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Preliminary economic impacts assessment of tariff reduction on water lifting technologies in Ethiopia

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BACKGROUND

One of the main barriers to agricultural growth in developing countries is the insufficient supply of agricultural inputs that improve production and productivity (Nakawuka et al., 2017; ATA, 2019). A number of factors contribute to this impediment, including high taxation of these items that makes them relatively expensive to purchase by the end user or farmer.

For example, irrigation adoption by smallholder farmers in developing countries is generally low due to high cost of acquiring small-scale irrigation (SSI) technology equipment such as pumps (rope and washer, solar, motor), pipes, tanks and their accessories (Gebregziabher et al., 2014; Nakawuka et al., 2017). Moreover, financing options from banks and microfinance institutions have been limited due to lack of collateral from smallholder farmers and other uncertainties surrounding loan repayment.

In 2019, the government of Ethiopia ratified a law that exempts a list of agricultural equipment from a tax, aiming to boost the import and use of such agricultural technologies. The Ethiopian Agricultural Transformation Agency (ATA) in collaboration with the Ministry of Agriculture (MoA) initiated a process of tax reform policy, conducting a cost-benefit analysis and identifying a list of equipment that qualify for exemption (ATA, 2019). The Ministry of Finance (MoF) approved the tax-free imports of agricultural mechanization, irrigation and animal feed technologies, and equipment. Irrigation equipment such as pumps and their accessories were among the list of equipment that benefited from the exemption. Under standard tariff rates, for example, pumps are taxed for duty and other taxes including VAT in the range of 37% and 42% of the pre-imported price (Gebregziabher et al., 2014; IFAD, 2019). This objective of this study is to conduct a preliminary assessment of the potential economic impacts of import tax exemption for motor and solar pumps on smallholder farmers in Robit kebele, Amhara region of Ethiopia.

METHODS AND MODEL SET-UP

A farm-level simulation model (FARMSIM) is used to analyze the potential economic impacts of water lifting technologies (WLT) tax exemption on household income and profitability in Robit kebele. FARMSIM is a Monte Carlo simulation model that quantitatively analyzes the economic and nutritional impacts of alternative farming technologies on small farms (Bizimana & Richardson, 2019). The model simulates and provides a five-year forecast for the current crop and livestock farming systems and an alternative farming system simultaneously.

Input data for FARMSIM comprises information on farm assets, liabilities, production costs, yields, output prices, and use of crops and livestock products for human consumption and livestock feed. For each input data, the user must provide information for the current (baseline) and the alternative farming systems (scenarios).

The study considered motor and solar pumps with a full tax exemption, which on average reduced the original cost (i.e. the cost before the tax law) by 40% (Table 1). The research framework strictly follows the model set-up from a previous study in Robit kebele analyzing the impacts of small-scale irrigation technologies on household income and nutrition (see Bizimana and Richardson, 2019). The major adjustment made to the model was the addition of price input reflecting the tax reduction on total cost of water lifting technologies (motor and solar pumps). It is assumed that the equipment is acquired through a loan (or credit) payable in a three-year period with an interest rate of 18 percent. The amount of loan, its interest rate and repayment period are all input into the model and simulated along other economic variables.

Table 1. Cost of pumps before and after-tax reduction, Robit

	Cost of pump before tax reduction (Birr)	Cost of pump after tax reduction (Birr)	Price reduction (Birr)
Motor pump	12,140	7,284	4,956
Solar pump	19,500	11,700	7,800

Note: Figures on costs of pumps before tax reduction are drawn from Bizimana & Richardson, 2019 but adjusted based on the current exchange rate 1 US\$ = 30 Birr prevailing in 2019.

SCENARIO ANALYSIS

Data input into FARMSIM are entered in parallel. For each input variable, the user must provide information for the current or baseline scenario and alternative farming system or alternative scenario. The baseline and alternative technology scenarios are simulated by FARMSIM using the same equations where the only difference in the economic and family nutrition outcomes are due to the technology differences.

To explore the potential economic impact of a tax reduction on water lifting technologies in Robit, the study analyzed five scenarios comprising a baseline and four alternative scenarios that involve motor and solar pumps with and without tax exemption. Seven food crops consisting of three cereals (maize, teff and millet), three vegetables (potatoes, tomatoes and cabbage), and one pulse (chickpeas), were considered. Moreover, two animal feeds (napier grass and fodder) were also included in the analysis. The livestock component of the model includes cattle, chicken, goats, and sheep. The scenarios analyzed are the following:

- Baseline: No or minimal irrigation
- Alt.1--MP: Motor pump with tax used in optimally irrigated systems
- Alt.2--MP-TaxEx: Motor pump with tax exemption used in optimally irrigated system
- Alt.3--SP: Solar pump with tax used in optimally irrigated systems
- Alt.4--SP-TaxEx: Solar pump with tax exemption used in optimally irrigated systems

The economic impacts of tariff reduction on water lifting technologies were evaluated using the net present value (NPV), benefit-cost ratio (B/C ratio) and the internal rate of return (IRR). The B/C ratio and IRR often used to carry out a cost benefit analysis (CBA) inform on the profitability and return on investment of new enterprise, in this case, irrigation technologies (motor and solar pumps) with or without tax exemption. The cost benefit analysis presents the probability distributions of the benefit-cost ratio (B/C ratio) and the internal rate of return (IRR) from 500 iterations (simulations) in FARMSIM to capture the risk of investment.

SIMULATION RESULTS AND DISCUSSION

For the five-year forecasting period, preliminary results on impact of tax exemption showed an increase in the NPV, B/C ratio and IRR under scenarios with equipment purchased free of tax in Robit kebele (Table 2). However, we do not see a significant change in the average profit.

The simulation results for the NPV, which assesses the long-term feasibility of an investment, indicate a positive NPV value for all the scenarios (including the baseline). In general, the NPV under the tax exemption scenarios for motor and solar pumps and optimal irrigation (Alt. 2 and Alt. 4) indicated superior performance compared to their counterparts with full tax application and the baseline (Table 2).

The household average annual net profit, on the other hand, did not vary among scenarios with the same type of WLT equipment but different tax policies. The increase in average profit from the baseline to the alternative scenarios were 189% and 115%, respectively for motor and solar pumps scenarios (Table 1).

Table 2. Economic impacts of tax exemption on irrigation technologies in Robit

	Baseline	Alt.1--MP	Alt.2--MP-TaxEx	Alt.3--SP	Alt.4--SP-TaxEx
Net present value (5 years) (Birr*)	80,309	152,204	156,365	118,090	124,772
Avg. annual net profit/family (Birr)	8,471	24,465	24,466	18,184	18,184
% change profit: Alt./Baseline**		189%	189%	115%	115%
Benefit-Cost Ratio: Alt/Baseline		3.2	4.2	1.5	2.3
Internal Rate of Return: Alt/Baseline		0.8	1.2	0.3	0.5

Note: *Birr = the Ethiopian currency, 1US\$ = 40 Birr.

**Alt/Baseline: Values are based on the present values of the difference between the alternative and baseline scenarios net profit.

To assess whether the benefits are worth the investment costs, a cost benefit analysis was conducted using two net present value-related metrics illustrated by the benefit cost ratio (B/R) and the internal rate of return (IRR). The two metrics inform on the feasibility and return on investments in small-scale irrigation technologies and other agricultural inputs under two different tax policies: a former policy with full tax and a new policy with tax exemption on agricultural equipment.

The cost benefit analysis results indicate on average B/C ratios ranging from 1.5 to 4.2 and greater than the threshold value of 1.0 (break-even) and IRR values ranging from 0.3 to 1.2 and greater than the discount rate of 0.1 (threshold value to break-even) for all irrigation technologies (solar and motor

pumps) with or without tax exemption (Table 2). This is an indication of the profitability of the alternative technologies (solar and motor pumps) compared to the baseline technology under the two tax policies.

Noticeably, the technologies with tax exemption (motor and solar pumps) have B/C ratios and IRR values greater than their counterpart values without tax exemption, showing the positive impact of the cost reduction on profitability and rate of return. Moreover, the full distribution of B/C and IRR values shows a zero probability of falling under their threshold values, indicating that these technologies have limited economic constraint and risk of a negative return in Robit (Figures 1 & 2). However, this risk appears to be higher for high-cost equipment (such as solar pump) than relatively low-cost equipment (e.g. motor pump) suggesting an increase in risk from left to right as we move from motor to solar pump sections on figures 1 and 2.

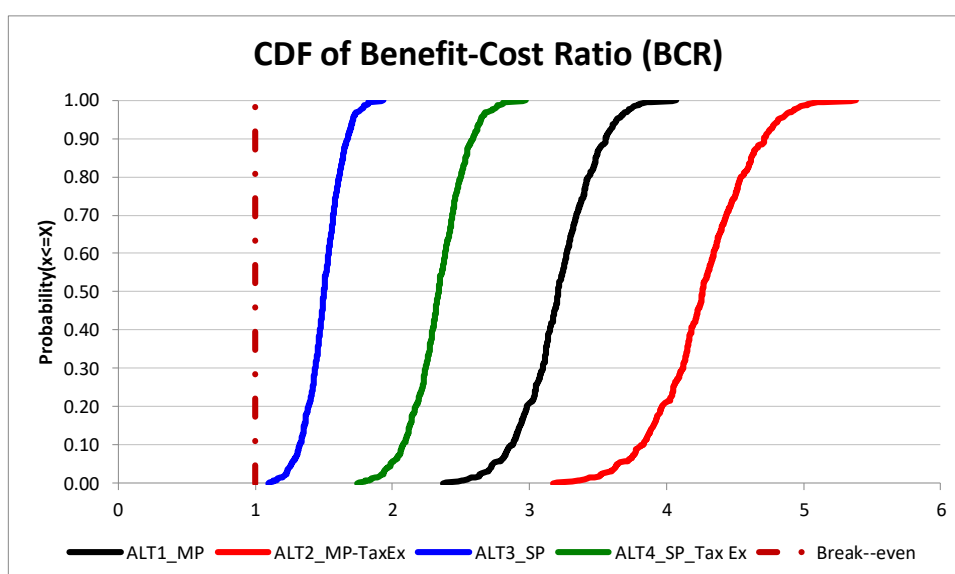


Figure 1: Probability distribution of benefit cost ratio for irrigation technologies, Robit

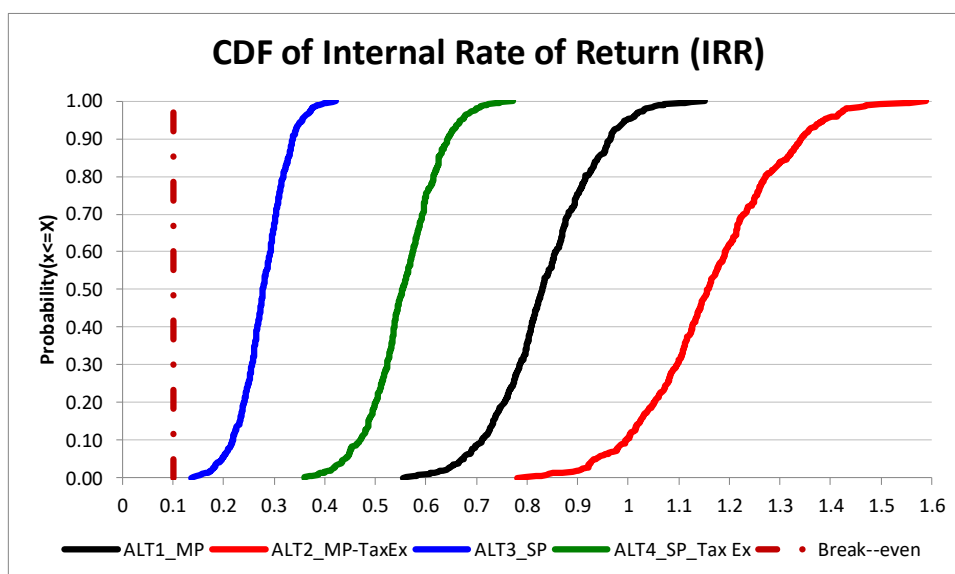


Figure 2: Probability distribution of internal rate of return for irrigation technologies, Robit

CONCLUSIONS AND RECOMMENDATIONS

The side-by-side comparison of alternative scenarios using small-scale irrigation water lifting technologies (motor and solar pumps) with and without an import tax exemption shows a high economic and profit potential for smallholder farmers in Robit kebele, Amhara region of Ethiopia. In fact, the reduction in cost of the irrigation technologies (tools and equipment) can have a positive impact on farmers ability to invest in the technology as the reduction in cost of the technology increases the feasibility of the enterprise. The other implication could be the increase in loan access from the banks or microfinance institutions to buy the technology as the reduction in amount borrowed reduces the uncertainty about the loan repayment. However more data collection and detailed analysis of the actual impacts of the tax exemption policy on agricultural equipment and input enacted by the Ethiopian government is recommended.

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