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Economic and environmental effects of reduction in smoking prevalence in Tanzania

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ABSTRACT

Background In Tanzania, strong tobacco control measures that would lead to a reduction in prevalence (consumption) have so far not been implemented due to concern about possible economic effects on gross domestic product and employment. The aim of this study is to analyse the economic effects of reducing tobacco consumption in Tanzania.

Methods The study uses computable general equilibrium (CGE) modelling to arrive at the effects of decreasing tobacco prevalence. A full-fledged global CGE model was developed, including comprehensive details on tobacco and tobacco products/sectors using the Global Trade Analysis Program-Environment model and database.

Results The results indicate that a 30% reduction in prevalence could lead to employment losses of about 20.8% in tobacco and 7.8% in the tobacco products sector. However, when compensated by increases in other sectors the overall decline in employment is only 0.5%. The decline in the economy as a whole is negligible at -0.3%.

Conclusion Initially, some assistance from the Tanzanian government may be needed for the displaced workers from the tobacco sector as a result of the decline in smoking prevalence. However, these results should be taken as a lower bound since the economic burden of diseases caused by tobacco may be far higher than the sectoral losses. The results do not include the health benefits of lower smoking prevalence. In addition, the revenues from higher taxes, as part of measures to decrease prevalence, would provide more fiscal space that can be used to finance assistance for displaced tobacco farmers and workers.

INTRODUCTION

Many countries hesitate to introduce strong tobacco control measures because they are concerned that the harm caused by tobacco may be offset by the economic benefits derived from growing, processing, manufacturing, exporting and taxing tobacco.¹ The argument that ‘tobacco contributes to revenues, jobs and incomes’ is a formidable barrier to tobacco control.² How large are the economic costs, and how large are the benefits from tobacco production, trade and consumption? To whom do the benefits accrue, and who bears the costs? Would tobacco control policies and interventions cause net economic losses? This paper is a limited attempt at exploring the economic effects on Tanzania of reducing tobacco consumption.

While the prevalence of current smoking declined globally from 23.5% in 2007 to 20.7% in 2015,³ it increased in Africa, from 13% to 15%, for the same

period and is projected to further increase by 2025. Tobacco prevalence among Tanzanian adults (aged 20–64 years) was 14.1% in 2012: 26.0% for males and 2.9% for females. Among youth aged 13–15 years, smoking prevalence was 2.2% for males and 1.1% for females based on the most recent survey in 2008.³ Smoking causes a huge economic burden to society; this effect is even more pronounced for a developing African country like Tanzania.¹

Although Tanzania signed and ratified the WHO Framework Convention on Tobacco Control (FCTC) in 2007, both tobacco production and consumption have continued to grow. Strong tobacco control policies which should accompany the FCTC, such as smoke-free policies, warning labels and advertising bans, continue to be absent or minimally applied. Taxes account for less than half of the WHO recommended levels needed to increase prices and decrease consumption.^{2,4}

The tobacco lobby has been particularly strong in emphasising the economic benefits of tobacco growing and producing tobacco products. It is therefore important to study the impact of decreased prevalence on employment, wages, land use and emissions from tobacco growing and cigarette production in Tanzania. Studies in this context are relatively limited. While economic logic itself may be persuasive, this paper has used computable general equilibrium (CGE) modelling to arrive at the effects of decreasing tobacco prevalence. CGE models provide us with economy wide perspectives. The CGE model demonstrates that effective substitutions of other products for tobacco would happen in response to a decline in prevalence, both at a sectoral level and an economy-wide level.

METHODS

CGE models are a class of economic models that can assess supply-chain effects, macroeconomic aspects, economy-wide equilibrium constraints, linkages between different sectors and countries as well as emission and land use effects of different commodities due to changes in policy, technology or other external factors. The CGE analysis here is based on the Global Trade Analysis Program-Environment (GTAP-E) model and database (see supplementary annex 2 for a description of the GTAP model), which is further augmented using country-specific data on tobacco crop and tobacco products, from various national and international data sources.

The intuition of CGE models is based on an input output structure where one single shock works its way through all inputs and prices to the outputs, employment, wages, prices, etc. Hence, it is a system of simultaneous equations based on factor and product markets. A shock is like a pendulum



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Table 1 Baseline information for tobacco control in Tanzania (2010)¹⁶

Variable	Raw tobacco	Tobacco products	Overall economy
Wage bill	US\$46.3 million	US\$97.9 million	US\$20 350 million
Emissions*	0.73 TCO ₂	3680 TCO ₂	5.43 MTCO ₂
Land use	US\$6.4 million	NA	US\$1647 million
Production	US\$90.3 million	US\$687 million	US\$68 907 million
Exports	US\$70.7 million	US\$15.9 million	US\$16 235 million

*Emissions refer to both consumption and production-induced emissions of carbon and other greenhouse gases.

Source: information collected during field research.

which swings through all markets till it reaches its stationary position again. The swing normally takes 3–5 years to reach a new equilibrium. Of course, several assumptions like static technology, imported products that are perfect substitutes for domestic products, are introduced and the results can only be considered as indicative. Nevertheless, they are a useful tool to guide policymakers.

The shock given to the CGE model is the reduction in consumption brought about by a 30% reduction in prevalence. The WHO Global Action Plan calls for a decrease of 30% between 2010 and 2025.⁵ This is consistent with the UN Sustainable Development Goals, which call for a one-third decrease in NCDs by 2030.⁶ Prevalence is defined as the ratio of people who consume tobacco and its products to the total population in a given country. Moreover, tobacco products here refers mainly to consumption of cigarettes and cigars as around 75% of tobacco leaves grown globally are used for cigarettes.⁷ However in Tanzania, tobacco products sector comprises all types of processed tobacco, such as cigarettes, bidis, cigars, chewing tobacco, etc. The 30% change in prevalence rate of tobacco and tobacco products translates to a 17.6% consumption shock estimated on the basis of elasticities and population growth as well as gross domestic product (GDP) growth (see supplementary annex 1 for the calculations). The model then simulates the effects of this shock, that is, the decrease in consumption, on most macroeconomic variables such as employment, production, prices, wages and exports.

RESULTS

The size of the Tobacco sector in the Tanzanian economy is shown in table 1. Together, raw tobacco and tobacco products form <1% of the value of total production in Tanzania's economy. Note that tax revenues from producing raw tobacco and tobacco products contributed <1% of total tax revenues of US\$7.6 billion in 2015/2016.⁸

The changes that occur after the consumption shock is introduced in the model are shown in table 2 (see supplementary annex 1 and 2 for the detailed description of the data, methodology and the model). Table 2 shows that the decline in output, exports, employment, wages, emissions and land use are much larger for raw tobacco production than for tobacco products, because of direct effects through decreased demand and indirect effects through decreased demand for tobacco products.

Production of tobacco products also declines as a result of reduction in domestic, import and export demand. This results in a reduction of employment and wages. On the other hand, it also leads to a reduction in emissions, due to reduced production. However, this has no direct implication for agricultural land use since the production of tobacco products does not use such land.

Table 2 Per cent changes in different variables due to prevalence reduction—CGE model

Variable	Raw tobacco	Tobacco products	Overall economy
Employment	– 20.3	– 7.8	– 0.5
Wages	–10.4	– 3.5	– 2.6
Emissions*	–22.1	–8.4	–0.7
Land use	– 18.2	NA	0.0
Output	–23.7	–10.1	–0.3
Export	–20.3	–14.8	1.3
Prices	9.8	24.3	2.6

*Emissions refer to both consumption and production-induced emissions of carbon and other greenhouse gases.

CGE, computable general equilibrium; NA, not available.

When output declines, so does demand for labour and wages. Emissions associated with raw tobacco and land use decrease substantially.⁹ We consider all the CO₂ emissions are generated by the production and consumption of tobacco and tobacco products. Land released from tobacco can be used by other crops as well as the forestry sector. Furthermore, deforestation as a result of tobacco cultivation would be reduced extensively. As this is a simulation exercise and projects to the future, it also refers to the land saved from tobacco cultivation if prevalence were to decrease. Thus, land which is already forested will not be deforested under the new equilibrium.

Production

Table 2 shows that while output of tobacco and tobacco products decline substantially, output of the overall economy declines only marginally, by 0.3% only. This shows that output in the other sectors would grow to compensate for the losses in the tobacco and tobacco products sectors.

As factors of production shift to other sectors, as shown in table 3, there are gains in most manufacturing and services sectors. Shifts depend on the input-output linkages between sectors, endowment constraints in the economy and consequent price changes in different sectors. So it is neither a completely proportionate shift nor do we assume neutrality.

The model results show that substantial gains are expected in minerals, vegetable oils, sugar, textiles, apparel, leather, wood products, paper and printing industries, chemicals, rubber and plastic products, all types of metals, non-metals and metal products, autos, electronics, machineries, other manufactures, transportation, financial intermediation, insurance, other business services, recreation and government services. Production would also increase in agro-based sectors, such as oilseeds (sesame, sunflower and groundnut, etc.), soy beans, copra, vegetables and fruits, nuts, potatoes, cassava, wheat, plant-based fibres (such as cotton, flax, hemp, sisal) and other crops such as live plants, cut flowers and flower buds, flower seeds and fruit seeds vegetable seeds.

These results were confirmed by studies on the Tanzanian economy. A survey by Wangwe *et al*¹⁰ of 50 emerging industrial enterprises in Tanzania during 2010–2012 highlighted that the most successful firms in terms of growth were in food processing, machinery and equipment, textiles and basic metals. Firms in sectors such as paper, electrical equipment and manufacture of basic metals had the highest rates of employment growth among new companies. These sectors are among the drivers of growth and employment in Tanzania.

However, sectors such as beverages, especially alcohol, other retail trade and some food products which accompany the diet

Table 3 Employment gains in the Tanzanian economy

Sectors	% Change
Other services (government)	2.08
Non-ferrous metals	1.25
Other manufacturing: includes recycling	1.11
Electronic equipment	0.96
Paper and paper products	0.95
Other transport equipment	0.87
Other machinery and equipment	0.87
Chemical rubber products	0.81
Plant fibres: cotton, flax, hemp, sisal	0.74
Other crops: live plants; cut flowers and flower buds	0.72
Iron and steel	0.67
Textiles	0.63
Insurance	0.51
Motor vehicles and parts	0.49
Leather	0.48
Sugar	0.42
Wood and products of wood	0.41
Vegetable oils	0.36
Water: collection, purification and distribution	0.36
Wheat	0.28
Other financial intermediation	0.18
Non-metallic minerals	0.10
Other business services	0.08
Recreation and other services	0.08
Other transport	0.05

and lifestyle of smokers would decline. Infrastructure-related sectors such as construction and utilities may take a slight hit, because of the overall decline in economic activity and investment which is high in tobacco and tobacco products.

Smallholders

Tobacco is mostly grown by smallholders under contract farming. Contract farming is a well-organised industry as it is controlled by multinationals. A reduction in tobacco production will have disproportionately adverse effects on these smallholders since they are mostly low-skilled workers. There are alternatives to tobacco, particularly since smallholders can also grow relatively small quantities of other crops such as maize. A recent study of the Tabora region of Tanzania, the main tobacco producing region of the country, found that the market value per unit of tobacco leaf is three times higher than that of maize in this area. The picture is however reversed when the cost of inputs, such as labour are included. Maize farmers have two crops per year as opposed to one for tobacco.¹¹ Governments seem to be reluctant to act against multinationals as the revenue and investment they bring are considered to be economically important. However, this paper shows that these alternatives can be explored without long-term economic damage.

Employment

The reduction in tobacco sector employment will not greatly affect overall agricultural production because land can be used by other agricultural sectors. Forest land also expands because land is released from tobacco cultivation. It should be noted that the assumptions in the model include fixed land resources which approximates the real-world situation.

The exact number of tobacco growers is difficult to estimate. However, government survey data estimate that Tanzania had

118 372 tobacco growers in 2014/2015.¹² In 2010, production of tobacco products contributed 7% of total manufacturing output.¹³ In terms of value added, raw tobacco forms about 20% while tobacco products constitute the remaining 80% of the tobacco sector. However, the raw tobacco sector is significant in terms of employment: about 32% of the employees in the tobacco sector are in tobacco farming, while the remaining 68% are in the tobacco products sector.

It is expected, according to GTAP results that employment in the raw tobacco sector would decline by about 20.3% and tobacco products sector by 7.8%, or around 43 000 and 20 000 jobs, respectively (table 2). While these declines are important they are not substantial since the gains in employment in other sectors (table 3) compensate for the losses in the tobacco sector. The net loss in the economy as a whole is only 0.5% (table 2). However, the tobacco industry also offers employment opportunities in input distribution, extension services and marketing activities, processing factories and in cigarette manufacturing and distribution. The GTAP model captures a great deal of these forward and backward linkages, given its comprehensive input-output-based structure. But all effects cannot be captured by the model.

Exports

Tobacco leaf is one of Tanzania's main exports and therefore boosts foreign exchange earnings. Raw tobacco accounted for approximately 7% of total export earnings in Tanzania in 2015.¹⁴ Despite the 20% decline in raw tobacco and 15% in tobacco product exports shown in table 2, total export earnings increase slightly, by about 1.3%. Expansion of export-oriented sectors in the economy contribute to foreign exchange earnings, and hence, substitute for earnings foregone from the decline in exports of raw tobacco and tobacco products.

This result is confirmed by WHO statistics. The share of tobacco leaf exports in total exports was 3.82% while cigarette exports accounted for 0.57% in 2012.¹⁵ The share of tobacco leaf and cigarette imports were <1.0% (0.08% and 0.09%, respectively).

With increased production, exports of non-mineral products, precious metal products, auto parts, textile products and sisal products are likely to increase. Thus, the projected decrease in tobacco exports would be compensated for by increases in other sectors (table 2). Exports of traditional agricultural exports (which include coffee, cotton, tea, cashews, cloves and sisal) have declined in Tanzania, accounting for only 20% of total merchandise exported in 2006 compared with 55% in 1996.⁹ These exports could take the place of reduced tobacco and tobacco products exports. Although the horticultural sector (vegetables, fruit and cut flowers) has shown strong growth rates of 6%–10% annually and has been increasing the country's export earnings, its share is still very small.¹⁶ Hence, there is scope for expanding the share of horticultural exports.

Land use

Tanzania is among the larger tobacco leaf growing countries, ranked 4th in Africa and 12th overall in 2015. Tobacco production was five times higher in 2015 compared with 2001.¹⁷ From table 1, we can observe that tobacco cultivation employs about 0.4% of the total land value in the economy, equivalent to US\$6.4 million. This is the maximum extent of forestlands that would have existed if tobacco had never been cultivated. So decreased land use would release US\$1.16 million according to the model. This amounts to about 0.2% more forest land cover in value terms. Exports of products made from forests increase by >0.8%.

As for the land released from tobacco production, it may be used for other crops as well as the forestry sector. As this is a simulation exercise and projects to the future, it also refers to the land saved from tobacco cultivation if prevalence were to decrease. Thus, land which is already forested will not be deforested under the new equilibrium.

Another noteworthy finding from our analysis is that the use of forestry products in the tobacco sector falls, owing to the reduction of tobacco output. This is in line with our expectation as wood for flue-curing in the tobacco sector leads to extensive deforestation. Therefore, tobacco control has a great positive effect on reforestation as evidenced by increased land in the forestry sector as well as reduced use of forestry products in producing tobacco.

DISCUSSION

At first sight, the results of the computable general equilibrium analysis show that implementation of a 30% reduction in prevalence leads to losses in employment in tobacco sector. However, such losses will be broadly compensated by absorption of labour in other expanding sectors, both from the demand and supply sides. The crops that are likely to gain due to the release of factors of production from tobacco cultivation include: rice, wheat, vegetables and fruits, oilseeds, plant-based fibres and other crops. Many of these crops have immense commercial value in terms of further processing. While some are inputs to the food processing sector, others like fibres and oilseeds may also be employed for higher value added products such as textiles, apparel and bio-fuels. Therefore, they can add more value to the economy domestically as well as internationally, due to a greater ability to export these products to other countries. In addition, it will help the economy to diversify and move up the value chain. Several manufacturing and services sectors gain from reduction in tobacco consumption, but some of them such as beverages, some food products, construction, utilities and retail trade lose because of complementarities with tobacco sectors and an overall slump in the economy, given the static economic structure in CGE models.

Diversification In the agricultural sector placed within broader rural development programmes can help meet the transition costs of the poorest farmers. Ultimately, the most effective policy may be to focus on reducing the demand for tobacco, and to allow supply to respond to changes in demand. Assistance may be required in training displaced workers in alternative sectors as well as in alternative forms of employment. Some of the increased tax revenue from higher taxes as part of the policies to reduce prevalence could be directed to alternative cultivation through agriculture extension services, training for services and other forms of industrial production.

Since economy-wide employment falls by <1% and emissions also are reduced by the same amount, we also see an increase in forestland, implying the reduction of deforestation and potential increase of afforestation. The most visible effect is the decrease in real wages, which could be compensated by increased expenditure by the government in retraining workers to work in other sectors of the economy. In the first instance, some assistance may also need to be provided to the displaced workers from the tobacco sector.

While our results stand on a reliable social accounting matrix and a comprehensive CGE model, this study has some limitations. First, it does not incorporate the health benefits of controlling tobacco, which implies that our negative economic results must be taken as a lower bound, since the health benefits would have mitigated some losses. Second, we assume that there is a reduction in prevalence. The 30% decrease in prevalence

can only be achieved with large increases in taxation rates, along with other tobacco control measures.

The economic burden of diseases caused by tobacco may be far higher than the economic losses shown by the CGE modelling. An estimated 5.7% of global health expenditure, or 1.8% of global GDP, including lost productivity, was spent on tobacco-related diseases in 2012.¹⁸ In high-income countries, lifetime healthcare costs are greater for smokers than non-smokers, even taking into account their shorter lives.¹⁹ There are no recent costs of smoking estimates for African countries. A study in South Africa found that direct and indirect costs amounted to almost 1% of GDP in 1988.²⁰ The documentation of the economic gains arising from decreased tobacco prevalence was however beyond the scope of this study.

Last but not the least, we do not attempt to calculate any productivity increase that might arise, for example, by an improvement of soil quality that may have deteriorated due to the toxicity of tobacco. In reality, there would be increase in yields and productivity, which in turn means the effects would be more positive than our predictions.

Therefore, on balance, effective tobacco control policies consistent with the FCTC can be implemented with minimal, if any, damage to the economy.

What this paper adds

- ▶ A few previous studies have advocated tobacco excise tax increases large enough to increase prices in order to cause a decline of demand for tobacco in Tanzania.
- ▶ Some studies have also highlighted the impact of tobacco production on deforestation in some of the main tobacco producing districts in Tanzania.
- ▶ There are no studies that have analysed the overall economic impact of tobacco control interventions in Tanzania.
- ▶ This study uses a computable general equilibrium (CGE) model of Tanzania to analyse the impact of decreased prevalence on sectoral employment, wages, land use and emissions from tobacco growing and cigarette production.
- ▶ The results show that an effective tobacco control policy can be implemented with minimal damage to the Tanzanian economy due to increases in non-tobacco sectors.

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REFERENCES

- 1 Kidane A, Mduma J, Naho A, *et al.* The demand for cigarettes in Tanzania and implications for tobacco taxation policy. *Adv Econ Bus* 2015;3:428–35.

- 2 Jha P, Musgrove P, Chaloupka F, *et al.* The Economic Rationale for Intervention in Tobacco Markets. In: Jha P, Chaloupka F, eds. *Tobacco Control in Developing Countries*. OUP, 2000:153–74.
- 3 WHO. *WHO Report on the Global Tobacco Epidemic, 2017: Monitoring tobacco use and prevention policies*. Geneva: World Health Organization, 2017.
- 4 WHO. Tobacco free initiative factsheet: united republic of tanzania, tobacco, agriculture and trade. <http://www.who.int/tobacco/country-fact-sheets/tza.pdf> (accessed 31 May 2018).
- 5 WHO Global Action Plan for the prevention and control of noncommunicable diseases 2013–2020. http://www.who.int/nmh/events/ncd_action_plan/en/ (accessed 13 May 2018).
- 6 UN Sustainable Development Goals. *UN Sustainable Development Summit 2015*. UN HQ, New York City. <http://www.who.int/mediacentre/events/meetings/2015/un-sustainable-development-summit/en/>. (accessed 31 May 2018).
- 7 Perucic AM. *Presentation: TobTax Capacity Building Workshop 20-22 February 2012*. Dublin, Ireland. http://www.who.int/tobacco/economics/meetings/dublin_demand_for_tob_feb2012.pdf.
- 8 Tanzania National Bureau of Statistics, Ministry of Finance and Planning, 2017. Tax statistics report 2015/16 tanzania mainland https://nbs.go.tz/nbs/takwimu/Tax/Tax_Statistics_Report%20_2015_16_Tanzania_Mainland.pdf.
- 9 Wolter D. Tanzania: the challenge of moving from subsistence to profit. *OECD Journal: General Papers* (accessed online 25 Oct 2017).
- 10 Wangwe S, Mmari D, Aikaeli J, *et al.* *The Performance of the Manufacturing Sector in Tanzania Challenges and the Way Forward*. Helsinki: WIDER Working Paper UNU-WIDER, 2014.
- 11 Kidane A, Ngeh ET. A comparative analysis of technical efficiency of smallholder tobacco and maize farmers in Tabora, Tanzania. *J Dev Agric Econ* 2015;7:72–9.
- 12 Tanzania National Bureau of Statistics., 2016. The united republic of tanzania 2014/15 annual agriculture sample survey report http://nbs.go.tz/nbs/takwimu/Agriculture/Annual_Agricultural_Sample_Survey_Report2014_15.pdf (accessed 25 Jun 2018).
- 13 UNIDO. *Tanzania Industrial Competitiveness Report 2012*. Vienna: United Nations Industrial Development Organization, 2012. <https://open.unido.org/api/documents/5096380/download/TANZANIA%20INDUSTRIAL%20COMPETITIVENESS%20REPORT%202012>. (accessed 15 Jun 2018).
- 14 Bank of Tanzania, 2016. Monthly economic review www.bot.go.tz/Publications/MonthlyEconomicReviews/MER%20April%202016.pdf (accessed 25 Oct 2017).
- 15 WHO and UNCTAD, 2015. Status of tobacco production and trade in africa, factsheets <http://www.who.int/tobacco/publications/industry/trade/status-production-africa-factsheets/en/> (accessed online 20 Oct 2017).
- 16 Tanzania Horticultural Development Strategy 2012– 2021. <https://www.google.ch/search?q=Tanzania+Horticultural+Development+Strategy+2012+2021&oq=Tanzania+Horticultural+Development+Strategy+2012+2021&aqs=chrome.69i57.1694j0j7&sourceid=chrome&ie=UTF-8>.
- 17 FAO. FAOSTAT data on production. <http://www.fao.org/faostat/en/#data> (accessed on 25 Jul 2018).
- 18 World Health Organization. Chapter 3: The Economic Costs of Tobacco Use, With a Focus on Low- and Middle-Income Countries. *The Economics of Tobacco and Tobacco Control – NCI Tobacco Control Monograph 21*. Bethesda, MD: U.S. Department of Health and Human Services, National Institutes of Health, National Cancer Institute; and Geneva, CH: World Health Organization, 2017;73:107.
- 19 Goodchild M, Nargis N, Tursan d'Espaignet E. Global economic cost of smoking-attributable diseases. *Tob Control* 2018;27:58–64.
- 20 McIntyre DE, Taylor SP. Economic aspects of smoking in South Africa. *S Afr Med J* 1989;75:432–5.