



Research article

Examining the effectiveness of dissuasive taxes as a policy tool for reducing tobacco and alcohol consumption in Cameroon: A welfare and microsimulation analysis

Paul Tadzong Mouafo^a, Hilaire Nkengfack^b, Rodrigue Nobosse Tchoffo^c,
Nelson Derrick Nguepi^{d,*}, Edmond Noubissi Domguia^a

^a University of Dschang, Centre de Recherche de Management et d'Economie (CERME), Dschang, Cameroon

^b University of Dschang, Faculty of Economics and Management, Dschang, Cameroon

^c University of Dschang, Groupe de Recherche en Economie Appliquée et Développement (GREAD), Dschang, Cameroon

^d Université catholique de Louvain, Economics School of Louvain (Belgium), University of Dschang, Groupe de Recherche en Economie Appliquée et Développement (GREAD), Dschang, Cameroon

ARTICLE INFO

JEL classification:

Jel code: H22

I32

I28

Keywords:

Dissuasive taxes

Well-being

poverty

Inequality

CGE

ABSTRACT

Deterrent taxes are a crucial policy tool for reducing the consumption of harmful products like tobacco and alcohol. However, assessing dissuasive taxes impact different income groups is important to ensure that their burden is not disproportionately borne by low-income households. This study examines the effectiveness of deterrent taxes as an economic policy tool for reducing tobacco and alcohol consumption in Cameroon. We analyse the impact on household welfare and distributional effects using microsimulation analysis. The data come from the Cameroon Household Living Conditions Survey and the 2022 tax records. Our methodology is based on a dynamic computable general equilibrium (CGE) model enriched with an addiction model. The results indicate that deterrent taxes can significantly reduce the consumption of these harmful products but also have regressive effects on low-income households. In response, we recommend the adoption of a progressive tax structure and the establishment of targeted support programmes to mitigate the negative impact on vulnerable populations.

1. Introduction

Tobacco and alcohol consumption in Cameroon pose significant health, economic, and social burdens. Over 18 % of Cameroonians aged 15 and above smoke daily, leading to approximately 24,000 deaths annually ([1]). Excessive alcohol consumption affects 15 % of adults, resulting in an estimated 15,000 deaths each year ([2,3]). Not only do these substances have devastating consequences for individual health, but they also strain families and communities. Households with addicted members face increased healthcare costs, food insecurity, and domestic violence ([4]). Additionally, tobacco and alcohol abuse impact the national economy by leading to lost productivity and economic losses estimated at over \$2 billion annually ([5]).

Beyond individual health and economic impacts, tobacco and alcohol abuse erode social cohesion. Strained relationships and

* Corresponding author.

E-mail addresses: paul.tadzong@univ-dschang.org (P.T. Mouafo), hilaire.nkengfack@univ-dschang.org (H. Nkengfack), r_tchhoffo@yahoo.fr (R.N. Tchoffo), nelsonngueps2@gmail.com (N.D. Nguepi), enoubissidomguia@yahoo.fr (E.N. Domguia).

<https://doi.org/10.1016/j.heliyon.2024.e40174>

Received 4 August 2024; Received in revised form 31 October 2024; Accepted 5 November 2024

Available online 6 November 2024

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domestic violence are common in households where substance abuse is present. Studies have shown that the rate of domestic violence doubles in households with alcohol-dependent members, and children in tobacco-using households are more susceptible to psychological distress and emotional abuse ([6]). These findings highlight the multifaceted nature of the problem, emphasizing that addressing addiction requires a comprehensive approach that considers not only individual behavior but also underlying social and economic factors.

While awareness campaigns and rehabilitation programs [7] play a crucial role in addressing addiction, global research suggests that a comprehensive approach is necessary. This includes implementing dissuasive taxes, which have been shown to be effective in reducing consumption in various countries ([8–10]). These levies aim to directly curb consumption by increasing the price of tobacco and alcohol, making them less accessible and incentivizing healthier choices ([11,12]). However, the effectiveness of this weapon remains a complex and nuanced question. Moreover, the effectiveness of deterrent taxes as an economic policy tool for reducing tobacco and alcohol consumption can also be considered in relation to financial technologies that can quantify the impact upon individual and public health ([13–15]). Worldwide studies have yielded mixed results, with factors such as tax design [16], enforcement, and cultural context [17] playing significant roles [17].

To shed light on the specific context of Cameroon, a nation with immense public health and economic burdens of these addictive substances ([18]), this research investigates the effectiveness of dissuasive taxes in reducing tobacco and alcohol consumption. By examining existing data, exploring consumer behavior, and considering the unique socioeconomic landscape of Cameroon, this research aims to provide policymakers with valuable insights into the potential impact and optimal design of dissuasive taxes in the fight against addiction.

Although a vast body of research, including recent meta-analyses and systematic reviews, confirms the effectiveness of dissuasive taxes in curbing tobacco and alcohol consumption through price increases, studies by ([19–21]), provide further insights into the potential benefits of these policies [19]. examined the relationship between smoking bans, cigarette prices, and life satisfaction, highlighting the non-health benefits of tobacco control [20]. analyzed alcohol excise taxes in OECD countries, offering data on taxation levels and their impact on alcohol consumption [21]. evaluated the effectiveness of tobacco control policies globally, providing a comprehensive overview of international efforts. These studies collectively support the notion that dissuasive taxes can be a valuable tool in reducing tobacco and alcohol consumption. Microsimulation studies ([22,23]) reveal that lower-income groups, which are more price sensitive, may experience disproportionate welfare reductions despite smaller consumption changes ([24]). Dynamic models suggest long-term benefits beyond immediate reductions, such as preventing youth initiation, delaying dependence onset, and even achieving long-term abstinence, leading to improved health outcomes and reduced healthcare costs ([25,26]). However, fully assessing their potential in settings such as Cameroon, which has significant informal markets, necessitates robust microsimulation tools and targeted research on welfare in developing countries ([27–29]). Only by embracing the complexities of how these taxes work across diverse contexts can we craft effective policies that prioritize both public health and individual well-being ([30]).

This existing research acknowledges the complexities of informal markets in settings such as Cameroon ([25]), and contextual factors such as cultural norms, beliefs, and social dynamics remain understudied in the context of dissuasive taxes and their impact on consumption patterns ([27]). This gap is particularly evident in developing countries, where poverty and income inequality add further layers of complexity ([28]). This work contributes to the literature in four main ways.

First, while studies such as [25,31] acknowledge the potential for disproportionate impacts on lower-income groups due to price sensitivity, understanding the true extent and nuances of this impact in developing countries such as Cameroon remains a critical research gap. We need targeted research that goes beyond national averages and investigates in greater detail the specific vulnerabilities and coping mechanisms of different socioeconomic groups within Cameroon. This research should explore alternative tax structures, exemptions, and mitigation strategies specifically tailored to the Cameroonian context. For instance, investigating targeted subsidies for essential goods alongside tax increases could help mitigate potential welfare losses for vulnerable populations ([32]). Additionally, we explore progressive tax structures that place a heavier burden on higher-income groups to enhance equity and effectiveness ([33]). This work prioritizes context-specific solutions, and we can ensure policy effectiveness in curbing addiction while minimizing negative welfare impacts ([29]).

Second, existing microsimulation models have proven valuable in assessing the impact of dissuasive taxes in formal economies ([34]), and their application to contexts such as Cameroon, characterized by significant informal markets, necessitates context-specific adaptations. Current models often struggle to capture the fluid dynamics and limited data availability inherent to informal sectors, leading to potential misinterpretations of policy impacts ([27]). Therefore, we develop tailored microsimulation tools that incorporate the unique characteristics of Cameroon's informal sector, which is crucial for reliable and nuanced policy assessments. This approach incorporates insight from diverse sources, including national surveys and administrative data. Leveraging existing data resources, such as the Cameroonian National Survey of Household Living Conditions (Enquête sur les Conditions de Vie des Ménages au Cameroun) and tax records, can provide valuable insights into economic activity and consumption patterns, even within the informal sector ([35]). Additionally, we incorporate agent-based modeling techniques that can simulate the dynamic interactions and adaptive behaviors of individuals within the informal sector, leading to a more realistic representation of its complex nature ([36]).

Third, the economic and social implications of dissuasive taxes extend far beyond immediate changes in consumption, demanding a nuanced understanding of their spillover effects in contexts such as Cameroon. While increased healthcare revenue generated by these taxes offers a clear benefit ([29]), exploring potential negative impacts such as job losses in informal markets, is crucial for crafting balanced and sustainable policies ([37]). Investigating both positive and negative spillover effects requires comprehensive research on increased government revenue. Taxes on tobacco and alcohol can generate substantial revenue for governments, which can be directed towards essential public services such as healthcare, education, and infrastructure ([33]). Quantifying the potential revenue increase in Cameroon and its allocation to specific services will inform resource allocation decisions. Moreover, reduced tobacco and alcohol

consumption can lead to a healthier and more productive workforce, potentially boosting economic growth ([38]). Estimating the potential productivity gains in Cameroon would strengthen the economic case for these taxes. Finally, studies suggest that alcohol and tobacco use are associated with increased crime rates ([39,40]). Reduced consumption could lead to safer communities ([41]). Exploring this potential benefit in Cameroon's context would add another layer to policy considerations.

On the other hand, increased prices due to dissuasive taxes might lead to reduced demand for goods and services sold in informal markets, potentially impacting employment ([27]). Assessing potential job losses in different sectors of Cameroon's informal economy is crucial for mitigating negative consequences. Moreover, higher taxes can incentivize illicit cross-border trade and the smuggling of tobacco and alcohol products, undermining the effectiveness of the policies and potentially leading to safety concerns ([42]). Investigating the potential for smuggling in Cameroon and designing countermeasures are essential. Finally, increased production costs due to taxes could affect small businesses involved in the tobacco and alcohol industries in Cameroon. Evaluating the potential impact on these businesses and designing mitigation strategies are important to ensure a balanced approach.

The broader economic and social impacts of dissuasive taxes extend beyond immediate consumption changes. While increased healthcare revenue from these taxes presents a positive outcome, potential negative effects such as, job losses in informal markets must also be considered. We need comprehensive research that explores both the positive and negative spillover effects of these taxes in the specific context of Cameroon. This will enable policymakers to craft balanced and sustainable policies that prioritize both public health goals and overall economic and social well-being. ([43]).

The rest of this article is organized as follows: Section 2 provides a detailed review of the literature, while section 3 explains the method used. The results and discussion are given in section 4, and section 5 concludes.

2. Literature review

2.1. Theoretical underpinning

The pernicious effects of tobacco consumption extend far beyond individual health, casting a long shadow on socioeconomic well-being and societal prosperity ([29]). In Cameroon, its grip is deeper, potentially exacerbating poverty and hindering welfare improvement ([44]). To effectively address this challenge, we must delve into the intricate link between tobacco use, economic hardship, and poverty reduction efforts. This necessitates a multifaceted approach that considers both the rational and irrational forces shaping individual choices.

On the one hand, rational addiction models, grounded in the principles of expected utility theory, propose that individuals make calculated decisions ([45]). Consumers weigh the expected utility of tobacco use against its costs, including monetary expenses and potential health risks ([46]). This framework suggests that excising taxes by increasing prices and reducing expected utility, should lead to a predicted decrease in demand ([47]). However, reality is often more nuanced. Intertemporal choices complicate matters, where discounting rates and self-control issues can blur the lines, making immediate gratification outweigh future health considerations ([48]). Additionally, imperfect information can hinder truly rational decision-making, as individuals may underestimate the long-term health risks associated with tobacco use ([49]). Furthermore, cognitive biases such as present bias and optimism bias can further skew decision-making processes ([50]).

On the other hand, irrational addiction theories acknowledge the powerful influence of impulsivity and cognitive biases that may undermine rational decision-making. Hyperbolic discounting prioritizes immediate pleasure over long-term consequences, making even individuals aware of health risks struggle to resist the urge to use tobacco ([51]). Prospect theory adds another layer, highlighting the amplified loss aversion associated with quitting, making the perceived pain of giving up outweigh the anticipated health gains ([52–54]). Further complicating matters, habit formation creates neural pathways that reinforce addictive behavior, pushing individuals toward automatic consumption beyond purely rational choices ([55]).

2.2. Revisiting tobacco and alcohol excise taxes: nuances and recent evidence

The impact of tobacco control policies ([56]), mainly taxes ([57]), on welfare ([58]), poverty ([59]), and inequality (Smith et al., 2021) is a complex and dynamic issue with significant social and economic ramifications. While these policies aim to improve public health by discouraging tobacco use, potential unintended consequences can arise, particularly for vulnerable populations.

❖ Positive impacts

Price remains a powerful lever in influencing consumer behavior, and tobacco taxes exemplify this principle effectively. Studies by Refs. [47,60], and [61] demonstrate that increased taxes through price hikes translate to decreased affordability, particularly among price-sensitive individuals in low- and middle-income countries. This translates to a significant decrease in demand, with [60] finding a 10 % price increase leading to a 4 % decrease in demand.

A positive chain reaction does not stop at a mere reduction in consumption. Lower tobacco use directly correlates with improved health outcomes, as evidenced by the [1] report highlighting decreased rates of heart disease, cancer, and respiratory illnesses. Moreover, research by Ref. [62] provide a promising picture, estimating that a 50 % increase in tobacco taxes could prevent a staggering 45 million premature deaths globally by 2050.

The benefits extend beyond individual well-being and impact society at large. By curbing tobacco-related illnesses, the healthcare burden on individuals and healthcare systems decreases significantly. [63], in a study in China, demonstrated this connection, finding

that higher cigarette taxes led to substantial healthcare cost savings, freeing up valuable resources for other crucial areas.

Tobacco taxes are not just about deterring consumption; they also generate significant revenue for governments worldwide. According to the [29], these taxes amassed a staggering \$266 billion in 2017 alone, representing a substantial resource for positive social change. The potential does not stop there. Research by Ref. [64] suggests that this figure continues to grow, offering an even greater opportunity to invest in the well-being of citizens.

However, the true power lies in how this revenue is utilized. Instead of simply adding to general funds, studies highlight the transformative potential of earmarking it for critical social programs. A study by Ref. [9] in the Philippines demonstrated this impact first. By dedicating tobacco tax revenue to healthcare, they observed a remarkable increase in healthcare utilization and improved health outcomes, particularly among underserved communities. This shift not only addresses the health consequences of tobacco use but also empowers individuals through improved access to vital services.

The benefits extend beyond healthcare [65]. argue that investing in social programs such as education and social safety nets can uplift lower-income families and contribute to poverty reduction. By directing tobacco tax revenue towards these areas, we can create a more equitable society where everyone has the chance to thrive. This approach addresses the potential regressive impact of tobacco taxes, ensuring that the benefits extend beyond deterring consumption and truly contribute to building a fairer future for all.

The benefits of tobacco control extend far beyond improved public health and reduced healthcare costs. Studies reveal a ripple effect impacting individual productivity and even fostering job creation in diverse sectors. The [66] highlights that reduced tobacco use translates to boost individual productivity. This means fewer instances of absenteeism, presenteeism (working while sick), and early retirement, leading to a more engaged and productive workforce. Individuals who quit smoking experience improvements in physical and mental health, resulting in better focus, concentration, and energy levels at work.

Furthermore, as tobacco use declines, resources and workforce capacities shift, creating new employment opportunities in other sectors ([9]) [67]. observed a prime example in Brazil, where a smoking ban in workplaces led to increased employment in the service sector. This suggests that as resources previously spent on tobacco are redirected, they can stimulate other areas of the economy, potentially creating jobs in sectors such as hospitality, leisure, and healthcare.

This potential for job creation is particularly critical in low- and middle-income countries, where economic opportunities are often limited. By transitioning resources away from tobacco and towards other sectors, tobacco control policies can contribute to economic growth and development, creating a virtuous cycle of improved health, increased productivity, and new job opportunities.

It is crucial to remember that these positive impacts are not guaranteed and require careful policy design and implementation. Addressing potential negative consequences, such as the regressive effect on low-income populations and black-market proliferation is vital for a truly equitable and effective approach to tobacco control.

❖ Potential negative impacts:

While the benefits of tobacco control policies are numerous, it is crucial to acknowledge and address potential unintended consequences. One major concern is the regressive effect on low-income populations. Since poorer households often dedicate a larger share of their income to tobacco, increased taxes can disproportionately impact their finances, potentially exacerbating poverty ([68]). This raises serious concerns about equity and necessitates the implementation of mitigating measures such as targeted welfare programs or tax exemptions for low-income individuals to safeguard their access to essential needs.

Another potential drawback is the reduction in access to essential goods. If not carefully addressed, decreased disposable income due to tobacco taxes could force families to cut back on necessities such as food and healthcare ([69]). This can negatively impact their overall well-being and potentially widen existing inequalities. To avoid this outcome, policymakers must consider accompanying measures such as income support programs or subsidized access to essential goods to ensure that the policy does not inadvertently harm vulnerable populations.

Furthermore, high tobacco taxes might incentivize the proliferation of black markets, benefiting criminal groups and undermining intended revenue generation ([9]). This not only reduces the financial benefit of the policy but also poses security risks and potentially exposes consumers to unregulated and potentially dangerous tobacco products. Addressing this challenge requires strengthening enforcement measures, tackling smuggling routes, and raising public awareness about the dangers of black-market tobacco.

While acknowledging the potential challenges of tobacco control policies, it is equally important to highlight effective strategies for mitigating them and ensuring a just and equitable approach. First, targeted welfare programs implemented alongside tax increases can buffer the financial burden on low-income families. Study by Ref. [70] support this, demonstrating how targeted programs can offset the impact of taxes, ensuring access to essential needs and protecting these families from falling deeper into poverty. This can involve direct cash transfers, subsidized access to groceries or healthcare, or other forms of social assistance tailored to their specific needs.

Second, earmarking tax revenue generated from tobacco taxes for social programs such as healthcare, education, and poverty reduction initiatives offers direct benefits to vulnerable populations. This approach, as highlighted by Ref. [60], promotes a more equitable distribution of resources, channeling funds back toward the communities most impacted by tobacco-related health issues and economic hardships. By investing in these areas, we can empower individuals and break the cycle of poverty, ultimately contributing to a more just and thriving society.

Third, implementing progressive tax structures can further mitigate the regressive impact on lower-income groups. This involves designing a tax system where tax rates increase as income levels rise. Research by Ref. [71] suggests that such structures can effectively reduce the burden on the poorest people while still achieving desired public health goals. This ensures that those with greater financial means contribute proportionally more, promoting fairness and social responsibility within the policy framework.

Finally, combating black market trade is crucial for maximizing the effectiveness and ethical implications of tobacco control

policies. Strengthening enforcement measures to curb smuggling and raising public awareness about the dangers of black-market tobacco products are key steps, as emphasized by Ref. [9]. Additionally, addressing the root causes of black-market proliferation, such as poverty and lack of economic opportunities can create a more sustainable solution and prevent criminal groups from exploiting vulnerable communities.

Tobacco control policies have the potential to improve public health, generate revenue for social programs, and contribute to poverty reduction. However, concerns about exacerbating existing inequalities require careful consideration. By implementing comprehensive strategies such as targeted welfare programs, progressive tax structures, and robust enforcement against black markets, we can strive for a more equitable approach that maximizes the benefits of tobacco control policies while minimizing potential harm to vulnerable populations.

❖ Research gap

While the provided literature review highlights the potential of tobacco taxes in reducing consumption, improving health outcomes and generating revenue for social programs, there are still several research gaps worth exploring.

2.2.1. Long-term impact on consumption and health

While existing research sheds light on the immediate benefits of tobacco taxes in reducing consumption and improving health (e.g., Ref. [72]), understanding their long-term effects remains crucial. Further studies are needed to explore how consumption patterns, health outcomes, and individual behaviors evolve over time in response to sustained tax increases. This deeper understanding can inform policy decisions and ensure long-term public health gains, as emphasized by ([73]) in their call for a global response to address unhealthy consumption patterns through taxation.

Furthermore, investigating the differential impacts of tobacco taxes across diverse populations is essential. Analysing how consumption and health outcomes vary among socioeconomic groups, genders, and age cohorts can reveal potential disparities, as highlighted by Ref. [74] in their discussion of macroeconomic policies for healthier populations. For example, understanding how low-income families are affected by tobacco taxes compared to higher-income groups can inform the design of effective mitigation strategies, ensuring equity in their impact (e.g., Ref. [75]).

2.2.2. Equity and mitigating strategies

Although the potential regressive impact of tobacco taxes on low-income populations has been recognized ([76]), more research is needed to evaluate the effectiveness and ethical considerations of various mitigation strategies. Understanding the long-term impacts of policies such as targeted welfare programs, progressive tax structures, and subsidized access to essential goods is crucial to ensuring that they truly help offset the financial burden for vulnerable groups ([75]). Studies like ([77]) highlight that well-designed mitigation strategies can promote equity in tobacco control policies.

Beyond effectiveness, exploring the ethical implications of these strategies is equally important. Transparency in targeting beneficiaries, ensuring sustainable funding mechanisms, and avoiding the creation of unintended consequences, such as dependency on welfare programs, are paramount (e.g., Ref. [78]). By prioritizing ethical considerations alongside effectiveness, we can ensure that mitigating strategies truly promote equity and justice in tobacco control policies.

Further research can shed light on the optimal design of these strategies, considering factors such as cultural contexts ([79]), local economic realities ([80]), and potential unintended consequences. Ultimately, the goal is to create a multifaceted approach that effectively reduces tobacco use while ensuring a just and equitable distribution of both the potential benefits and burdens across all socioeconomic groups.

2.2.3. Black market trade and enforcement

While tobacco taxes can effectively deter consumption, the emergence of a black market poses a significant challenge. To optimize policy effectiveness and ensure public health gains, further research is crucial to understand the dynamics of black-market trade in response to these taxes.

First, a deeper understanding of the actors involved is essential. Exploring the involvement of criminal groups, smuggling routes, and their modus operandi can inform targeted enforcement strategies and disrupt their activities. Studies such as [9] highlight the complexity of these networks, emphasizing the need for international collaboration and information sharing to effectively dismantle them.

Second, investigating consumer motivations for purchasing illegal tobacco is crucial. Are they driven purely by price? Do cultural factors or lack of awareness play a role? Understanding these motivations can inform targeted interventions and communication campaigns to discourage black market purchases [81]. suggested that perceived risks and social norms influence consumer behavior, indicating the potential of interventions addressing these aspects.

Third, evaluating the effectiveness of different enforcement measures implemented to curb black market trade is vital. Examining the impact of increased border security, stricter penalties, and track-and-trace systems can guide policy decisions and resource allocation. A study by Ref. [82] revealed that increased enforcement efforts in Turkey led to a decline in the illegal tobacco trade, demonstrating the potential effectiveness of such measures.

Finally, exploring innovative approaches to combat black market proliferation is vital. This could involve technological solutions such as blockchain-based tracking systems, partnerships with communities to report illegal activity, or harm reduction strategies aimed at steering consumers towards safer alternatives. Studies such as those by Ref. [83] exploring alternative nicotine delivery

systems offer insights into potential harm reduction approaches.

By delving deeper into the dynamics of the black-market tobacco trade, evaluating existing measures, and exploring innovative solutions, we can effectively address this challenge and maximize the public health benefits of tobacco control policies. We have updated the citations with the latest published works as you added them to the paragraph.

2.2.4. Economic impacts beyond revenue generation

While the literature review highlights the immediate economic benefits of tobacco control policies, such as increased productivity and potential job creation in other sectors, a comprehensive understanding necessitates delving deeper into their broader economic impacts. Further research is needed to fully grasp the potential job losses within the tobacco industry, assess the overall impact on economic growth and development, and consider the complex interplay between these factors.

Investigating the distributional effects of these economic impacts across different sectors and populations is crucial for informing policy design that minimizes negative consequences and promotes inclusive economic development. Understanding how job losses in the tobacco industry affect specific communities, for instance, can guide targeted economic diversification and reskilling programs. Additionally, analysing how the overall economic impact varies across different income groups and regions can ensure that policies do not exacerbate existing inequalities.

Studies by Ref. [84] emphasize the importance of considering both the positive and negative economic impacts of tobacco control, advocating for comprehensive assessments that account for potential job losses and economic adjustments. Furthermore [70], highlighted the need for policies that promote economic empowerment and poverty reduction alongside tobacco control to ensure a just and equitable transition.

3. Method

To evaluate the impact of the excise tax on poverty income inequalities, we base our analysis on the top-down microsimulation method developed by [85]. This method consists of feeding products and factor price changes obtained from a CGE model into a microsimulation household model. Thus, we employ a viable methodology that stems from a CGE model extended in the microsimulation framework. Therefore, the first subsection summarizes the CGE features, followed by a description of the scenarios. In the third subsection, we finally explain how microsimulation is carried out in this study.

3.1. CGE model description

[86] showed the importance of CGE models, which have become very popular, especially because of their capacity to investigate not only sectoral impacts but also the microsimulation framework where a large number of households are considered [87]. defines a CGE model as a set of simultaneous equations relating variables, some of which are endogenous and determined within the model, while the rest are exogenous. The main database for implementing CGE models is the social accounting matrix (SAM). It refers to a square matrix portraying inter-linkages among the various domestic sectors as well as with the rest of the world, ensuring that a column sum of each account equals its corresponding row sum ([88]). In this study, CGE analyses are based on Cameroon's SAM for 2019 supplied by the National Institute of Statistics. This SAM is then transformed to accurately fit the PEP SAM structure. Indeed, we employ the dynamic CGE model PEP-1-t ([89]). The structure of this model is described as follows:

Factors of production are first aggregated in a constant elasticity of substitution (CES) nested structure to obtain a composite factor. The latter is then complemented with intermediate inputs ([90]) to form sectoral outputs. Investment demand distinguishes between gross fixed capital formation (GFCF) and changes in inventories. The aggregate output of each industry consists of several products, consistent with rectangular input-output¹ tables. Several intermediate variables are added to make the theoretical underpinnings of the model more explicit and to link model variables to national accounting concepts more closely. There is a difference between commodities that are imported but not produced locally and commodities that are produced locally and sold solely on the foreign market. However, in general, imports follow the [91] specification. The key parameters, such as elasticity and marginal propensity parameters, are first calibrated based on information from 2015, the benchmark year. The unknown CES and CET parameters are derived from the literature to fit the economic features of the selected countries.

3.2. Dynamic structure

By delving into the long-term and diverse effects of tobacco and alcohol taxes, we can unlock further potential for promoting public health and ensuring that our policies are effective and inclusive for all. Moreover, hyperbolic discounting prioritizes immediate pleasure over long-term consequences, making even individuals aware of health risks struggle to resist the urge to use tobacco ([51]). On the other hand, imperfect information can hinder truly rational decision making, as individuals may underestimate the long-term health risks associated with tobacco use ([92]). Thus, the dynamic equations used in this study fall into two categories: one set of statements update variables that grow at a constant rate per period; the other equations control the accumulation of capital. Most of the variables increase over time, assuming a population index pop_t that increases at a population rate n_t . pop_t is then set at unity for the first

¹ input-output models that reveal intersectoral interdependence can be used, especially in structural change analysis ([106,107and108]).

period and for the other periods,

$$pop_t = pop_{t-1}(1 + n_{t-1}) \quad (1)$$

The labor supply ($LS_{i,t}$) is a variable that is assumed to grow at the same rate as the population index pop_t as a result of population growth, a shift in the participation rate, or a combination of both (see equation (2)).

$$LS_{i,t} = LS_i^0 pop_t \quad (2)$$

which is equivalent to $LS_{i,t+1} = LS_{i,t}(1 + n_t)$.

The capital accumulation rule is checked through equation (3).

$$KD_{k,j,t+1} = KD_{k,j,t}(1 - \delta_{k,j}) + IND_{k,j,t} \quad (3)$$

where $KD_{k,j,t+1}$ is the stock of type k capital in industry j in period $t + 1$; $IND_{k,j,t}$ is the type k capital investment in sector j ; and $\delta_{k,j}$ is the depreciation rate of capital k used in sector j .

3.3. Agents' behavior description

Firms are assumed to operate in a perfectly competitive market. Therefore, each industry's representative firm maximizes profits subject to its production technology, while it considers the prices of goods and services and factors as given (price-taker). At the top level (equations (4) and (5)), the sectoral output ($XST_{j,t}$) of each productive activity j combines value added ($VA_{j,t}$) and total intermediate consumption ($CI_{j,t}$) in fixed proportions. The aggregate inputs are strictly complementary in a Leontief production specification.

$$VA_{j,t} = v_j \cdot XST_{j,t} \quad (4)$$

$$CI_{j,t} = i_{oj} \cdot XST_{j,t} \quad (5)$$

where v_j and i_{oj} are Leontief technical coefficients.

Households have three sources of income: labour income ($YHL_{h,t}$), capital income ($YHK_{h,t}$), and transfers received from other agents ($YHTR_{h,t}$). Its total income ($YH_{h,t}$) is therefore given by equation (6):

$$YH_{h,t} = YHL_{h,t} + YHK_{h,t} + YHTR_{h,t} \quad (6)$$

On this income, he pays direct taxes and makes transfers to other local households and to foreigners as well. A part of the disposable income is used to purchase goods and services available in the market, and the unused income constitutes its savings.

The government's income comes from six sources, including government capital income (YGK_t); household income taxes ($TDHT_t$); business income taxes ($TDFT_t$); taxes on products and imports, which consist of indirect taxes on consumption, taxes and duties on imports, and export taxes; other taxes on production, which consist of payroll taxes, taxes on capital, and taxes on production ($TPRCTS_t$); other taxes on production ($TPRODN_t$); and government transfer income ($YGTR_t$). Thus, the total government income (YG_t) is given by equation (7).

$$YG_t = YGK_t + TDHT_t + TDFT_t + TPRODN_t + TPRCTS_t + YGTR_t \quad (7)$$

The demand for commodities includes private, public, and intermediate demand, as well as investment and inventory changes.

3.4. Additive behavior in the CGE model

An addicted person is defined as someone whose future consumption depends strongly on past consumption of certain commodities ([93]). Thus, they cannot easily shorten the quantity of the commodity being consumed. To account for this behaviour, we first separate the set of commodities into two groups. The first group is composed of agriculture, food, mining, industry, transport, trade, private services and public services. This group is for normal goods. Their quantity can vary with respect to the market price due to either their substitutability or their complementarity. The second group consists of tobacco, malt, champaign, and other beverage products.

Therefore, we suppose that the excise tax positively affects the share of income of the second group of products while reducing that of the first group.

We model this through a LES (linear expenditure system) function as follows: the use of household income that does not consume alcohol or tobacco is given by equation (8).

$$YDHD_{nbs,h,t} = \gamma \cdot LES_{nbs,h} \cdot YDH_{h,t} \quad (8)$$

where $\gamma \cdot LES_{nbs,h}$ is the marginal share of commodity i in household h 's consumption budget.

The behavior of those consuming these products is given by equation (9), where $ttic_{bs,t}$ depicts the excise tax rate and $ttico_{bs}$ its baseline value.

$$YDHD_{bs,h,t} = \gamma \cdot LES_{bs,h} \cdot YDH_{h,t} \frac{1 + ttic_{bs,t}}{1 + ttico_{bs}} \tag{9}$$

3.5. Closure of the model

In the model, the exchange rate is chosen as the *numéraire*. Government expenditure, the volume of public sector investment, and the current account balance are set to be exogenous. The capital stock in each period is exogenous because it is the result of the capital accumulation rule. In addition, some variables are generally considered to be exogenous, and they are routinely fixed in each period. There are minimum consumption, the labor supply, the volume of inventory changes and the world prices of imports and exports. Furthermore, slopes, marginal rates and tax rates are exogenous in the model.

3.6. Deriving the scenarios

Three main scenarios are analyzed in this study. The first scenario examines the impacts of tobacco consumers on various poverty and inequality indicators. The second scenario involved the same investigations for those who consumed alcohol. Third, people who consume both tobacco and alcohol are studied. In each case, we apply a 10 % increase in the excise tax for the specific group of products.

Furthermore, we check the robustness of our findings in a sensitivity analysis. In this respect, we applied a 50 % increase in the values of substitution parameters in the value-added equation. The main observation is that our results are consistent with those of the exogenous parameters since there are no significant changes.

3.7. Poverty and inequality issues

To achieve the objective stated at the top of this study, we employ the Foster Geer Torbeck index, a poverty incidence baseline constructed by Ref. [94] The general formula is given by equation (10):

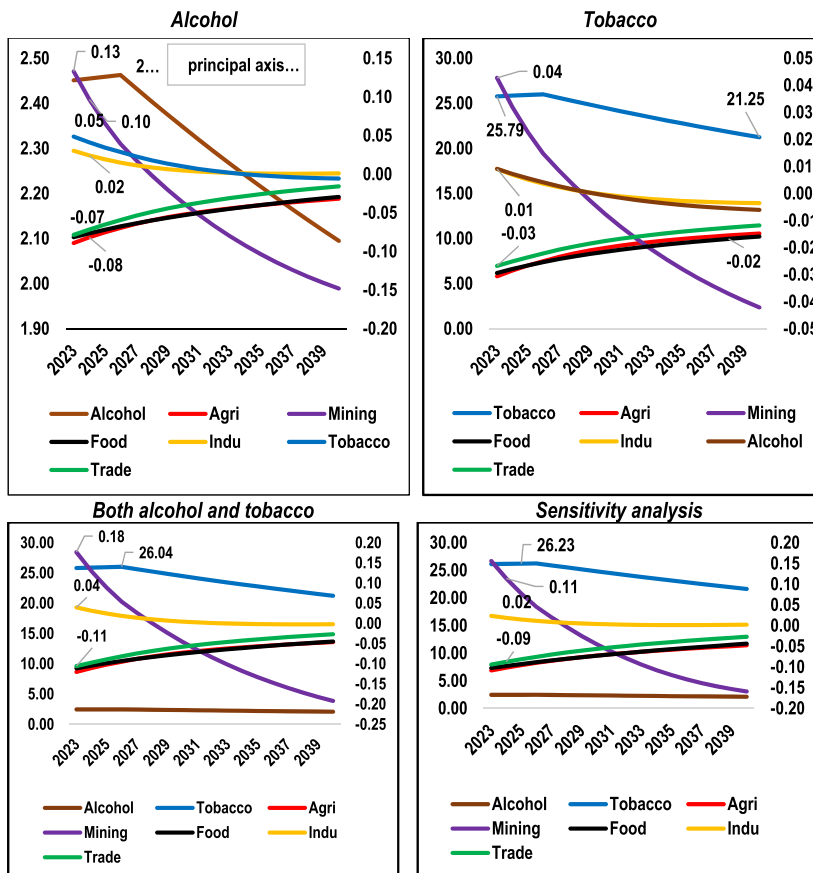


Fig. 1. Impact on sectoral consumption. Source: Authors from GAMS software

$$P_\alpha = \frac{1}{n} \sum_{i=1}^q \left[\frac{\mathcal{Z} - y_i}{\mathcal{Z}} \right]^\alpha \tag{10}$$

where n is the population size, \mathcal{Z} is the poverty line, y_i is the income of the i 's individual, q is the total number of individuals whose income is above the poverty line, and α is the poverty level, which takes three values (0 for incidence, 1 for depth and 2 for severity).

To complete our analysis of poverty, we also use inequality indices to assess the distribution of income within the populations studied. A commonly used index is the Gini index, introduced by Corrado Gini in 1912. The general formula for the Gini index in equation (11):

$$G = \frac{1}{2\mu_y n^2} \sum_{i=1}^n \sum_{j=1}^n |x_i - x_j| \tag{11}$$

where n is the size of the population, x_i and x_j are the incomes of individuals i and j , respectively, and μ is the average income. The Gini index varies between 0 (perfect equality) and 1 (perfect inequality).

To account for sectoral analyses, we first examine the different scenarios in the CGE corpus. The generated impacts on household income, as well as expenditures and factor prices, are then used in the household data survey, where the poverty lines are first computed for both countries surveyed. Poverty in the agricultural sector, as well as in the industrial and transport sectors, is captured with respect to the thoroughness of the TI in that specific sector. On this basis, sensitivity analysis is also applied to the CGE results. We pursue this in the second scenario, where only the agricultural sector is subject to the TI. All these poverty analyses were implemented in the DASP package of Stata software.

4. Results

4.1. Results from the CGE analysis

In this section, we examine the impact of the excise tax on various macroeconomic indicators, including sectoral consumption, income share, price purchasing goods, government income, employment, GDP and welfare. A 10-percent increase in excise tax on

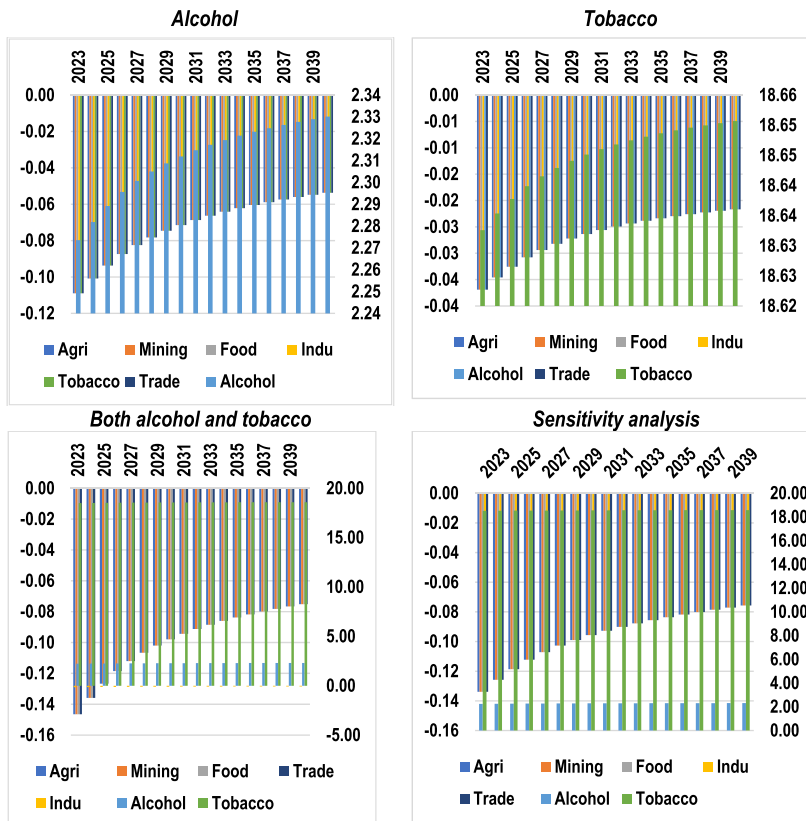


Fig. 2. Impact on sectoral share income. Source: Authors from GAMS software

alcohol and tobacco offers a slightly nuanced pattern.

4.1.1. Consumption effect

Fig. 1 shows that a 10 % increase in the alcohol excise tax leads households consuming alcohol to increase their auto consumption by 2.45 % (2023), which falls to 2.10 % (2040). At the same time, the consumption of other products declines. This impact is -0.09 % (2023) and -0.03 % (2040) for agriculture, which slightly corroborates that of food products. Tobacco and industrial products exhibited a decreasing trend.

For the tobacco scenario, an excise tax yields significant outcomes depending on the type of commodity being consumed. As far as addicted people are concerned, households that consume tobacco significantly augment their consumption of this product by 25.79 % (2023) and 21.25 % (2040). In the same vein, their consumption of alcohol and industrial products will increase but will steadily increase by approximately 0.01 % by 2023. Both food products and agricultural commodities declined during the simulation period. We can observe a variation of -0.03 % in 2023 and -0.02 % in 2038 for those commodities. This trend for the tobacco scenario is possibly the same as that for both tobacco and alcohol. According to the Cameroon household data survey, all those who consume tobacco also consume alcohol.

These findings demonstrate that when a household is addicted to alcohol or tobacco, an increase in the price of a specific product does not negatively impact its consumption of this product. He or she will prefer to reduce his or her total expenditure on other products to compensate for the indirect income lost in addicted products to maintain constant consumption or even increase consumption. Therefore, as the head of the family, the main losers will be the other members. An excise tax would therefore, worsen the living conditions of family members. Therefore, excising taxes appears to be an inefficient way to dissuade addictive people from their consumption [95]. highlighted that households with addicted members spend 25 % more on healthcare, diverting resources from essentials such as food and education, and spend more than 25 % if an excise tax is applied, which deteriorates the living conditions of family members and aggravates poverty specifically. Therefore, the lack of financial resources amplifies the issues of food security and even rates of crime ([96]).

4.1.2. Income effect

Fig. 2 shows the results of the excise tax on income, especially the share of income for each commodity consumed. This figure shows that the excise tax exerts pressure on addicted people to alleviate the share of income allocated to other products to increase the income share of products to which they are addicted. In the alcohol scenario, the income from alcohol use increases by 2.27 % in 2023 and 2.33 % in 2040, while there is a decrease in income from other products. In 2023, income from agriculture, food, tobacco and industrial commodities will decline by 0.11 %. This decrease in income is expected to reach -0.05 % in 2040.

Based on the global overall income, Fig. 3 reveals that excising taxes on tobacco and alcohol decreases the corresponding income. In 2023, people who only consume alcohol saw their income decrease by 0.11 %. On the other hand, those who are addicted to tobacco experience a decrease of 0.04 %. The impact becomes greater for those who consume both alcohol and tobacco. Their revenue declined by 0.14 %. These impacts will decrease through the time horizon by 2040.

4.1.3. Welfare effect

Following income evolution, which partially shows welfare dynamics [97,98], advocate for the use of equivalent variation as a preferred instrument for welfare measures in CGE analyses [99]. further support this approach in their research. Indeed, it substitutes the utility, taking into account both the income/consumption and consumers' price variation. Fig. 3 shows that excise tax in an addictive model reduces households' welfare, especially for families in which the header is addicted. A loss of welfare of 0.23 % is generated in 2023 for those who consume alcohol, and this loss declines in the long-term to 0.03 %. For tobacco consumers, the total impact is -0.09 % in 2023 and -0.04 % in 2040. This impact is greater for households that consume the two commodities, with values

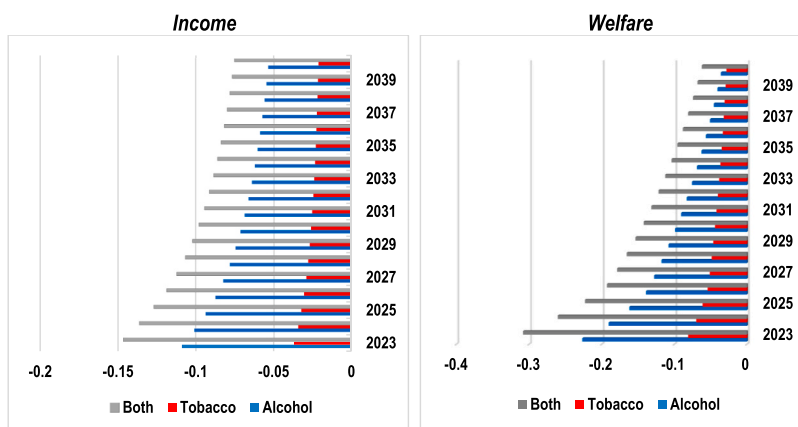


Fig. 3. Welfare and global income impact.

Source: Authors from GAMS software

of -0.31% in 2023 and -0.07% in 2040. The implication of this finding is that addiction slows down welfare. This finding is consistent with the conclusions of [24,100], who showed that lower-income groups, which are more price-sensitive in microsimulation studies, may experience disproportionate welfare reductions. This is why [101] suggested prioritizing policies that favour both public health and individual well-being.

4.1.4. Price and demand effects

A 10 % increase in the excise tax on alcohol and tobacco positively affects prices but negatively affects the demand for the product of interest. At the same time, the trend is reversed for other products both in the short and long term. For alcohol taxation, the price of this product increases by 2.26 % (2023) and 2.31 % (2040), while the demand decreases by 0.97 % and 0.96 %, respectively. Given that the consumption of alcohol-addicted members is increasing, the observed decrease in demand is due to households not being heavily addicted to alcohol. This finding aligns with the conclusion of [47], who argued that excising taxes by increasing prices and reducing expected utility should lead to a predicted decrease in demand.

On the other hand, the prices of agricultural products heavily consumed in Cameroon declined both in the short and long term by 0.12 % and 0.07 %, respectively. However, the demand also declines in the short term (-0.02%) and increases only in the long term (0.03 %). An important observation is made for tobacco demand. As its price declines, tobacco-addicted members will increase their demand for this product (1.01 % in 2023 and 1.11 % in 2040).

Regarding the tobacco scenario, the main observation is that, while prices slowly decrease and demand slowly increases for other products, as for the first scenario, tobacco products experience very large impacts. In 2023, prices increase by 17.70 %, while demand decreases by 12.98 %. We can justify this result by the fact that those who just started to consume tobacco resigned due to the excise tax. This result can have positive consequences for the labour market.

4.1.5. Employment impact

Exploring the potential negative impacts of excise taxes, such as job losses in informal markets, is crucial for crafting balanced and sustainable policies ([100]). Increased prices due to dissuasive taxes might lead to reduced demand for goods and services sold in informal markets, potentially impacting employment ([28]). Our model differentiates between skilled labor and unskilled labor. The results of Table 1 show that the excise tax negatively affects employment in the alcohol and tobacco sectors, based on the scenario being applied. However, such policies have positive effects on employment in other sectors for both skilled and unskilled workers. In 2023, job creation increases in the mining sector by 0.23 % for the alcohol scenario and 0.08 % for the tobacco scenario. The impacts on unskilled workers are 0.28 % and 0.10 %, respectively. This finding is consistent with many works; for instance Ref. [21], showed that reduced tobacco and alcohol consumption can lead to a healthier and more productive workforce, potentially boosting economic growth. In the same vein, the [67] highlighted that reduced tobacco use results in increased individual productivity. This occurs through fewer instances of absenteeism and early retirement, leading to a more engaged and productive workforce. The report indicates that individuals who quit smoking experience improvements in physical and mental health, resulting in better focus, concentration, and energy levels at work. Furthermore, as tobacco use declines, resources and workforce capacities shift, creating new employment opportunities in other sectors ([9]). Indeed [68], observed a prime example in Brazil, where a smoking ban in workplaces led to increased employment in the service sector. As they explained by transitioning resources away from tobacco and towards other sectors, tobacco control policies can contribute not only to job creation but also to economic growth and development, creating a virtuous cycle of improved health, increased productivity, and new job opportunities.

Table 1
Sectoral impacts in short and in long terms (in percentage).

		Alcohol scenario				Tobacco scenario			
		Domestic demand	Market price	Skilled Labour	Unskilled Labour	Domestic demand	Market price	Skilled Labour	Unskilled Labour
Agriculture	2023	-0.02	-0.12	-0.06	-0.01	-0.01	-0.04	-0.02	0.00
Agriculture	2040	0.03	-0.07	0.00	0.03	0.00	-0.02	0.00	0.01
Mining	2023	0.03	0.04	0.23	0.28	0.01	0.01	0.08	0.10
Mining	2040	0.12	-0.08	0.07	0.10	0.03	-0.02	0.03	0.04
Food	2023	0.00	-0.08	-0.04	0.02	0.00	-0.03	-0.02	0.00
Food	2040	0.02	-0.05	-0.02	0.01	0.00	-0.02	-0.01	0.00
Industry	2023	0.21	-0.01	0.37	0.43	0.07	0.00	0.12	0.14
Industry	2040	0.28	-0.03	0.25	0.28	0.09	-0.01	0.09	0.10
Alcohol	2023	-0.97	2.26	-1.21	-1.15	0.33	0.00	0.38	0.40
Alcohol	2040	-0.96	2.31	-1.05	-1.02	0.36	-0.01	0.37	0.38
Tobacco	2023	1.01	-0.01	1.17	1.22	-12.98	17.70	-15.40	-15.39
Tobacco	2040	1.11	-0.04	1.14	1.17	-13.53	18.34	-14.28	-14.27
Transport	2023	0.07	-0.02	0.08	0.14	0.02	-0.01	0.02	0.04
Transport	2040	0.08	-0.01	0.04	0.07	0.02	0.00	0.01	0.02
Services	2023	0.04	-0.05	0.03	0.09	0.01	-0.02	0.01	0.03
Services	2040	0.04	-0.03	0.02	0.05	0.01	-0.01	0.00	0.01
Public	2023	0.01	-0.01	0.00	0.06	0.00	0.00	0.00	0.02
Public	2040	-0.01	0.01	-0.02	0.01	0.00	0.00	-0.01	0.00

Source: Authors from GAMS software

4.1.6. GDP and government income

The results in Fig. 4 show that the excise tax generates a government income surplus. Due to the high volume of alcohol consumed daily in Cameroon, the increase in government income is greater for the alcohol scenario than for the tobacco scenario. When the alcohol tax increases by 10 %, government income increases by 1.37 % in the short term and 1.58 % in the long term. For the tobacco scenario, these increases are 0.45 % and 0.52, respectively. For the third scenario, where both alcohol and tobacco excise taxes are increasing, the increases are 1.83 % and 2.08 % in the short and long terms, respectively. This finding is consistent with the conclusion of [33] who showed that taxes on tobacco and alcohol can generate substantial revenue for the government. They suggested that to improve the efficiency of these income sources, they could be directed towards essential public services such as healthcare, education, and infrastructure.

Regarding the impact on growth, the excise tax has a positive impact on GDP for both scenarios: 0.20 % for the alcohol scenario and 0.07 % for the tobacco scenario in the short term, with long-run impacts of 0.24 % and 0.08 %, respectively. This finding is consistent with the conclusion of [21], who showed that reduced tobacco and alcohol consumption can lead to a healthier and more productive workforce, potentially boosting economic growth.

4.2. Poverty

This section investigates the outcome of the microsimulation. Table 2 presents the poverty results, while Table 3 illustrates the impact of the excise tax on income inequalities across various scenarios. A 10 percent increase in the excise tax on tobacco commodities drives a smaller increase in poverty within the considered strata. First, we consider the poverty incidence.

4.2.1. Poverty incidence

Table 2 shows that the excise tax policy has no impact on rural households consuming tobacco, while urban households experience an increase of 0.28 percentage points. The greatest increase of 0.82 percentage points are recorded within married households, yet single households are not affected.

For alcohol consumers, a 10 percent increase in the excise tax yields a smaller increase in poverty incidence, and only the residential zone category is affected, with marital status being an incentive. Thus, rural households experience a 0.06 percentage point increase, which is double that of the urban zone (0.03 points).

The lesson we can derive from these findings is that, as long as an individual is addicted either to tobacco or alcohol, an excise tax will only affect the State revenue, while the related households will experience a loss, especially for married households and those living in the urban zone (tobacco scenario) and both rural and urban areas (alcohol scenario). This finding corroborates that of [102], who showed that tobacco consumption in Cameroon, while having pernicious effects, extends far beyond individual health ([17]), exacerbates poverty and hinders welfare improvement. The inefficiency of excise taxes on tobacco and alcohol has already been studied by Ref. [69], who argued that as poorer households often dedicate a larger share of their income to tobacco, increased taxes can disproportionately impact their finances, potentially exacerbating poverty.

However, the number of sectoral programs may help mitigate these negative impacts. As stated by Ref. [66], investing in social programs such as education and social safety nets can uplift lower-income families and contribute to poverty reduction. A more equitable society could be created by directing tobacco tax revenue towards these areas [65]. appreciate the idea of redirecting income generated from tobacco taxes into social programs such as healthcare, education, and poverty reduction initiatives, which offer direct benefits to vulnerable populations. Such a policy will promote a more equitable distribution of resources, channeling funds back toward the communities most impacted by tobacco-related health issues and economic hardships [72]. argue that implementing progressive tax structures can further mitigate the regressive impact on lower income groups. This ensures that those with greater financial means contribute proportionally more, promoting fairness and social responsibility within the policy framework.

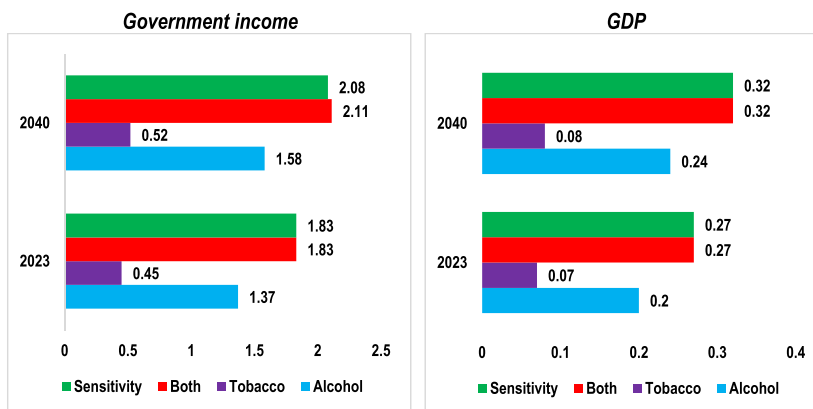


Fig. 4. Impact on GDP and Government income (in percentage). Source: Authors from GAMS software

Table 2
Poverty impact.

	Tobacco				Alcohol			
	Area of residence		Marital statute		Area of residence		Marital statute	
	Rural	Urban	Married	Single	Rural	Urban	Married	Single
Baseline (in percentage)								
FGT0	46.42	22.13	50.82	24.43	49.41	18.46	43.90	25.82
FGT1	17.55	6.54	18.13	7.48	18.00	5.05	14.33	8.01
FGT2	8.84	2.77	8.73	3.16	9.04	2.01	6.42	3.61
Simulation (in percentage)								
FGT0	46.42	22.41	51.64	24.43	49.48	18.48	43.90	25.82
FGT1	17.76	6.65	18.43	7.58	18.03	5.06	14.36	8.02
FGT2	8.95	2.84	8.91	3.21	9.06	2.01	6.44	3.62
Variation (in percentage)								
FGT0	0.00	0.28	0.82	0.00	0.06	0.03	0.00	0.00
FGT1	0.20	0.11	0.30	0.09	0.03	0.01	0.03	0.01
FGT2	0.12	0.06	0.19	0.05	0.02	0.01	0.02	0.01

Source: Authors using DASP package

Table 3
Inequality impact.

	Tobacco				Alcohol			
	Area of residence		Marital statute		Area of residence		Marital statute	
	Rural	Urban	Married	Single	Rural	Urban	Married	Single
Baseline								
GINI	0.3360	0.3678	0.3816	0.3581	0.3716	0.3670	0.3617	0.3914
Absolute †	536961	1012922	666234	869655	635768	1100977	680720	1078121
Simulation								
GINI	0.3368	0.3685	0.3831	0.3588	0.3716	0.3671	0.3618	0.3915
Absolute	535460	1011819	665176	868579	635239	1100348	680256	1077504
Variation (GINI in percentage)								
GINI	0.0742	0.0737	0.1501	0.0689	0.0022	0.0016	0.0063	0.0036
Absolute	-1500	-1103	-1058	-1076	-529	-629	-463	-617

† Absolute stands for absolute value of Gini, expressed in CFA Franc.

Source: Authors using DASP package.

4.2.2. Depth of poverty

Even though rural households consuming tobacco do not observe any change in their poverty incidence, the depth of poverty shows an increase of 0.20 percentage points, which is greater than the 0.11 observed within urban households that experienced a significant increase in poverty incidence. Thus, excise tax effects are more pronounced among poor people than just plunging some wealth into poverty. The distance between the consumption level and the poverty threshold increases by 0.20 percent for poor rural households and 0.11 percent for poor urban households. On the basis of marital status, the depth of poverty also increases by 0.30 percent for married households and 0.09 percent for single households.

Similarly, for alcohol consumers, the depth of poverty in the rural zone increases by 0.03 percentage points compared with 0.01 percentage points in the urban zone. The same dynamic is observed within married households, who experience a 0.03 percent increase against 0.01 percent for single households.

4.2.3. Severity of poverty

The severity of poverty represents the degree of inequality within poorer households. This is simply because some of the poor are extremely poor. How far are some of the poorest households from the closest threshold poverty line? The results from FTG2 show that excise tax deepens the severity of poverty. The rural tobacco consumer group experienced an increase of 0.12 percentage points compared with 0.06 for urban households. This impact is highest for married households, at 0.19 percentage points. This impact is quite small for alcohol consumers, whereas rural households record an increase of 0.02 percentage points, which is otherwise the same impact for married households. This impact challenges urban and single households, whose effect is 0.01 percentage points.

4.2.4. Poverty relationship with nonconsumers

How can excise taxes affect nonaddicted people? We address this issue in this section by highlighting the incidence of poverty within this category. Fig. 5 shows that tobacco expenditures tend to positively affect nonconsumers in rural areas according to a threshold of 134,010 CFA francs per adult equivalent per year. However, this incidence is greater than the threshold of 804,060 CFA

francs, where the impact ranges between 0.5 and 1 percentage point. This income shows the largest variance in the marginal tax rate, as measured by the 5th and 95th percentiles. This finding demonstrates the effect of the various targeted and income-dependent measures after income surpasses the minimum wage ([103]).

The opposite situation occurs in urban areas where nontobacco consumers experience a decrease in poverty incidence, with the lowest score being -1.5 percent for a poverty line of 1,340,100 CFA franc. On the other hand, married households that do not consume tobacco experience a decrease in poverty incidence due to the excise tax, but this occurs only from a threshold of 536,040 CFA franc. Single households align with the urban tendency, with a decrease in poverty incidence from a threshold of 134,010 CFA francs.

Fig. 6 shows that based on alcohol consumption, the excise tax negatively impacts the poverty incidence of nonconsumers regardless of the household category being studied. Thus, even though it increases the poverty rate of consumers, it reduces that of nonconsumers. A plausible explanation is that, as excise tends to slow prices of other commodities such as agriculture, food, industry, and transport (see Table 1), nonconsumers of alcohol and tobacco record an indirect increase in their total revenue, which in turn alleviates their poverty status. Hence, this outcome occurs as an indirect positive effect of the excise tax.

4.3. Inequality

4.3.1. General outcomes

Table 3 shows that the excise tax leads to an increase in inequality. The percentage of rural and urban households consuming tobacco increased by 0.07 %. The corresponding loss in income is 1500 CFA francs in the rural zone and 1103 CFA francs in the urban zone. Concerning marital status, inequalities between married households that consume tobacco increase by 0.15 %, while single households constitute 0.07 %. This corresponds to a loss of 1076 CFA francs in total income against 1508 CFA francs for married households. Otherwise, the impact is sensibly low for the alcohol scenario, where the income lost by rural household consumers

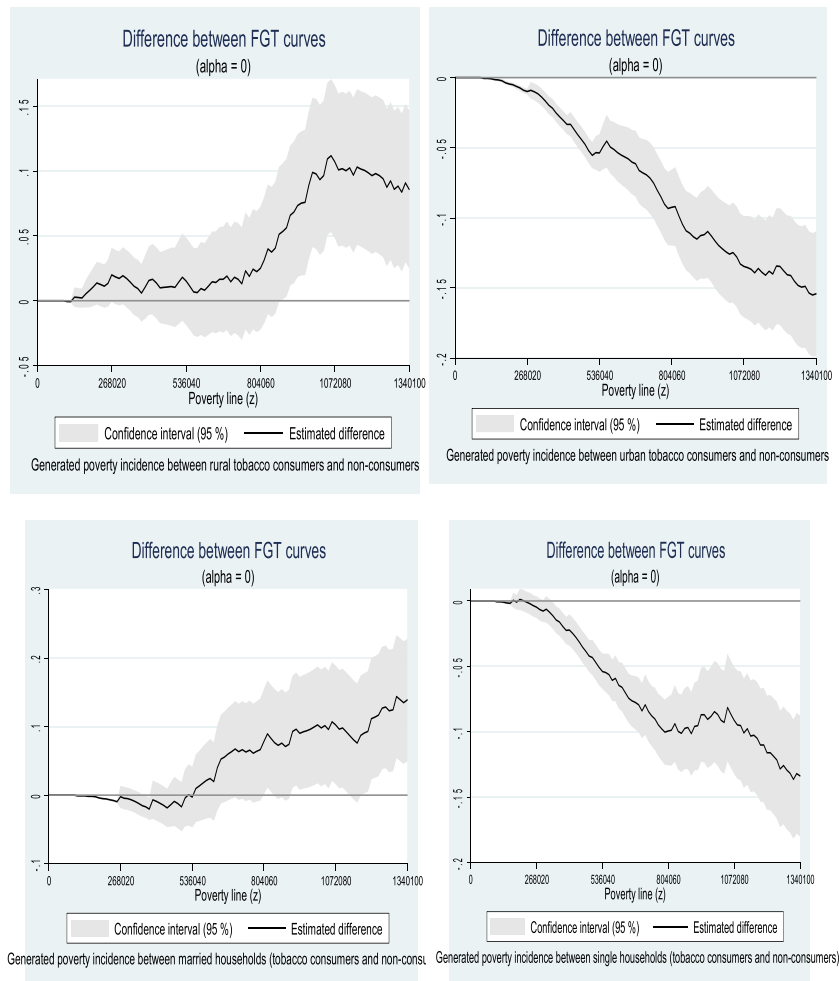


Fig. 5. poverty incidence within households categories consuming tobacco or not.

Source: Authors from stata 14 software

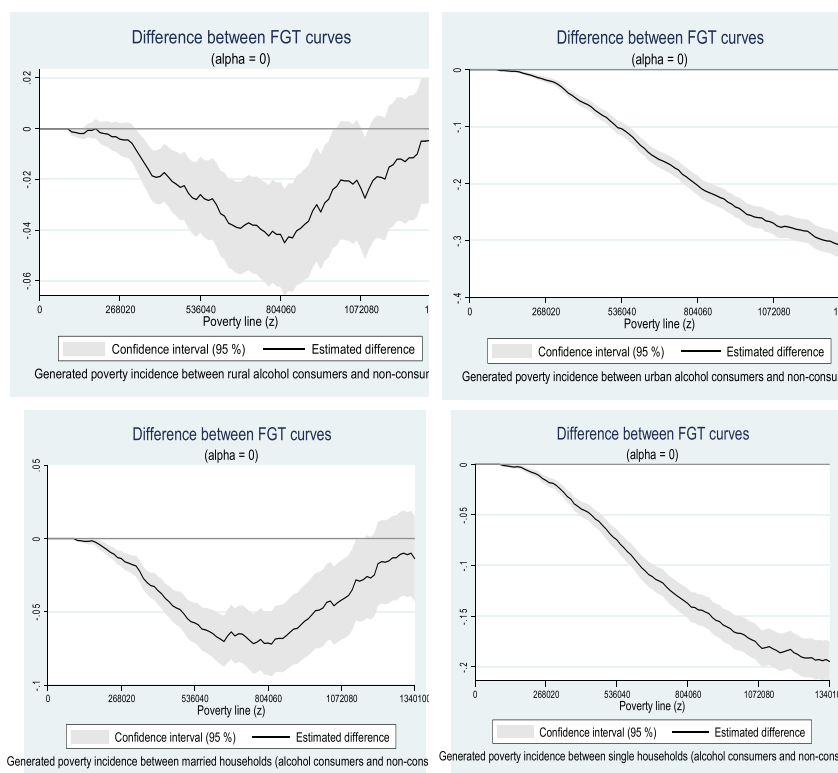


Fig. 6. poverty incidence within households categories consuming alcohol or not.

Source: Authors from stata 14 software

amounts to 529 CFA francs against 629 CFA francs for urban households. These findings are consistent with the conclusion of [104], who found that the simultaneous consumption of both goods contributes up to 1.03 % of the inequality in health, while tobacco use alone contributes only 0.6 % [105]. further noted that while alcohol and tobacco use alone are strongly related to the risk of poor health, simultaneous exposure to these goods had a stronger multiplicative effect on health inequality.

4.3.2. Inequalities between consumers and nonconsumers

Fig. 7 indicates that inequalities among tobacco consumers are greater in urban areas than in rural areas. Approximately 72 % of individuals consuming tobacco in rural areas have access to half of their disposable resources, while in urban zones, this percentage increases to 75 %. This is related to the fact that there is a greater proportion of poor people consuming tobacco in urban areas than in rural areas.

We can also note that compared with single households, married households that consume tobacco experience high inequalities. Approximately 77 % of single households, compared to 79 % of married households, have access to 50 % of available resources. For alcohol consumption, the situation is reversed. Inequalities among alcohol consumers are greater in rural areas than in urban areas. At the same time, inequalities are less common among married households than among single households.

5. Conclusion

In conclusion, the main objective of this study was to assess whether the introduction of deterrent taxes can effectively reduce tobacco and alcohol consumption in Cameroon and how these taxes affect household well-being and microeconomic behaviour. To conduct this analysis, we used data from various sources, including national surveys on household living conditions, administrative data, Cameroon's social accounting matrix for 2019, and previous studies assessing the health and economic impacts of tobacco and alcohol consumption. The methodology is based on a combination of microsimulation and computable general equilibrium (CGE) models, allowing the impact of deterrent taxes on consumption to be examined, as well as their impact on household income and the economy as a whole. The results suggest that disincentive taxes have significant potential to reduce the consumption of harmful products. However, the effects are nuanced, affecting different income groups in different ways and having different implications for public health and household expenditure. While these excise taxes can generate revenue and positively impact employment in certain sectors, they also have negative consequences. Households consuming these substances experienced reduced income, welfare, and increased poverty, particularly those in urban areas and married households. Furthermore, excise taxes can exacerbate inequality and have mixed effects on consumption patterns and prices. To mitigate these negative impacts, the study suggests implementing targeted

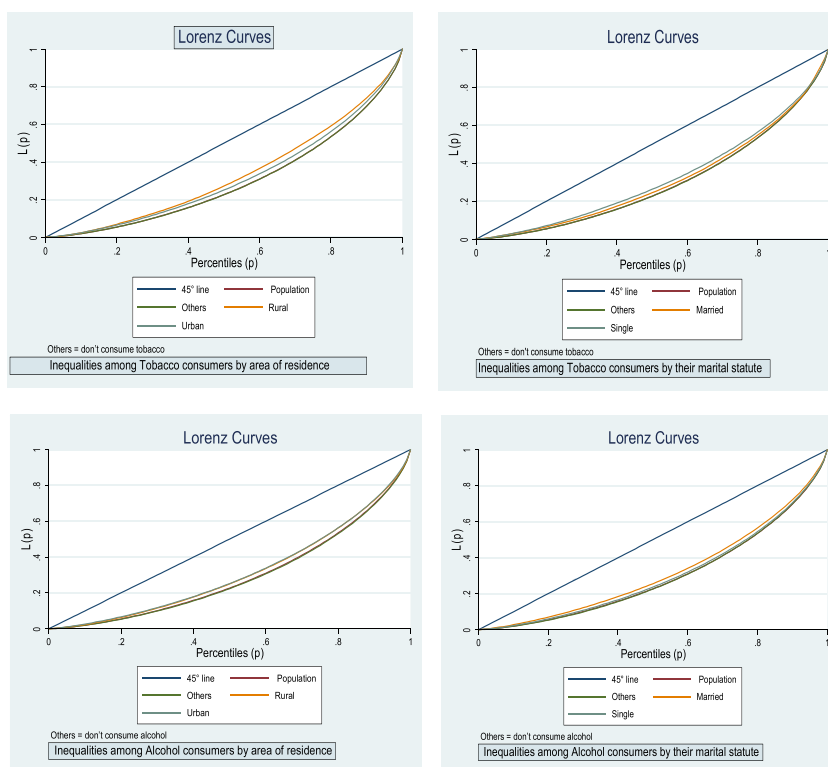


Fig. 7. Income inequalities within consumers and nonconsumers of tobacco and alcohol.

Source: Authors using stata 14 software

social programs and progressive tax structures. Overall, the research highlights the complex relationship between excise taxes, poverty, and inequality in Cameroon, emphasizing the need for careful policy considerations when implementing such measures.

5.1. Policy recommendations

Given the multifaceted relationship between excise taxes, poverty, and inequality in Cameroon, a comprehensive approach is necessary to mitigate potential negative impacts while achieving desired policy objectives. Targeted Social Programs are crucial to protect vulnerable households from the adverse effects of excise taxes. Prioritizing low-income individuals, particularly those in urban areas and married households, can help alleviate financial strain and improve well-being. Investing in education and health initiatives can further empower these groups, reducing their reliance on harmful products and enhancing their resilience to economic shocks.

Progressive tax structures are essential to ensure a fairer distribution of the tax burden. Requiring higher-income earners to contribute a larger share of their income, the regressive impact of excise taxes on low-income households can be mitigated. This can help create a more equitable society and reduce poverty. Moreover, a comprehensive policy approach should go beyond excise taxes and incorporate other public health interventions. Public awareness campaigns, restrictions on advertising, and access to treatment programs can complement excise taxes in reducing consumption of harmful products and promoting healthier lifestyles. Regular monitoring and evaluation of these policies are essential to assess their effectiveness and make necessary adjustments.

Diversifying revenue sources can reduce the reliance on excise taxes and minimize their negative impacts. Exploring alternative tax options can help spread the tax burden more equitably and reduce the burden on vulnerable populations. Finally, it is crucial to adopt a long-term perspective when implementing excise taxes. Recognizing the complex and evolving nature of these policies is essential for making informed decisions and ensuring sustainable outcomes. By carefully considering the potential impacts on public health, poverty, and inequality, Cameroon can develop effective strategies to balance revenue generation with social welfare objectives.

5.2. Limitation and future research

While the study provides valuable insights, it has limitations related to data representativeness and model complexity. Future research should focus on collecting primary data, refining the CGE model, conducting dynamic analysis, and examining regional variations. This will allow for a more comprehensive understanding of the effects of excise taxes in Cameroon and inform the development of more effective policies.

CRediT authorship contribution statement

Paul Tadzong Mouafo: Writing – review & editing, Writing – original draft, Validation, Supervision, Conceptualization. **Hilaire Nkengfack:** Validation, Supervision. **Rodrigue Nobosse Tchoffo:** Writing – review & editing, Writing – original draft, Methodology, Data curation. **Nelson Derrick Nguapi:** Writing – review & editing, Writing – original draft, Methodology. **Edmond Noubissi Domguia:** Writing – review & editing, Writing – original draft.

Patient consent

Not applicable.

Availability of data and materials

Data are available on request from the authors.

Ethics approval

Not applicable.

Permission to reproduce material

Not applicable.

Clinical trial registration statements

Not applicable.

Funding

The authors declare that they have not received any funding for the production of this paper.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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