by net income per equivalent household member
Source: Author's calculations using GHATAX

GHATAX: Collaboration

GHATAX is a joint venture between IFS and MoF & GRA

- Collaborative approach brings many benefits

    - Helps us develop our micro-data analysis skills

    - Allows us to ensure model takes account of Ghanaian context and our modelling requirements

    - Improves sustainability of the model: understand development and maintenance process, not just how to use it

- But international collaboration is tricky

    - Very technical work requiring large, discrete time commitments

    - Can be difficult to collaborate from a distance

- Thus, IFS has led much of model development with MoF/GRA input and a focus on workshops on model development, use, etc.

ETHTAX (I)

ETHTAX covers over three quarters of Ethiopian tax revenues and other important payments made by households

- Personal Income Tax
- Taxes on profits to individuals
- VAT

- Import duties
- Excise duties
- Surtax

...and cash benefits paid by the government

- Rural PSNP

- Hypothetical cash transfer

ETHTAX (II)

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Model has same broad features as GHATAX

- Distributional and revenue effects of policies and reforms

- Same architecture of interface module, parameters files and calculation code

- Outputs full individual level dataset and summary spreadsheets

Model design and build led more by IFS in this case

- MOFEC had STATA training in 2017

- First training workshop on ETHTAX last week!

Input Data

Household surveys

- Microsimulation requires integrated information on incomes, expenditures and other household characteristics for a nationally representative sample

  - Ghana's GLSS household survey

  - Ethiopia's ESS and HCES surveys

In addition

- Social Accounting Matrix to allow the modelling of taxes on intermediate goods and services

- In Ghana use admin data to help modelling of import duties

Understanding data limitations is crucial to using the model

Quality assurance process is important

Informality and tax evasion

Who pays taxes?

- The informal economy and tax non-compliance more broadly are clearly important issues to consider in the LMIC context

- Limited information on direct taxes paid on income in the surveys

  – Use proxy variables to identify who is more likely to pay income tax and SSCs (e.g. civil service employees)

  – Test how results change under different assumptions

- No information on taxes paid on expenditure

  – Estimate an average rate of tax compliance for VAT/NHIL

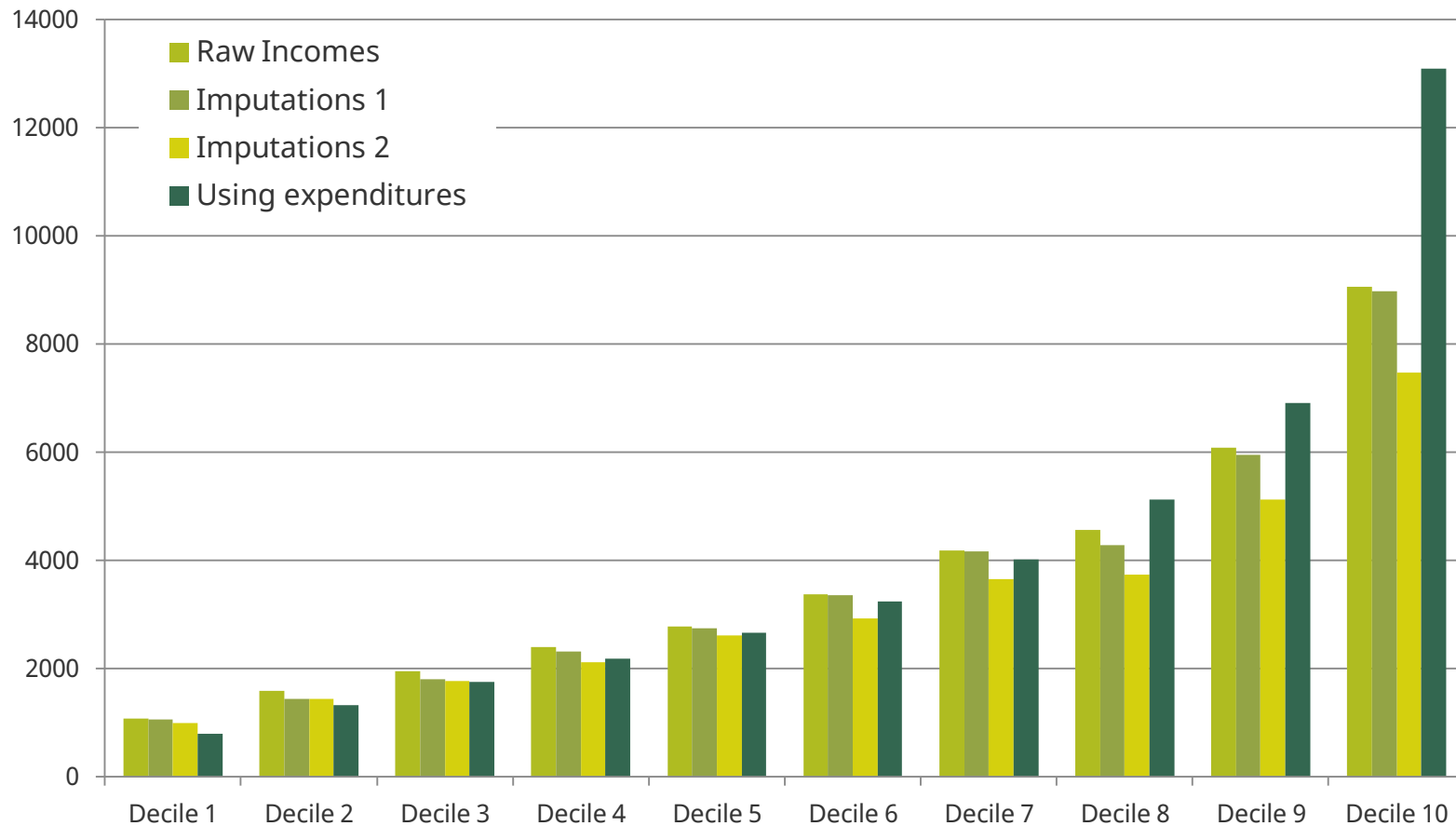 – Implications for distributional results of analysis?

Outliers in income data

Misreporting of incomes is important to consider

- Huge implications for distributional analysis and revenues

  – One spurious observation can have a big impact on results

- How can one deal with this? How can we know what is misreporting?

- We consider two approaches:

1. Relying on consumption/expenditure data.

   – Assume that this is more reliable and form income estimates from this; this is an option available for the user

   – A common approach when income data is unreliable

2. Imputing top income outliers at the top of the distribution according to job characteristics

Sensitivity check in Ghana

Equivalised household income using different imputation methods by equivalised consumption decile (GHC 2012/13)

Ghana: model performance

Tax/benefit	Outturn*	Model estimate
Income Tax	3,702.4	3,681.4
SSNIT	2,122.4 (2015)	4,052.9
VAT/NHIL	6,804.0**	7,036.1
Taxes on fuel	4,992.1	8,094.1
CST	338.8	239.1
Other excise	297.3	261.4
Import duties	4,129.9	2,738.8
LEAP	50.0	67.4

All figures except LEAP are in millions of nominal Cedis and are based on "baseline" assumptions (see GHATAX main report, forthcoming)
* 2016 unless otherwise specified
** Net of refunds

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Ethiopia: model performance

Tax/benefit	Outturn*	Model estimate
Income Tax	22,255	17,285
Tax on profits	8,093	14,825
VAT	54,718**	51,080
Excise	11,491	11,262
Surtax	12,216	11,888
Import duties	21,723	22,438
PSNP	6,750	2,715

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Looking forward (I)

1. **Further integration at MoFs**

- A greater focus on model maintenance and data creation

- "Training of trainers" so more policymakers can utilise the software

- Use in process of policy analysis and evaluation

2. **Updating with new data sources**

- e.g In Ghana GLSS wave 7 and new Social Accounting Matrix

- This process can align nicely with point 1 above

Looking forward (II)

3. Improve the data that can be used in our models

- Administrative data: e.g. PAYE records for better income tax modelling

- Improving the Ethiopian household surveys (with World Bank)

4. Building better evidence on assumptions underlying models

- Key assumption is economic incidence of tax: who 'actually' pays it

- In line with international practise, our models assume indirect taxes passed through to consumers

- Plan several studies (e.g. Mexico) to investigate how true this is in a context where formal taxed firms compete with informal untaxed firms

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Government of Ghana

TaxDev

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