Are Special Economic Zones a Lever for Tax Revenue Mobilization in Africa?

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Abstract: This article analyzes the effect of the adoption, proliferation and structural characteristics of special economic zones (SEZs) on tax revenue mobilization in Africa over the period 1996–2021. In order to identify a causal effect, we use the entropy balancing method combined with fixed country and year effects, the results indicate that the adoption of a SEZ significantly increases the tax revenue/GDP ratio by about 0.8 to 1 point of GDP on average, and that the proliferation of areas reinforces this effect, suggesting the existence of cumulative dynamics related to the effects of agglomeration and productive integration. The analysis of the characteristics shows that integrated, multi-sectoral, medium- to large-sized areas managed in public-private partnerships generate significant tax gains, unlike specialized or exclusively privately governed areas. The gains observed are mainly driven by direct taxes and taxes on goods and services and are channeled through increased formal employment, trade openness and FDI flows, suggesting that SEZs can be a lever for sustainable fiscal capacity building when they effectively support structural transformation.

Keywords: Special Economic Zones; Tax revenues; Africa; Entropy balancing.

JEL code: H21, H25, O14, O23, F21

1. Introduction

The mobilization of tax revenues is one of the foundations of the state capacity and a cornerstone in the development of nations. In the state-building literature, taxation is not only a budgetary instrument; it is a central institution that structures the relationship between the state and citizens,

reflects the citizens' willingness to pay for public goods and services,, shapes economic incentives, and determines the sustainability of growth trajectories (Besley & Persson, 2013; Timmons, 2010). In developing countries, and particularly in Africa, insufficient tax revenues limit the provision of public goods, constrain productive investment, and increase dependence on debt and extractive rents (Prichard, 2015; Moore & Prichard, 2020). The question of how to sustainably broaden the tax base is therefore a central issue for both public and development economics. According to the OECD (2025), an additional $1.6 trillion in financing will be needed by 2030 to achieve the SDGs. This amount represents 7% of the continent's annual GDP and does not cover the needs related to climate change adaptation or the demographic, energy, and ecological transitions and digital transformation.

African countries have structurally lower levels of fiscal mobilization than other developing regions. The average tax-to-GDP ratio in sub-Saharan Africa hovers between 14% and 17%, compared to more than 25% in OECD economies and about 20–22% in Latin America and East Asia (World Bank, 2022; OECD, 2020). This gap is not simply due to a difference in income levels. It reflects deeper structural constraints: high levels of informality, low productive diversification, dependence on primary exports, limited administrative capacity and institutional fragilities (Aizenman & Jinjarak, 2008; Fenochietto & Pessino, 2013).

The empirical literature has extensively documented the macroeconomic determinants of fiscal mobilization. Seminal work shows that higher levels of per capita income, urbanization and trade openness are positively associated with tax revenues (Gupta, 2007; Gnangnon, 2019). Fiscal capacity models emphasize economic formalization and financial inclusion as necessary conditions for broadening the tax base (Besley & Persson, 2014). Other studies highlight the role of institutions: better quality of governance, stronger rule of law, and greater credibility of tax administration all improve compliance and reduce evasion (Bird, Martinez-Vazquez, & Torgler, 2008; Moore, 2014). More recent literature has demonstrated that digitalization and financial innovations can be levers for tax mobilization (Apeti & Edoh, 2023; Mascagni, 2018). Work on tax technology shows that modernizing collection systems, improving the traceability of transactions, and reducing compliance costs can broaden the tax base (Okunogbe & Pouliquen, 2022). However, despite this thematic expansion, one dimension for improving fiscal mobilization in Africa remains underexplored to the best of our knowledge: the role of territorialized industrial policies, and in particular Special Economic Zones (SEZs).

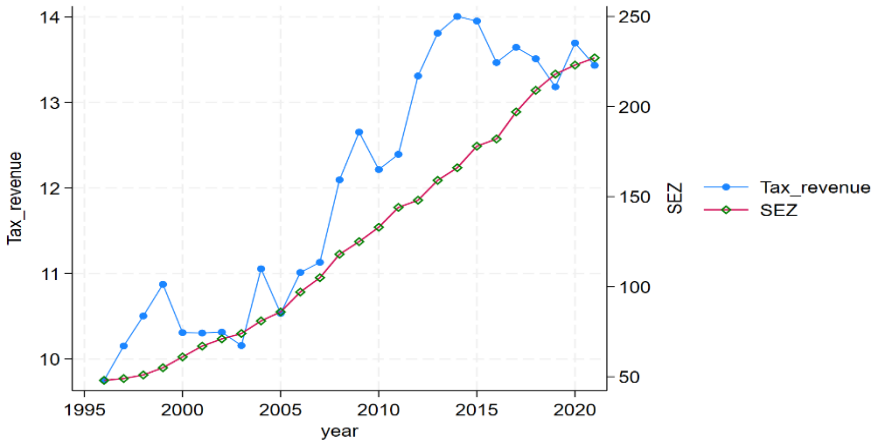
SEZs have come to occupy a central place in the industrialization strategies of African countries. Defined as geographically demarcated areas benefiting from a regulatory, fiscal and administrative framework distinct from the rest of the territory, they aim to attract foreign direct investment (FDI), promote exports and catalyze structural transformation (Farole, 2011; UNCTAD, 2021, AEZO, 2025). Globally, more than 5,000 SEZs have been identified, including 237 in Africa (UNCTAD, 2021). Countries such as Morocco (Tangier Med), Ethiopia (Hawassa Industrial Park), Kenya (Konza Technopolis), Senegal (Diamniadio), Ghana (Tema Free Zone) and Rwanda (Kigali SEZ)

have placed these instruments at the heart of their industrial strategy. The literature on SEZs has mainly focused on three dimensions: FDI attraction (Wang, 2013; Rodriguez-Pose et al., 2022; Frick and Rodriguez-Pose, 2023: Tamno and Keneck-Massil, 2025a, Tafesse et al., 2025), export performance (Aggarwal, 2010; Tamno and Keneck-Massil, 2025c, Talla et al., 2026) and structural transformation (Zeng, 2016; Otchia and Wiryawan, 2025, Abagna et al., 2025). The results are heterogeneous. Some studies show that SEZs can generate positive effects on exports and employment (Cheng & Kwan, 2000; Wang, 2013), while others highlight the risks of productive isolation and dependence on tax incentives (Farole & Akinci, 2011, Phelps, 2015; Phelps et al., 2017). However, the question of their net impact on tax revenue mobilization remains largely absent from the empirical debate, particularly in the African context.

From a theoretical point of view, the relationship between SEZs and tax revenues is ambiguous. In a static framework, tax exemptions associated with SEZs can reduce government revenues in the short term. This logic is consistent with the literature on international tax competition, which highlights the risks of eroding the tax base (Devereux & Griffith, 1998; Keen & Konrad, 2013). However, in a dynamic framework of structural transformation, SEZs can broaden the tax base through several cumulative mechanisms: formalization of employment, increase in declared profits, export growth, technological diffusion and integration into global value chains (Aghion et al., 2015; Rodrik, 2008). This tension refers to an intertemporal trade-off between immediate fiscal costs and future gains linked to the expansion of the productive base. If SEZs manage to generate positive externalities and sustainable agglomeration effects (Duranton & Puga, 2004), the net effect on tax revenues can become positive in the medium term. Conversely, if tax incentives result in artificial relocations without net domestic value added, the impact may be neutral or even negative.

Empirically, the descriptive correlation between the proliferation of SEZs and the evolution of tax revenues in Africa suggests a positive dynamic over the past two decades (Figure 1). However, this raw correlation is subject to an obvious selection bias: countries that adopt SEZs often have a more favourable macroeconomic and institutional environment. The identification of a causal effect therefore requires a rigorous empirical strategy.

Figure 1: Cross-sectional evolution of tax revenues and SEZs in Africa (1996–2021)



Source: Author's construction based on data from GRD UNU Wider and UNCTAD.

To address this issue, this article uses the entropy balancing method (Hainmueller, 2012), combined with a panel model with fixed country and temporal effects. We use a sample of 45 African countries over the period 1996–2021, the results show that the adoption of an SEZ is associated with a positive and statistically significant increase in the tax revenue-to-GDP ratio, in the order of 0.8 to 1.0 points of GDP on average. This effect remains robust to the introduction of additional controls selected via Bayesian Model Averaging, as well as to the use of alternative methods (propensity score matching, IPW, IPWRA). The compositional analysis reveals that the effect is mainly driven by direct taxes, in particular personal income tax and corporate tax, as well as by taxes on goods and services. Heterogeneity analyses indicate that the impact is more pronounced in middle-income countries, with better institutional quality and higher trade integration. The analysis of the mechanisms shows that SEZs significantly influence three intermediate variables associated with tax revenues: the participation of the formal workforce, trade openness and FDI. These results suggest that SEZs act not only through a direct fiscal adjustment, but through an endogenous expansion of the tax base through structural transformation.

This study contributes to three points. First, it enriches the work on the mobilization of domestic resources in Africa by integrating a territorialized industrial policy dimension, through the analysis of the effects of SEZs. Second, we first select the relevant determinants of tax revenue mobilization in Africa; we then use impact assessment methods to analyze the effect of SEZ adoption and proliferation, taking into account their characteristics: type, form of governance, size, and functionality. Third, a disaggregated analysis is carried out to examine the effects related to the geographical region, structural factors and landlocked nature of the countries. Fourth, this study suggests that formal job creation, trade openness, and FDI attractiveness are the mechanisms by which SEZs influence tax revenue mobilization in Africa.

The rest of the article is organized as follows. Section 2 presents the theoretical framework and testable hypotheses. Section 3 describes the empirical strategy and the data. Section 4 presents the basic results. Sections 5 and 6 examine robustness and heterogeneity. Section 7 analyzes the mechanisms of transmission. Section 8 concludes by discussing the implications for economic policy.

2. Theoretical review: SEZs and tax revenue mobilization

The relationship between SEZs and tax revenue mobilization can be analyzed through the lens of fiscal capacity and structural transformation. Musgrave (1959) emphasizes that tax performance depends on the productive structure, while Tanzi (1992) and Tanzi and Zee (2000) show that the broadening of the tax base accompanies sectoral change and economic formalization. Besley and Persson (2014) formalize this intuition by considering fiscal capacity as an intertemporal investment: economic policy choices dynamically affect the future trajectory of the tax base. In this perspective, SEZs can be interpreted as an institutional instrument that can influence the mobilization of public revenues through several transmission mechanisms. Consider an open economy in two periods $(t = 0,1)$. Tax revenue is defined by $R_t = \tau_t B_t$, where τ_t is the effective tax rate and B_t the taxable base. The introduction of an SEZ generally implies a reduction in the effective rate on a fraction θ of the formal activity :

$$\tau_0^{ZES} = (1 - \theta)\tau$$

which results in an immediate loss. However, the taxable base changes according to: $R_0^{SEZ} < R_0^{NoSEZ}$

$$B_1 = B_0(1 + g + \Phi),$$

Where g represents the exogenous growth and the additional effect induced by the SEZs. The condition of intertemporal sustainability is given by:$g\Phi$

$$\beta\tau B_0\Phi \geq \theta\tau B_0.$$

The theoretical analysis therefore consists in identifying the components of Φ.

The first mechanism is based on attracting foreign direct investment. Dunning's (1988) eclectic paradigm emphasizes that multinational firms localize their activities according to institutional, fiscal and infrastructural advantages. SEZs concentrate these attributes in order to attract FDI. The classic literature shows that FDI promotes growth via technology transfer and productivity externalities (Borensztein, De Gregorio, & Lee, 1998; Alfaro, Chanda, Kalemli-Ozcan, & Sayek, 2004; Javorcik, 2004; Keller & Yeaple, 2009). Recent work confirms that, in the African context, the adoption and proliferation of SEZs significantly increases FDI flows, with amplified effects when areas are multisectoral, large and governed by public-private partnerships (Tamno &

Keneck-Massil, 2025a, Tafesse et al., 2025). However, the increased FDI associated with SEZs will only broaden the tax base only if the productive and fiscal benefits exceed the incentive costs. Contemporary literature on international taxation highlights the risks associated with preferential regimes like those offered by SEZs. Keen and Konrad (2013) show that tax competition can lead to an erosion of the tax base, while Klemm and Van Parys (2012) point out that the effectiveness of incentives is highly dependent on institutional quality. Recent debates around the global minimum corporate tax rate also indicate that SEZ regimes may see their tax attractiveness reduced, thereby changing their ability to generate net revenue (Waruguru Ndubai-Ngigi & Readhead, 2024).

A second mechanism potentially linking SEZs to greater tax revenue concerns the overall participation of the workforce. Fiscal capacity depends not only on the activity of enterprises, but also on the degree of productive integration of the labour force. Gordon and Li (2009) show that informality structurally limits the tax base in developing countries, while La Porta and Shleifer (2014) point out that the transition to formal activities is a slow but crucial process for tax modernization. SEZs can boost labour market participation by creating direct and indirect jobs, increasing relative wages and attracting under-represented segments of the labour force, including youth and women. The agglomeration effects identified by Krugman (1991) and the dynamics of collective learning reinforce this productive integration. Recent analysis on Africa show that SEZs contribute to employment expansion and industrial integration, particularly through their role in global value chains (Tamno & Keneck-Massil, 2025b, Tafesse et al., 2026). The related increase in formal labour market participation increases the declared wage bill, stimulates taxable consumption and broadens the base of direct and indirect taxes. This channel therefore acts as a structural fiscal multiplier, conditioned by the capacity of the labour market to absorb labour into formal activities.

A third mechanism through which SEZs may increase tax revenue is through greater trade openness. SEZs reduce trade friction by simplifying customs procedures and improving logistics connectivity. Modern Trade Theory (Melitz, 2003; Antràs & Helpman, 2004; Baldwin, 2012) shows that reducing trade costs promotes the reallocation of resources to the most productive firms and increases trade flows. However, the tax effect of the opening is ambiguous. Baunsgaard and Keen (2010) show that tariff liberalization reduces tariff revenues, and that substitution by domestic taxation is not automatic. More recent work indicates that trade openness can increase tax revenues when governments have sufficient capacity to capture domestic value addition (Gnangnon & Brun, 2019). Contemporary analyses of African SEZs highlight that their contribution to integration into global value chains is conveyed through FDI, employment and bilateral trade, but remains heterogeneous across institutional and infrastructural capacities (Tamno & Keneck-Massil, 2025b). For example, the trade opening induced by SEZs can broaden the tax base, but only if it is accompanied by a strengthening of tax institutions and a modernization of domestic taxation.

Overall, the structural effect of SEZs on tax revenue mobilization depends on the interaction between FDI attractiveness, increased labor participation, and trade openness. Recent work shows that the impact of greater FDI, expanded labor participation, and trade openness on tax revenue are strongly conditioned on the institutional context, the quality of infrastructure and the governance of the areas (Rodríguez-Pose et al., 2022; Tamno & Keneck-Massil, 2025a, 2025b). Contemporary debates on international taxation and the global minimum rate further reinforce this conditional dimension, by changing the balance between tax incentives and actual revenues. The theoretical ambiguity therefore remains central: SEZs can either sustainably expand the tax base through productive transformation or generate a net erosion if the exemptions exceed the structural gains.

3. Methodology

Our central aim is to establishing whether there is a causal link between the adoption of a SEZ and the mobilization of tax revenues. The adoption of an SEZ, which is a function of a country's economic performance (business climate, technological development, human capital and institutional capacity), is not a random event. These performance-related factors, which can also influence tax revenue mobilization, make the adoption of SEZs endogenous. As such, it is difficult to isolate the effect of SEZs. To get around this problem, the study uses an impact assessment method, called "entropy balancing", developed by Hainmueller (2012). This method has been widely used in the literature to measure, for example, the impact of SEZs on export diversification (Tamno and Keneck-Massil, 2025c), the impact of the adoption of tax reforms and mobile money (Apeti et *al*., 2023) and the impact of IMF programs on sovereign debt crises (Balima and Sy, 2021).

In this study, the entropy balance method identifies the effect of SEZ adoption by comparing countries that have adopted SEZ with those that have not adopted SEZ but are similar in terms of observable characteristics, while controlling for fixed effects over time and by country. This method offers several advantages over competing impact analysis methods such as propensity score matching or difference-in-differences methods (Apeti and Edoh, 2023). First, it allows for a degree of balance between the treatment and control groups by creating a synthetic group that is as close to the treatment group as possible.

Second, unlike other impact assessment methods, it does not require an empirical model for the uptake of SEZs, thus limiting specification and multi-collinearity issues. Third, unlike conventional matching methods, the entropy balance uses a more flexible reweighting approach by keeping the weights closer to the base weights to avoid the loss of information. Unlike conventional matching, which is based on the conditional independence assumption, the fourth advantage is that entropy balance allows us to exploit the panel aspect of our data and control for temporal and country fixed effects in the second step of the regression.

Drawing on the methodology of Apeti and Edoh (2023), the approach used in this study is based on the principle that SEZ adoption is the treatment variable and tax revenue mobilization is the outcome variable. The units of observation are the country-year observations. Countries with SEZ adoption represent the treatment group, and countries without SEZs represent the control group. Therefore, to achieve the objective of this study, the impact assessment methodology of estimating the average treatment effect on treaties (ATT) is defined as follows:

$$ATT = E[(T_i = 1)] - E[(T_i = 1)] \quad (2)$$

Where Y(.) is the outcome variable measuring tax revenue. T indicates whether the observation unit is subject to the adoption of the SEZ (T=1) or not (T=0). $E[(T_i = 1)]$ is the expected outcome for countries that have adopted the SEZ (treatment group), and is the counterfactual outcome for countries that have adopted the SEZ, i.e., tax revenue mobilization in countries that have an SEZ if they had not adopted the SEZ. The treatment effect (ATT) is therefore the difference in the mobilization of tax revenues between the situation due to the adoption of a SEZ and the situation without the adoption of SEZs.

This approach would suffer from a counterfactual problem, since it is not possible to observe how the country would have evolved if it had not adopted the SEZ. For this reason, this study adopts a counterfactual framework consisting of untreated countries, which also represents a potential control group for the treated countries. Since the treatment allocation is not random, a simple difference in outcome between the treated units and the control group does not ensure the reliability of the estimates, given the potential selection bias. Thus, the matching approach consists of reproducing a situation close to a context where units are randomly assigned to processing. The latter are therefore matched with those who have been exposed to treatment, on the basis of their pre-observable characteristics, which are as assimilable as possible. The ATT resulting from the matching can be formalized as follows:

$$ATT(\chi) = E[(T_i = 1,\ X = \chi)] - E[(T_i = 1, X = \chi)] \quad (3)$$

Where χ is the vector of covariates resulting from the BMA and LASSO methods that can be correlated with the treatment and potentially with the outcome variable. This vector makes it possible to address the endogeneity problem due to omitted variables to which all impact assessment methods are subject (Apeti and Edoh, 2023). This vector therefore allows the entropy balance method to control for endogeneity bias resulting from unobserved temporal factors that affect both tax revenue mobilization and SEZ adoption. $E[(T_i = 1,\ X = \chi)]$ is the expected result for the processed observations, and $E[(T_i = 1, X = \chi)]$ is the expected result for the best counterfactuals of the treated units. Moreover, to contain the inverse causality, we shift these covariates by a period.

Estimating ATT by entropy balancing requires two steps. The first step is to calculate the weights of the control groups (untreated groups). These weights can satisfy pre-specified

equilibrium constraints involving the moments of the sample of observable features (X). This study retains the equilibrium constraints that impose equal covariate means between the treatment and control groups (Neuenkirch and Neumeier, 2016). In doing so, it will be a question of ensuring that the control group, on average, has untreated units that are as similar as possible to the treated units. The second step uses the weights of the first step in a regression analysis where economic diversification is the dependent variable, and the dummy variable of SEZ adoption is the main explanatory variable, in order to estimate in a second step the average treatment effect of the SEZ (ATT) on tax revenues. In the second step, we also control for entropy balancing covariates as well as time- and country-specific effects, as in a randomization experiment, to increase the efficiency of the estimates.

While entropic balancing is our core method, we also use other impact analysis methods such as Propensity Score Matching (PSM), Inverse Probability Weighting (IPW), and Inverse Probability Weighted Regression Adjustment (IPWRA) in order to test the robustness of our results. Moreover, like any impact analysis method, entropic balancing fails to control for endogeneity bias resulting from unobserved, time-varying factors that affect both tax revenue and mobile money adoption, or omitted variables. Therefore, we complement our robustness tests by adding additional control variables in our entropy balancing specification (see Gutmann et al., 2021) and use additional methods such as panel fixed-effect regression and the GMM system.

4. Data, and descriptive statistics

4.1. Data

To assess the effects of the adoption, proliferation and characteristics of SEZs on tax revenue mobilization, we rely on a large panel of data covering 45 African countries over the period 1996-2021 (i.e. 45 x 26= 1170 observations). We are focusing on African countries given the rapid expansion of SEZs in recent years. Countries are included in the sample based on the availability of tax revenue data. Data are collected from different sources: UNU- WIDER Government Revenue Dataset Version 2021, UNCTAD, literature review, World Development Indicator (WDI). The data sources and their descriptions, as well as the full list of countries, are provided in the annex (Tables A1 and A2). The full description of the data is as follows.

4.1.1. Dependent variable

Following previous studies (Apeti and Edoh, 2023; Gnangnon and Brun, 2019; Morrissey et al., 2016), our main dependent variable is tax revenue excluding resource taxes and social contributions. It is taken from the UNU-WIDER Government Revenue Dataset (GRD). The main advantage of the DSM over other sources of government revenue data, such as the World Revenue Longitudinal Database (WoRLD) or the Organisation for Economic Co-operation and Development (OECD), is that it distinguishes between resource and non-resource sector revenues, based on disaggregated data from the IMF's Article IV reports (Prichard, 2016). For robustness

analyses, we will take into account the distribution of taxes collected according to whether they are direct or indirect. Also, following Gupta et al. (2021) and Apeti and Edoh (2023), we focus on five categories of taxes, namely personal income tax (PIT), corporate income tax (CIT), property tax (IF), goods and services tax (IBS), which includes VAT, and international trade tax (trade tax).

4.1.2. Variable of interest: SEZ adoption, proliferation and characteristics

In view of the objective of this analysis, which aims, on the one hand, to analyse the effect of the adoption of the SEZ and, on the other hand, to analyse the effect of the proliferation and characteristics of the SEZs created in a country, three SEZ measures result. First, this study uses new data sources, presenting information on the specific characteristics of African SEZs. To build the panel base over the study period, first, we use UNCTAD's SEZ Universe database, which provides the information on the 237 African SEZs on aspects such as date of creation, functionality, size, governance and legal status. The database, initially built in 2019, was updated in 2020. The classification of SEZs reflects the UNCTAD definition of "special economic zone". However, while the dataset provides basic information on all 237 areas, data availability issues emerge when looking closely at country-specific cases. Therefore, to complement this information, we second, use data from country/SEZ-specific literature, including academic publications, policy reports, draft laws related to the establishment of SEZs, white papers, and grey literature. Following this, the measure relating to the adoption of the SEZ is a dummy variable that takes the value 1 after the adoption of an SEZ in a country on date t and 0 before. On the other hand, the number of SEZs is a counting variable that increments with each creation of an SEZ in a country during the study period. For this measure, the characteristics related to SEZs are also discrete numerical variables that increment when the defined criterion is met by the SEZ established at date t.

4.1.3. Control variable: determinants of tax revenue mobilization

The contemporary literature on tax revenue mobilization in developing countries is part of the broader framework of work on fiscal capacity and state-building (Besley & Persson, 2014). It highlights that fiscal performance is not only the result of technical tax policy choices, but of a set of structural conditions related to the productive base, macroeconomic stability, financial and trade integration, as well as the quality of institutions and demographic constraints. From this perspective, the determinants of tax mobilization can be organized into three interdependent sets: (i) structural economic determinants, which condition the size of the tax base; (ii) political and institutional determinants, which influence administrative capacity and tax compliance; and (iii) socio-demographic and geographical determinants, which affect collection costs and revenue stability.

- **Economic determinants: broadening and securing the tax base**

The capacity for fiscal mobilization is based first and foremost on the level and structure of economic development. Real GDP per capita (log) is a standard measure of the level of productive

sophistication and average ability to pay. An increase in per capita income mechanically broadens the income tax base, increases taxable profits, and stimulates taxable consumption (Gupta, 2007; Pessino & Fenochietto, 2010; Crivelli & Gupta, 2014). However, the level of development does not act in isolation: it interacts with the sectoral structure. Indeed, a large share of agriculture, forestry and fisheries (% GDP) is generally associated with higher informality and tax bases that are more difficult to capture (Gupta, 2007; Castro & Ramírez, 2014), while a more industrialized productive structure facilitates direct and indirect taxation. In line with this logic, financial depth, measured by domestic credit to the private sector (% GDP), reflects the degree of formalization and traceability of transactions. Besley and Persson (2014) show that modern fiscal capacity is based on the verifiability of economic flows. In addition, financial freedom and freedom of investment, derived from the indicators of economic freedom, capture the quality of the financial regulatory framework and investor protection, which are likely to encourage formalization and broaden the tax base. In the same vein, the digital transformation, apprehended by fixed telephone subscriptions and more broadly by ICT infrastructures, improves the traceability of transactions and reduces compliance costs. Djeufack et al. (2026) demonstrate that ICTs enhance fiscal mobilization not only directly, but also indirectly through financial development and institutional quality. Moreover, the size of the State, measured by public expenditure (% GDP), reflects the demand for public financing. An expansion of spending can increase the fiscal effort when the government seeks to ensure fiscal sustainability (Teera & Hudson, 2004; Gupta, 2007). Similarly, domestic investment and FDI flows (% GDP) contribute to broadening the tax base by stimulating formal activity and wage employment (Nguyen et al., 2022), although their impact depends on the ability to limit the erosion of the tax base.

In addition, international integration is another central channel. Trade openness (% GDP) and the Globalisation Index (KOF) capture trade intensity and overall economic integration. While liberalization can reduce customs revenues in the short term (Baunsgaard & Keen, 2010), it can also support a transition to more efficient domestic taxation when accompanying institutional reforms are implemented (Gnangnon & Brun, 2019). Similarly, migrant remittances (% GDP) can indirectly broaden the tax base through domestic consumption and investment (Singer, 2010), while official development assistance (% GNI) can either strengthen administrative capacity or reduce the incentive to mobilize domestic resources in cases of over-dependence (Gupta, 2007).

Finally, macroeconomic stability secures the real value of revenues. Inflation erodes tax revenues in the presence of collection delays, in line with the Olivera-Tanzi effect (Tanzi, 1988), while exchange rate (log) fluctuations influence foreign trade and financial flows. In addition, natural resource rents (% GDP) are introduced in order to test the rent-dependent hypothesis: states with a high extractive resource endowment may develop a lower domestic fiscal capacity due to a lower incentive to diversify their revenue sources (Besley & Persson, 2014; Crivelli & Gupta, 2014). Finally, the secondary school enrolment rate (% gross) captures the accumulation of human capital, which promotes economic formalization and tax compliance (Castro & Ramírez, 2014).

- **Policy and institutional determinants: credibility, compliance and administrative capacity**

Beyond economic fundamentals, fiscal mobilization depends closely on institutional quality. The control of corruption and the rule of law capture the credibility of the state and the protection of property rights. Better governance strengthens voluntary compliance and reduces tax evasion (Bird et al., 2008; Gupta, 2007). In the same vein, the literature on fiscal capacity emphasizes that the construction of credible institutions promotes the emergence of a fiscal contract between the state and taxpayers (Besley & Persson, 2014). Moreover, democracy influences political incentives to levy taxes. Ehrhart (2009) shows that a democratic regime can strengthen the fiscal effort in response to the social demand for public goods. Similarly, administrative simplification, measured by the time it takes to pay taxes, is a key operational determinant: simpler procedures reduce compliance costs and improve collection (OECD, 2022; Apeti & Edoh, 2023). Finally, the State Fragility Index measures institutional instability that can weaken administrative capacity, while the Vulnerability Index captures exposure to economic or climate shocks that can undermine revenue stability (Gwaindepi, 2021; Ajeigbe et al., 2024).

- **Socio-demographic and geographical determinants: structural constraints of collection**

The demographic structure directly influences the tax base. Indeed, the dependency ratio reduces the proportion of the contributing population, while the rate of participation in the labour force automatically widens the tax base. Rural population growth and population density affect the administrative costs of collection (Apeti and Edoh, 2023). Economies with a high geographical dispersion have higher collection costs and higher levels of informality (Castro & Ramírez, 2014). The fragility of the state limits administrative capacity and increases revenue volatility (Gwaindepi, 2021). Finally, economic vulnerability to external shocks can weaken fiscal stability (Ajeigbe et al., 2024). Descriptive statistics for all these variables are presented in Table A3 (Appendix).

- **Choice of basic control variables by the Bayesian Model Averaging (BMA) method**

The identification of robust determinants of tax revenue mobilization faces substantial uncertainty related to the specification of the model. The literature does not propose a unified and comprehensive theoretical framework to capture all the factors likely to influence fiscal capacity (Gupta, 2007; Moore et al., 2018; Apeti & Edoh, 2023). The potential determinants relate to economic, institutional and socio-demographic dimensions, the relevance of which varies according to the geographical contexts and the periods studied. This multiplicity exposes traditional estimates to the risk of omission bias and a high sensitivity to specification choices. In order to explicitly address this uncertainty, we use the BMA's approach.

The BMA makes it possible to simultaneously consider a large set of models from different combinations of the explanatory variables and to assign to each one an a posteriori probability. Rather than arbitrarily selecting a single specification, this approach calculates for each variable a posterior inclusion probability (PIP), reflecting its empirical robustness across the model space. Given the large number of potential predictors (97 variables grouped into 29 categories), an exhaustive exploration of all the combinations is not technically feasible. We use an MC^3 (Markov Chain Monte Carlo Model Composition) algorithm to efficiently sample the specification space. The estimate is based on 1,874 models visited, with 40,000 MCMC prints after a burn-in of 5,000, ensuring adequate exploration of the model space. It should be noted that country and year fixed effects were systematically included in the Bayesian estimates. The introduction of country fixed effects makes it possible to control for unobservable time-invariant heterogeneity, such as institutional inheritance, administrative structure or geographical characteristics, which may have a lasting influence on fiscal capacity. Fixed temporal effects capture shocks common to all countries, such as international economic cycles, global tax reforms, or financial crises. This strategy ensures that the inclusion probabilities estimated by the BMA reflect clear relationships of unobservable factors specific to countries or years. The results highlight a hard core of determinants with a probability of inclusion equal to 1, indicating their systematic presence in the most probable models (Table A4 in the appendix). These include financial development, the size of the state, natural resource rents, trade openness, corruption control, labour force participation and migrant remittances. The estimated signs are economically consistent: financial development, government size, trade openness, institutional quality, and labor market participation have a positive effect on tax revenue mobilization, while dependence on natural rents is associated with a negative effect, supporting the hypothesis of less incentive to broaden the domestic tax base in rentier economies. Other variables, such as GDP per capita, vulnerability, the share of agriculture or the rule of law, have high but lower than unity probabilities of inclusion and are used in robustness analyses, in particular that of the additional variables.

In order to strengthen the credibility of the results and to limit the dependence on a single selection strategy, we supplement the analysis with a penalized approach of the Least Absolute Shrinkage and Selection Operator (LASSO) type (Tibshirani, 1996). This method minimizes the sum of the squares of the residuals under L1 stress, leading some coefficients to be contracted to zero and thus allowing an automatic selection of the relevant variables. The ten-fold cross-validation selects an optimal penalty parameter ($\lambda = 0.8$), leading to a sparse model with nine non-zero coefficients and a high out-of-sample predictive performance ($R^2 \approx 0.86$). Consistent with the strategy adopted in Bayesian estimation, LASSO models also include country and year fixed effects, ensuring that variable selection is conditional on country-specific unobserved heterogeneities and common temporal shocks. The variables used by LASSO largely overlap with those identified by the BMA, including financial development, the size of the state, corruption control, trade openness and natural rents. The convergence of the results from the BMA and the LASSO, under control of the country and year fixed effects, suggests that the determinants identified are not the result of an arbitrary specification or an omission of unobserved heterogeneities. This methodological strategy

reinforces the internal validity of the estimates and ensures that the baseline specification is based on a set of empirically robust determinants of tax revenue mobilization specific to our study sample over the defined period. Descriptive statistics for all of these variables above are presented in Table A4 (Appendix).

4.2. Descriptive statistics

Insofar as the adoption of SEZs is not a random public policy decision, but is the result of a set of structural, institutional and macroeconomic conditions, the analysis of pre-treatment characteristics appears to be an essential step. Countries may decide to set up SEZs precisely because they already have more developed financial systems, stronger institutions, or a more diversified productive base, all of which are closely linked to tax revenue mobilization. To ignore these initial differences would lead to attributing to the adoption of SEZs effects that are in fact the result of pre-existing structural heterogeneities. In this context, descriptive statistics play a central diagnostic role: they make it possible to assess the comparability of the treated and control groups before the application of the entropy balancing method.

Table 1 presents the tests for comparing averages between countries adopting an SEZ and those without one, before reweighting. The results highlight significant differences on several key variables. Adopting countries show a significantly higher level of financial development (26.45% vs. 17.14% of GDP; $p<0.01$), suggesting that deep credit markets can facilitate both SEZ implementation and economic formalization. Conversely, non-adopting countries have higher levels of total government revenues and natural resource rents, which may reflect a higher dependence on extractive revenues and, consequently, a lower incentive to diversify the tax base through industrial policy instruments such as SEZs. At the institutional level, the adopting countries also stand out for their better control of corruption (–0.56 vs. –0.70; $p< 0.01$), which is consistent with the idea that the establishment of SEZs requires a minimum of administrative capacity and regulatory credibility. In addition, the labour force participation rate is significantly higher in the enacting countries, reflecting greater integration into the labour market and a potentially wider tax base. In contrast, remittances from migrants are higher in non-adopting countries, which could indicate an increased dependence on external income rather than domestic productive expansion. In contrast, trade openness does not show a statistically significant difference between the two groups, suggesting that integration into international markets, taken in isolation, is not sufficient to explain the adoption of SEZs. Overall, these results confirm the existence of a selection bias: adopting countries differ structurally from non-adopting countries on dimensions that also influence tax performance. A gross comparison of tax revenue levels would therefore be likely to be biased.

Table 1: Descriptive statistics before weighting

Variable	[1] No SEZ	[2] SEZ	[3] = [1] - [2] Difference
Lag Financial development	17.1379	26.4512	-9.3133***
Lag Government revenue	15.9392	14.1205	1.8187***
Lag Natural resource rents	13.3431	11.6355	1.7076**
Lag Trade openness	66.6357	68.1116	-1.4758
Lag Control of corruption	-0.7041	-0.5605	-0.1436***
Lag Labor force participation	14.5464	15.4040	-0.8576***
Lag Remittances	4.1335	2.8769	1.2566***

Notes: The table reports mean comparison tests between SEZ adopters and non-adopters. Two-sample t-tests with unequal variances (Welch–Satterthwaite correction) are applied. p<0.01, ** p<0.05, * p<0.10.

Table 2 presents descriptive statistics after applying the entropy balancing method. The reweighting procedure makes it possible to eliminate the differences in means between the two groups: the values of the covariates become identical, and the standardized deviations are practically zero. This indicates that the synthetic control group constructed by reweighting faithfully reproduces the observable characteristics of the adopting countries before treatment. The convergence diagnoses and the distribution of weights suggest a stable and economically reasonable reweighting. As a result, subsequent comparisons of results can no longer be attributed to pre-existing observable differences, which enhances the credibility of the counterfactual approach.

Table 2: Descriptive statistics after weighting

Variable	[1] SEZ	[2] Control	[3] = [1] - [2] Difference
Lag Financial Development	17.156	17.156	0
Lag Size of Government	15.939	15.939	0
Lag Natural Resource Rents	13.340	13.340	0
Lag Trade Openness	66.635	66.635	0
Lag Control of Corruption	-0.705	-0.705	0
Lag Labor Force Participation	14.543	14.543	0
Lag Remittances	4.138	4.138	0
Observations	564	511	
Total of weights	511	511	

p < 0.01, **p < 0.05, *p < 0.1. (a) t-test of the difference in means.

Table 3 then examines the differences in tax revenues. Before reweighting, the adopting countries recorded an average of 12.04% of GDP compared to 11.01% for the non-adopting countries, i.e. a gross difference of about 1 point of GDP that was statistically significant. Figure 1 visually confirms this difference: the distribution of tax revenues in adopting countries is generally shifted towards higher levels, with a median higher than that of non-adopting countries. This graphical representation reinforces the idea of a positive association between SEZ adoption and tax performance, while recalling that this relationship remains descriptive at this stage. Beyond the

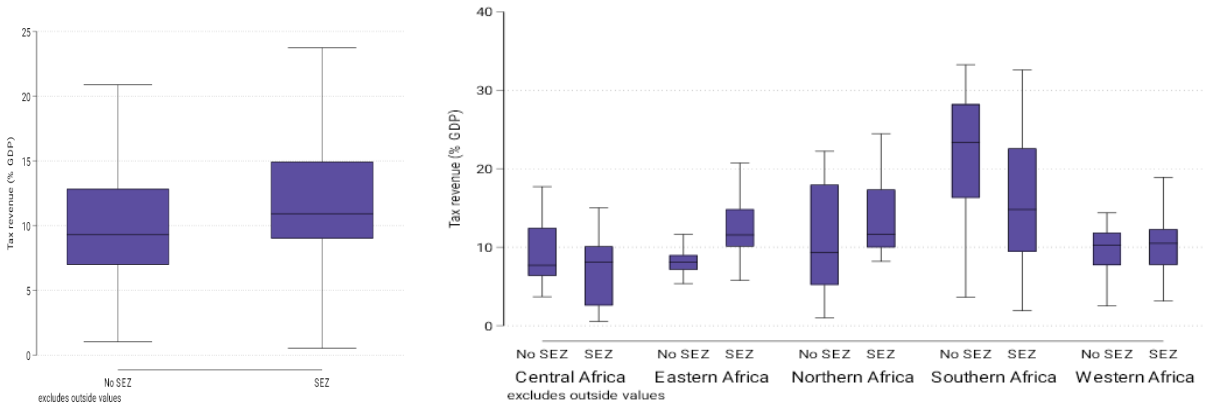
overall comparison between groups, the boxplot by region sheds additional light on the geographical heterogeneity of tax mobilization. The corresponding figure shows that median levels of tax revenue vary significantly across African regions. Southern Africa generally has higher levels and relatively contained dispersion, reflecting more consolidated tax systems. Conversely, some regions in Central and West Africa show a greater dispersion, suggesting a marked structural heterogeneity in the capacity for fiscal mobilization. North Africa is at an intermediate level, with moderate variability. This regional heterogeneity is crucial for the interpretation of the results. It indicates that the relationship between SEZs and fiscal mobilization can be influenced by specific regional contexts, particularly in terms of productive structure, trade integration or institutional stability. The boxplot also highlights that intra-regional differences can be as large as interregional differences, highlighting the need for a rigorous control for countries and year fixed effects in subsequent econometric estimates.

Table 3: Tax revenue by SEZ adoption

Variable	No SEZ	SEZ	Difference	Ttest	p-value
Tax revenue (%GDP)	11.0144	12.0433	-1.0289	-2.9727	0.0030

Notes: The table reports mean comparison tests of non-resource tax revenue excluding social contributions (% GDP). Two-sample t-tests with unequal variances (Welch–Satterthwaite correction) are applied. p<0.01, ** p<0.05, * p<0.10.

Figure 2: Tax revenue by SEZ adoption



Note: In the box plots, the lower and upper hinges of each box show the 25th and 75th percentiles of the samples, the line in the box indicates the respective medians, and the endpoints of whiskers mark next adjacent values.

5. Baseline Results

Table 4 presents the estimated effect of the adoption of an SEZ on the mobilization of tax revenues measured as a percentage of GDP. The estimation is based on the entropy balancing method, which

compares countries that have adopted an SEZ with a group of statistically similar synthetic countries based on pre-treatment characteristics, while controlling for country and temporal fixed effects. The results indicate that the variable capturing the adoption of an SEZ is associated with a positive and statistically significant coefficient across the different specifications. In other words, all other things being equal, African countries that have adopted an SEZ have a higher tax-to-GDP ratio than comparable countries that have not adopted an SEZ. This result is robust to the gradual introduction of macroeconomic, structural, and institutional control variables, suggesting that the observed effect does not simply reflect a pre-existing differential in development or institutional quality between adopting and non-adopting countries.

Indeed, SEZs are generally associated with substantial exemptions from corporate tax, VAT and customs duties. The International Institute for Sustainable Development's policy brief highlights that, in some jurisdictions, the effective tax rate in SEZs has been reduced to almost zero (Ndubai-Ngigi & Readhead, 2024). Similarly, national tax incentive guides indicate that several African countries are granting significant CIT rate reductions, customs duty exemptions, and VAT concessions to companies located in the zones (KPMG, 2018). In South Africa, for example, qualified companies operating in an SEZ can benefit from a reduced corporate tax rate of 15%, combined with relief schemes for VAT and customs duties (UNCTAD, 2021). From a static perspective, these measures should mechanically reduce public revenues. The fact that the estimated coefficient is positive suggests that the dynamic effects of broadening the tax base offset or even exceed the initial tax losses. This interpretation is consistent with dynamic approaches to fiscal capacity, according to which policies that promote structural transformation can sustainably increase the tax base (Besley & Persson, 2013). SEZs, defined as geographically delimited areas with a separate regulatory regime and centralized administration (Ndubai-Ngigi & Readhead, 2024; UNCTAD, 2019), can reduce transaction costs, improve formalization and attract investments that would not have occurred in the absence of these schemes. In this context, a targeted reduction in the effective tax rate can increase the total volume of formal activity, thereby increasing aggregate tax revenues relative to GDP.

Moreover, the stylized facts support this reading. According to the analysis published in *African Leadership Magazine*, Nigerian free zones have attracted more than $66 billion in cumulative FDI and generated tens of thousands of jobs, while Multi-Facility Economic Zones in Zambia have mobilized more than $5.6 billion in investment (African Leadership Magazine, 2023). In Ethiopia, industrial zones have contributed to a significant expansion of manufacturing exports and the creation of formal jobs (African Leadership Magazine, 2023). These volumes of investment and formal activity suggest a substantial broadening of the tax base, notably through personal income tax, indirect taxation and spillover effects on local firms. However, recent literature reminds us that the effectiveness of tax incentives depends heavily on their design and governance. Excessively generous incentives can generate deadweight losses without sustainable gains in competitiveness (Farole, 2011; Ndubai-Ngigi & Readhead, 2024). The positive result of Table 4

should therefore be interpreted as an average effect, conditioned by the institutional quality and the integration of the SEZs into the national economy.

Table 4: Adoption of SEZ and Tax revenue (%GDP)

	Tax revenue (% GDP)							
Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Adoption of SEZ	**1.170*** **	**0.707*** **	**1.507*** **	**1.496*** **	**1.598*** **	**1.602*** **	**1.850*** **	**1.666*** **
	(0.414)	**(0.267)**	**(0.362)**	**(0.352)**	**(0.395)**	**(0.391)**	**(0.332)**	**(0.320)**
Lag Financial deepening		0.122***	0.125***	0.115***	0.117***	0.118***	0.123***	0.121***
		(0.026)	(0.012)	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)
Lag Government consumption			0.055**	0.064**	0.065**	0.066**	0.040*	0.047**
			(0.026)	(0.026)	(0.027)	(0.028)	(0.024)	(0.023)
Lag Trade				0.021***	0.023***	0.022**	0.011	0.007
				(0.008)	(0.009)	(0.009)	(0.009)	(0.008)
Lag Labor force					0.539	0.545	1.292***	1.298***
					(0.640)	(0.636)	(0.376)	(0.368)
Lag Natural resource rents						0.002	-0.038**	-0.030*
						(0.016)	(0.019)	(0.018)
Lag Corruption							0.115	0.470
							(0.442)	(0.417)
Lag Remittances								0.128***
								(0.044)
Year fixed effects in the second step	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country fixed effects in the second step	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,075	1,075	1,075	1,075	1,075	1,075	1,075	1,075
R-squared	0.864	0.926	0.910	0.911	0.912	0.912	0.902	0.907

Unreported constant included. Robust standard errors in brackets. p < 0.01, **p < 0.05, *p < 0.1.

6. Robustness checks

6.1.Taking into account the proliferation and characteristics of SEZ

After the analysis of the effects of the adoption of SEZs on the mobilization of tax revenues. It is interesting to see if this result does not depend on the characteristics of the area that has been placed. The results in Table 5 show that the fiscal impact of SEZs depends closely on their structural and institutional characteristics. The positive effect observed for integrated, multi-sectoral, medium- to large-sized areas governed by public-private partnerships suggests that the tax performance of SEZs does not automatically result from the incentives granted, but rather from their ability to generate productive externalities and to broaden the tax base in the long term. According to UNCTAD (2021), despite the rapid proliferation of SEZs on the continent, their performance has been highly contrasted, and often below expectations in terms of FDI, exports and employment. Many areas have remained landlocked, with limited links with the local productive fabric, thus reducing their macroeconomic benefits. This empirical reality sheds light on the negative or insignificant coefficients associated in Table 5 with certain specialized areas or areas with exclusively private governance. When an area functions as an enclave benefiting from

significant exemptions without sectoral or territorial integration, the dynamic effects likely to offset direct tax losses remain limited (Farole, 2011). Conversely, multisectoral areas with a positive and significant fiscal effect correspond to the recurrent recommendations of the literature on territorialized industrial policies. The integration of several sectors within the same area promotes inter-industrial complementarities, agglomeration economies and technological diffusion (Krugman, 1991; Rodríguez-Pose & Hardy, 2017). The case of Tangier Med in Morocco illustrates how an integrated zone, backed by a strategic logistics infrastructure and part of a coherent industrial strategy, can attract high value-added investments and stimulate activity beyond its borders (UNCTAD, 2021). Such dynamics are reflected in a broadening of the tax base through GDP growth, the formalization of employment and the increase in taxable revenues. The results on the size of the zones also confirm the importance of a critical mass. The literature insists on the principle that "size matters", highlighting that insufficient size limits the ability to attract anchor investors and develop quality infrastructure (AEZO, 2023). Mid- and large-sized areas, such as Coega in South Africa or Tema in Ghana, have benefited from economies of scale and better logistical integration, promoting FDI attraction and formal job creation (UNCTAD, 2021). These empirical elements are consistent with the theory of the new economic geography, according to which the spatial concentration of productive activities increases productivity and strengthens the tax base (Krugman, 1991). The role of governance also appears to be central. Areas managed in public-private partnerships have more favourable tax effects than those that are the exclusive responsibility of a public or private actor. This observation is in line with UNCTAD's institutional recommendations, which call for inter-institutional coordination, administrative autonomy of area authorities and alignment with the national development strategy (UNCTAD, 2021). Public-private partnerships can combine operational efficiency with public oversight, enhancing regulatory credibility and the state's ability to capture economic benefits. Conversely, exclusively private governance can increase the risks of aggressive tax planning, especially in the context of international tax competition (Keen & Konrad, 2013).

Table 5: SEZ's characteristics and tax revenue (%GDP)

Variables	Tax revenue (%GDP) (1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
	Type			Functionality		Area			Governance		
Special areas	**1.098*** **										
	(0.402)										
Industrial Parks		-0.126									
		(0.451)									
Other zones			**1.803*** **								
			(0.324)								
Functionality: Multisector				**0.184*** **							
				(0.069)							
Functionality: Specialized					-0.916*						
					(0.291)						
Area under 500ha						0.605*					
						(0.325)					
Area 500–1000ha							**2.166*** **				
							(0.577)				
Area above 1000ha								**1.248** **			
								(0.510)			
Governance: PPP									**1.330*** **		
									(0.350)		
Governance: Public										0.188	
										(0.597)	
Governance: Private											-1.494*
											(0.814)
Covariate in the second step	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects in the second step	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country fixed effects in the second step	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,075	1,075	1,075	1,075	1,075	1,075	1,075	1,075	1,075	1,075	1,075
R-squared	0.892	0.888	0.907	0.872	0.910	0.911	0.892	0.873	0.881	0.911	0.911

Unreported constant included. Robust standard errors in brackets. p < 0.01, **p < 0.05, *p < 0.1.

While Table 5 highlights that the fiscal performance of SEZs depends closely on their institutional and structural characteristics, Table 6 deepens the analysis by examining whether these effects remain robust when taking into account not only the nature of the areas, but also their intensity of deployment within national economies. In order to identify the effect of SEZ intensity on tax revenue mobilization, the analysis adopts a continuous extension of entropy balancing, in line with recent developments in the literature on continuous processing. The initial entropy balancing approach proposed by Hainmueller (2012) is based on a principle of reweighting aimed at balancing the observable covariates between comparable groups. In its version adapted to continuous processing, as formalized by Tübbicke (2022), the method allows to directly impose the orthogonality between the intensity of the treatment and the pre-treatment characteristics, thus ensuring that the intensity of SEZs is not correlated with observable determinants of tax revenues.

This strategy is particularly relevant in the context of the proliferation of SEZs. The number or density of areas within a country is not exogenous: countries that multiply SEZs often have a more developed administrative capacity, a higher degree of trade openness or a more favourable institutional environment. By controlling for these observable correlations, the continuous extension of entropy balancing allows the estimated coefficients to be interpreted as marginal effects associated with an incremental increase in SEZ intensity, rather than as a reflection of pre-existing structural differences. This logic is a continuation of the work on generalized propensity scores for continuous processing (Hirano & Imbens, 2004), while imposing balancing in a direct way. The results show that the proliferation of SEZs remains positively and significantly associated with the tax revenue-to-GDP ratio after adjusting for the intensity-related selection bias. The estimated effect is interpreted as a dose–response relationship: an increase in the degree of SEZ deployment is associated with a measurable change in fiscal mobilization. This result suggests that the fiscal impact of SEZs is not limited to a discrete adoption effect, but that it is part of a cumulative dynamic compatible with a gradual expansion of the system.

A central point is the stability of the effects associated with the institutional characteristics of SEZs. The variables relating to critical size, governance in public-private partnerships and multisectoral orientation retain their sign and significance even when the continuous intensity of the areas respecting these characteristics is taken into account. In other words, the quantitative extension of SEZs does not dilute the qualitative effects identified above; It confirms that institutional design remains an autonomous determinant of tax performance. This robustness is consistent with the analytical properties highlighted by Tübbicke (2022), according to which continuous entropy balancing effectively reduces the bias related to the observed dependencies between treatment and covariates.

Table 6: Proliferation of SEZ and Tax revenue (%GDP)

Tax revenue (%GDP)	(1)	(2)	(3)	(4)	(5)	(6)
		Type		**Functionality**		
	All SEZ	Special Zones	Industrial Parks	Other Zones	Multisector	Specialized
Number of SEZ	0.243***	0.423***	-0.307	0.243**	0.295***	-0.739***
	(0.084)	(0.123)	(0.457)	(0.106)	(0.103)	(0.285)
Covariate in the second step	yes	yes	Yes	yes	yes	yes
Country fixed effects in the second step	yes	yes	Yes	yes	yes	yes
Year fixed effects in the second step	yes	yes	Yes	yes	yes	yes
Observations	1,075	1,075	1,075	1,075	1,075	1,075
R-squared	0.865	0.892	0.888	0.907	0.871	0.911
	(7)	(8)	(9)	(10)	(11)	(12)
	Area			**Governance**		
Tax revenue (%GDP)	0-500 ha	500-1000ha	More than 1000ha	PPP	Public	Private
Number of SEZ	0.080	1.105***	0.875***	0.444***	0.544*	0.494
	(0.115)	(0.324)	(0.334)	(0.091)	(0.437)	(0.814)
Covariate in the second step	yes	yes	Yes	yes	yes	yes
Country fixed effects in the second step	yes	yes	Yes	yes	yes	yes
Year fixed effects in the second step	yes	yes	Yes	yes	yes	yes
Observations	1,075	1,075	1,075	1,075	1,075	1,075
R-squared	0.910	0.892	0.872	0.881	0.911	0.911

Unreported constant included. Robust standard errors in brackets. p < 0.01, **p < 0.05, *p < 0.1.

6.2. Consideration of additional control variables

The robustness analysis presented in Table 7 aims to verify whether the estimated effect of SEZ adoption on tax revenues (% GDP) remains stable when the specification is enriched with additional variables identified as relevant. These additional covariates are not arbitrarily chosen: they were retained from the BMA approach because of their probability of subsequent inclusion, although less than 1 was greater than 0.5. In other words, they have a significant explanatory weight in the determination of tax revenues, but they do not constitute unanimously selected determinants in all the specifications. It is therefore methodologically relevant to test whether taking them into account modifies the estimated main effect. Panel A introduces these variables only in the second step of the estimation (weighted regression), after constructing the balancing weights. Panel B integrates them exclusively in the first step, i.e. in the balancing process, without explicitly including them in the final regression. Finally, Panel C adopts the most demanding configuration by incorporating them simultaneously into both stages. The variables considered, namely the growth of the rural population, fixed telephone subscriptions, the log of GDP per capita,

the vulnerability index, the share of agriculture in GDP and the rule of law, cover demographic, technological, structural and institutional dimensions known to influence fiscal capacity. Across all three panels, the coefficient associated with SEZ adoption remains positive and statistically significant at the 1% level, with an amplitude of approximately 0.6 to 1 percentage point of GDP. Neither the direct addition of the controls in the regression (Panel A), nor their integration into the equilibrium (Panel B), nor their simultaneous inclusion (Panel C) qualitatively alter the sign or the significance of the main coefficient. These results reinforce the credibility of previous results and suggest that the estimated relationship is not the result of an omission bias or a fragile specification, but of a persistent structural effect associated with the adoption of SEZs.

Table 7:P otential omitted covariates or additional control

	(1)	(2)	(3)	(4)	(5)	(6)
Tax revenue (%GDP)	**Rural population growth**	**Fixed telephone subscriptions**	**Log GDP per capita**	**Vulnerability index**	**Agriculture, forestry & fishing (% GDP)**	**Rule of Law**
Panel A: Additional Covariate in the second step in the second stage only						
Adoption SEZ	0.926	0.927	0.926	0.760	0.892	0.883
	(0.257)	(0.257)	(0.256)	(0.294)	(0.282)	(0.281)
Covariate in the second step	Yes	Yes	Yes	Yes	Yes	Yes
Fixed effect countries	Yes	Yes	Yes	Yes	Yes	Yes
Time fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1075	1075	1075	1075	1075	1075
R-squared	0.927	0.927	0.927	0.921	0.927	0.921
Panel B: Additional Covariate in the second step in the first stage only						
Adoption SEZ	0.926	0.928	0.928	0.616	1,041	0.868
	(0.257)	(0.258)	(0.245)	(0.262)	(0.255)	(0.266)
Covariate in the second step	Yes	Yes	Yes	Yes	Yes	Yes
Fixed effect countries	Yes	Yes	Yes	Yes	Yes	Yes
Time fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1075	1075	1075	1075	1075	1075
R-squared	0.927	0.927	0.927	0.929	0.927	0.927
Panel C: Additional Covariate in the second step in both the second and first stage						
Adoption SEZ	0.926	0.929	0.927	0.681	1,036	0.802
	(0.257)	(0.258)	(0.244)	(0.305)	(0.276)	(0.293)
Covariate in the second step	Yes	Yes	Yes	Yes	Yes	Yes
Fixed effect countries	Yes	Yes	Yes	Yes	Yes	Yes
Time fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1075	1075	1075	1075	1075	1075
R-squared	0.927	0.927	0.927	0.922	0.927	0.921

Unreported constant included. Robust standard errors in brackets. p < 0.01, **p < 0.05, *p < 0.1

6.3. Alternative estimation methods

Table 8 consolidates the credibility of the results by mobilizing a coherent set of evaluation methods from the literature on treatment effects. We first use Propensity Score Matching (PSM), developed by Rosenbaum and Rubin (1983), which allows us to correct the selection bias on observables by constructing a counterfactual from comparable units. The Nearest-Neighbors, Radius, Kernel and Local Linear Regression variants each exploit a specific logic: strictly local matching, controlled enlargement of the support, continuous weighting of the entire sample or correction of biases at the boundaries of the common support. Then, we apply Inverse Probability Weighting (IPW), which reweights observations according to their estimated probability of processing, as well as Inverse Probability Weighted Regression Adjustment (IPWRA), a so-called "doubly robust" estimator combining weighting and regression adjustment (Imbens & Wooldridge, 2009). Despite these conceptual and technical differences, the overall estimates converge on the result that the adoption of SEZs is associated with a positive and statistically significant increase in tax revenues, with coefficients of approximately 0.8 to 1.4 percentage points of GDP. This consistency indicates that the estimated effect does not depend on a particular number of neighbors, a specific distance radius, or a given functional form of the treatment model or the outcome model. In other words, the positive relationship between SEZs and tax mobilization resists identification strategies based on separate assumptions about the selection mechanism and the structure of the model.

Table 8: Propensity score matching method

Tax revenue (%GDP)	N-Nearest-Neighbors Matching			Radius Matching			Kernel Matching	Local Linear Regression	IPW	IPWA
	N=1	N=2	N=3	r=0.005	r=0.01	r=0.05				
Adoption SEZ	1.154***	1.300***	0.954***	1.005***	1.161***	0.817***	1.116***	0.976***	1.056***	1.387***
	(0.234)	(0.541)	(0.321)	(0.114)	(0.415)	(0.766)	(0.012)	(0.015)	(0.321)	(0.275)
Observations/treated	1075/564	1075/564	1075/564	1075/564	1075/564	1075/564	1075/564	1075/564	1075/564	1075/564
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bootstrap replication	500	500	500	500	500	500	500	500	500	500

Unreported constant included. Robust standard errors in brackets. p < 0.01, **p < 0.05, *p < 0.1.

6.4. Composition effects

Tables 9 and 10 identify the channels through which the adoption of SEZs influences the structure of government revenues. Table 9 shows that the overall positive effect on tax revenue (% GDP) is mainly due to a significant increase in direct taxes, in particular personal income tax (1.229***) and corporate income tax (0.194***). This result is consistent with the theoretical argument that SEZs stimulate formal investment, wage job creation, and profit reporting, thereby broadening the direct tax base. In Morocco, the Tanger Med industrial platform has fostered the establishment of automotive and logistics firms integrated into global value chains, generating formal jobs and substantial indirect tax revenues (UNCTAD, 2021). In Ethiopia, textile-oriented industrial parks have helped formalize urban female employment, strengthening the income tax base. Similarly, in Rwanda, the Kigali Special Economic Zone has supported light industrialization and corporate formalization, with increasing domestic tax spillovers. These experiences confirm that, even in the presence of targeted tax incentives, the expansion of the tax base can offset the initial exemptions. In addition, the positive effect on taxes on goods and services (0.406***) also suggests an increase in taxable domestic activity. In Kenya, the Mombasa and Athi River economic zones have promoted regional integration and boosted local transactions. In Senegal, the Diass Integrated Special Economic Zone, backed by Blaise Diagne Airport, has strengthened logistics and service activities, expanding the domestic VAT base. These cases illustrate the dynamic mechanism by which SEZs generate multiplier effects beyond directly exempted companies. On the other hand, the non-significant effect on trade taxes (-0.208) is consistent with the very nature of SEZs, which are often associated with customs exemptions. In Egypt, free industrial zones have benefited from exemptions on intermediate imports, reducing direct tariff revenues.

Table 9: SEZ adoption and different types of tax revenue

	(1)	(2)	(3)	(4)	(5)	(6)	(8)
Tax revenue (%GDP)	Direct taxes	Indirect taxes	Personal income tax	Corporate income tax	Property tax	Taxes on goods and services	Trade taxes
Adoption SEZ	0.679***	0.138	1.229***	0.194***	0.071***	0.406***	-0.208
	(0.140)	(0.211)	(0.165)	(0.069)	(0.016)	(0.138)	(0.201)
Covariate in the second step	yes	Yes	yes	yes	yes	yes	yes
Country fixed effects in the second step	yes	Yes	yes	yes	yes	yes	yes
Year fixed effects in the second step	yes	Yes	yes	yes	yes	yes	yes
Observations	1,075	1,075	1,050	877	925	1,050	1,075
R-squared	0.900	0.872	0.859	0.907	0.518	0.858	0.797

Unreported constant included. Robust standard errors in brackets. p < 0.01, **p < 0.05, *p < 0.1

However, as shown in Table 10, these potential losses are offset by a significant increase in non-resource revenues (2.155***) and total government revenues (1.010***). The significant increase in the tax effort (0.048***) is particularly significant. It suggests that the improvement in revenues

comes not only from a mechanical expansion of GDP, but from a strengthening of the capacity to mobilize. The administrative reforms associated with SEZs, one-stop shops, digitalization of procedures, improvement of compliance, observed for example in Ghana (Tema Free Zones) or Mauritius, have often served as an institutional laboratory for modernizing tax administration. This is in line with Besley and Persson's (2013) approach to building fiscal capacity: territorialized economic reforms can generate positive externalities on national fiscal performance. These compositional effects confirm that SEZs do not lead to simple tax substitution to the detriment of trade revenues, but to a structural recomposition towards more sustainable domestic taxes, in particular income tax, corporate tax and domestic VAT.

Table 10: SEZ adoption and other measures of tax revenue

Tax revenue (%GDP)	(1) Non-Ressources tax w/social contribution	(2) Government revenue (%GDP)	(3) Tax effort
Adoption SEZ	2.155***	1.010***	0.048***
	(0.313)	(0.317)	(0.018)
Covariate in the second step	Yes	Yes	Yes
Fixed effect countries	Yes	Yes	Yes
Time fixed effect	Yes	Yes	Yes
Observations	850	875	1,073
R-squared	0.881	0.913	0.268

Unreported constant included. Robust standard errors in brackets. p < 0.01, **p < 0.05, *p < 0.1

6.5. Heterogeneity analysis

Table 11 highlights a marked regional heterogeneity in the effect of SEZ adoption on tax revenues (% GDP), confirming that the impact previously estimated is not uniform across the continent. In Central Africa, the coefficient is negative and insignificant, suggesting that SEZs have not yet generated a measurable broadening of the tax base. This lack of effect can be explained by a high dependence on extractive rents, low productive diversification and persistent institutional constraints that limit the integration of areas into the national economic fabric. Conversely, East Africa and North Africa recorded positive and highly significant effects, respectively of 1.354*** and 1.837*** points of GDP, which indicates that in these regions, the adoption of SEZs is accompanied by a substantial increase in fiscal mobilization. These results are consistent with the experiences of countries that have integrated SEZs into export-oriented industrialization strategies, backed by efficient logistics infrastructure and administrative reforms that promote formalization and the capture of tax benefits. In Southern Africa, the coefficient is positive but not significant, reflecting intra-regional heterogeneity where the marginal effect of SEZs can be mitigated by already relatively developed tax structures. In West Africa, the effect is positive and significant, although of a more moderate magnitude (0.439**), suggesting that tax gains exist but remain conditional on the quality of the economic and institutional integration of the areas. Overall, these

results confirm the theoretical intuition that the tax efficiency of SEZs depends on the structural and institutional context: regions characterized by better trade integration, stronger administrative capacity, and a coherent industrialization strategy better capture the dynamic effects of SEZs on broadening the tax base.

Table 11: Heterogeneity by country region

	(1)	(2)	(3)	(4)	(5)
Tax revenue (%GDP)	Central Africa	Eastern Africa	Northern Africa	Southern Africa	Western Africa
Adoption SEZ	-0.424	1.354***	1.837***	1.219	0.439**
	(0.580)	(0.301)	(0.616)	(1.112)	(0.218)
Covariate in the second step	Yes	yes	yes	yes	yes
Country fixed effects in the second step	Yes	yes	yes	yes	yes
Year fixed effects in the second step	Yes	yes	yes	yes	yes
Observations	200	200	150	200	325
R-squared	0.906	0.871	0.920	0.859	0.880

Unreported constant included. Robust standard errors in brackets. p < 0.01, **p < 0.05, *p < 0.1

As an extension of the regional heterogeneity analysis, Table 12 deepens the examination by identifying the structural factors that condition the effect of SEZs on tax revenue mobilization. While the previous analysis showed that the impact varied significantly across African regions, these results indicate that this variability reflects more fundamental differences related to the level of development, geography, productive structure and institutional quality. The results reveal that the fiscal effect of SEZs is strongly conditioned by the structural characteristics of the economies. The impact is significantly higher in middle-income countries than in low-income countries, suggesting that the ability to turn SEZ implantation into actual revenues depends on the degree of economic and administrative maturation. Similarly, the effect is substantial in non-landlocked countries, while it becomes insignificant in landlocked countries, confirming that market access and logistical connectivity are essential preconditions for the tax profitability of export-oriented areas. Heterogeneity by legal origin reveals a more pronounced effect in countries with a British tradition, which may reflect institutional differences in governance, investor protection and regulatory effectiveness. Moreover, while the effect is positive in both low- and high-rent economies, it is significantly larger in countries with low resource dependence, indicating that SEZs contribute more to broadening the tax base where revenue mobilization is already based on productive activities rather than extractive rents. The results also highlight the central role of institutional quality and human capital. The effect is significant in countries with high government efficiency and high levels of education, but diminishes or becomes insignificant in institutionally fragile contexts. This suggests that SEZs generate substantial tax gains only when the administration is able to capture the induced economic externalities. Finally, although the effect persists in environments with high corruption or high rurality, its magnitude is systematically higher in more favorable contexts.

Table 12: Role of structural factors

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Tax revenue (% GDP)	Low income	Middle Income	Landlocked	No landlocked	French origin	English Origin	Low Natural resource rents	High Natural resource rents
Adoption SEZ	0.645*	1.219***	0.370	2.038***	0.489*	1.989***	1.611***	0.655*
	(0.334)	(0.389)	(0.306)	(0.507)	(0.269)	(0.710)	(0.502)	(0.365)
Covariate in the second step	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country fixed effects in the second step	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects in the second step	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	371	704	375	700	725	300	557	518
R-squared	0.744	0.922	0.912	0.929	0.904	0.912	0.933	0.867
	(9)	(10)	(11)	(12)	(13)	(14)	(13)	(14)
Tax revenue (% GDP)	Low government effectiveness	High government effectiveness	Low rural population	High rural population	Low Education	High Education	High corruption	Low corruption
Adoption SEZ	0.603	0.974***	1.327***	1.239***	0.411	1.977***	0.974**	1.332***
	(0.434)	(0.354)	(0.365)	(0.398)	(0.303)	(0.474)	(0.403)	(0.329)
Covariate in the second step	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country fixed effects in the second step	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects in the second step	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	531	544	815	260	434	641	531	544
R-squared	0.897	0.946	0.921	0.937	0.943	0.892	0.860	0.934

Unreported constant included. Robust standard errors in brackets. $p < 0.01$, **$p < 0.05$, *$p < 0.1$

6.6. The effect of SEZ overtime

Building on previous analyses, Table 13 examines the temporal dynamics of the effect of SEZs on tax revenues (% GDP), to determine whether the observed impact is immediate or part of a cumulative trajectory. The coefficients associated with successive delays in adoption show a clearly increasing profile in the short and medium term: the effect is positive and significant from the first year (0.617**), then amplifies at the t-2 (0.855***) and t-3 (0.978***) horizons, before stabilizing around 0.92–0.98 GDP points at the t-4 and t-5 horizons. This progression suggests that the fiscal impact of SEZs does not materialize instantaneously but is reinforced over time, as investments materialize, formal employment develops, and productive externalities spread through the domestic economy. This dynamic profile is consistent with the theoretical mechanisms used previously. SEZs typically involve an initial phase of installation, building infrastructure, setting up businesses, ramping up supply chains, during which direct revenues may be limited due to tax incentives. As activity intensifies, the broadening of the tax base through income tax, non-exemption corporate tax and consumption taxes generates a more pronounced tax effect. The stabilization of the effect after three to four years indicates that the gains are becoming structural rather than transitory. The constancy of statistical significance and the gradual increase in R^2 as the time horizon lengthens confirm the robustness of this dynamic. All the results suggest that the impact of SEZs on tax mobilization is a cumulative process: far from being a one-off shock, the adoption of SEZs triggers a trajectory of gradual strengthening of public revenues, compatible with a logic of sustainable expansion of the tax base.

Table 13: Effect of SEZ over time

	(1)	(2)	(3)	(4)	(5)
Tax revenue (%GDP)	T-1	T-2	T-3	T-4	T-5
Adoption SEZ	0.617**	0.855***	0.978***	0.978***	0.921***
	(0.271)	(0.280)	(0.280)	(0.310)	(0.345)
Covariate in the second step	Yes	yes	Yes	yes	yes
Country fixed effects in the second step	Yes	yes	Yes	yes	yes
Year fixed effects in the second step	Yes	yes	Yes	yes	yes
Observations	1,075	1,032	989	946	903
R-squared	0.928	0.929	0.931	0.933	0.938

Unreported constant included. Robust standard errors in brackets. $p < 0.01$, **$p < 0.05$, *$p < 0.1$

7. Channels

Beyond the estimation of a robust average effect, a central question remains: by what economic mechanisms do SEZs translate concretely into an increase in tax revenues? To shed light on this question, we adopt a two-step strategy inspired by Apeti and Edoh (2023): we first examine whether certain macroeconomic variables are significantly associated with fiscal mobilization, and

then we test whether the adoption of SEZs influences these same variables, in accordance with the theoretical framework developed above.

Table 14 shows that three key variables, namely labour force participation, trade openness and FDI, are positively and significantly correlated with tax revenues (% GDP). Labour force participation has a high and highly significant coefficient, indicating that an expansion of the formal labour market results in a substantial increase in the income tax and social security base. Trade openness is also positively associated with revenues, which is consistent with open economy models in which increased trade stimulates domestic production, taxable consumption, and integration into value chains. Finally, FDI shows a significant positive correlation, suggesting that the inflow of foreign capital strengthens the tax base through the expansion of productive activity, declared profits and local externalities. Table 15 completes this analysis by showing that the adoption of SEZs has a positive and significant effect on these three intermediate variables. SEZs increase labour force participation, strengthen trade openness and significantly attract FDI. This double relationship, the effect of the SEZs on the canals, and the effect of the channels on revenues, draws a coherent sequence of transmission. SEZs function as platforms for productive integration: they promote the establishment of formal businesses, stimulate exports and attract international capital. These structural transformations then broaden the tax base and improve the capacity to mobilize domestic resources.

The joint interpretation of the two tables thus reinforces the validity of the theoretical framework. The fiscal impact of SEZs is not primarily the result of a direct adjustment of fiscal instruments, but of an endogenous and cumulative broadening of the tax base through formal employment, trade and investment. This empirical articulation between treatment, intermediate variables, and final variable reinforces the causal interpretation of the results: SEZs improve tax performance because they modify the economic fundamentals that underpin the fiscal capacity of states.

Table 14: Correlation between tax revenue and main channels.

Tax revenue (%GDP)	(1)	(2)	(3)
Labor Force	1.368***		
	(0.222)		
Trade		0.055***	
		(0.005)	
FDI			0.060**
			(0.029)
Main controls	Yes	Yes	Yes
Fixed effect countries	Yes	Yes	Yes
Time fixed effect	Yes	Yes	Yes
Observations	1,075	1,075	1,075
R-squared	0.746	0.747	0.604

Unreported constant included. Robust standard errors in brackets. Main controls are those of Tables 1 and 2 ***p < 0.01, **p < 0.05, *p < 0.1. Estimations are based on OLS.

Table 15: Transmission channels.

	(1)	(2)	(3)
	Labor Force	Trade	FDI
Adoption SEZ	0.111***	0.622**	1.439***
	(0.007)	(0.831)	(0.496)
Covariate in the second step	Yes	Yes	Yes
Country fixed effects in the second step	Yes	Yes	Yes
Year fixed effects in the second step	Yes	Yes	Yes
Observations	1,075	1,075	1,075
R-squared	0.988	0.953	0.944

Unreported constant included. Robust standard errors in brackets. $p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

8. Conclusion

This article analyzes whether the adoption of SEZs improves tax revenue mobilization in 45 African countries over the period 1996–2021. By mobilizing the entropy balancing method, we show that the adoption of a SEZ significantly increases the tax revenue/GDP ratio compared to comparable countries that have not implemented such zones. This result remains robust to several alternative specifications, including the extension of the vector of control variables selected via Bayesian Model Averaging, sample modification, the use of alternative treatment definitions as well as the application of competing estimation methods such as propensity score matching, inverse probability weighting and doubly robust estimators. The analysis of the composition of revenue reveals that the increase observed is mainly driven by direct taxes, in particular personal income tax and corporate tax, as well as taxes on goods and services. Heterogeneity tests indicate that the effect of SEZs depends on the level of development and institutional quality of the countries. Beyond adoption, the proliferation of SEZs reinforces the fiscal impact, suggesting cumulative dynamics related to agglomeration economies and productive integration. Above all, tax performance depends closely on the characteristics of the zones: integrated, multisectoral, medium- to large-sized SEZs governed by public-private partnerships generate significant tax gains, unlike specialized zones or with exclusively private governance, which shows that the effects do not automatically result from tax incentives but from the capacity of the zones to produce productive externalities and to expand in the long term the tax base.

These results suggest several economic policy implications. First, governments should design SEZs as integrated instruments of structural transformation, ensuring that they are integrated into a coherent national industrial strategy and linked to local value chains. Second, the size and spatial planning of areas must reach a critical mass sufficient to foster economies of scale and attract anchor investors. Third, the governance of SEZs should favor public-private partnerships framed by transparent accountability mechanisms, in order to avoid the risks of aggressive tax optimization and to guarantee the capture of economic benefits by the State. Fourth, tax incentive schemes should be progressively linked to measurable targets for investment, formal employment,

technology transfer and local integration, in order to limit tax losses without productive returns. Fifth, strengthening administrative capacity and better coordination between tax authorities, investment agencies and area managers are essential to ensure performance monitoring and coherence with international reforms, particularly in the context of global minimum taxation. Finally, the effectiveness of SEZs as a tax lever will depend on their complementarity with broader policies of formalization, controlled trade openness and improvement of institutional quality. Future research could delve deeper into the long-term dynamic effects, distributional impacts, and interaction between SEZ regimes and new international tax architectures in order to refine evidence-based industrial and fiscal strategies.

Appendix

Table A1: List of countries

North Africa (5)	West Africa (15)	Central Africa (8)	East Africa (10)	Southern Africa (7)
Algeria (DZA)	Benin (BEN)	Angola (AGO)	Burundi (BDI)	Botswana (BWA)
Egypt (EGY)	Burkina Faso (BFA)	Cameroon (CMR)	Comoros (COM)	Eswatini (SWZ)
Libya (LBY)	Cabo Verde (CPV)	Central African Republic (CAF)	Ethiopia (ETH)	Lesotho (LSO)
Morocco (MAR)	Ivory Coast (CIV)	Chad (TCD)	Kenya (KEN)	Namibia (NAM)
Tunisia (TUN)	Gambia (GMB)	Congo, Dem. Rep. (COD)	Madagascar (MDG)	South Africa (ZAF)
	Ghana (GHA)	Congo, Rep. (COG)	Mauritius (MUS)	Zambia (ZMB)
	Guinea (GIN)	Equatorial Guinea (GNQ)	Mozambique (MOZ)	Zimbabwe (ZWE)
	Guinea-Bissau (GNB)	Gabon (ATM)	Rwanda (RWA)	
	Mali (MLI)		Tanzania (TZA)	
	Mauritania (MRT)		Uganda (UGA)	
	Niger (NER)			
	Nigeria (NGA)			
	Senegal (SEN)			
	Sierra Leone (SLE)			
	Togo (TGO)			

Source: Authors

Table A2: Source and description of variables

Variable	Measurement	Definition	Source
Adoption of SEZ	Dummy (0/1)	Takes value 1 from the year a country adopts at least one Special Economic Zone	Author's computation
Number of SEZ	Count variable	Total number of operational SEZs in a country-year	Author's computation
Special areas	Count	Number of large multi-sector Special Economic Zones	Author's computation
Industrial Parks	Count	Number of industrial and science parks	Author's computation
Other zones	Count	Number of EPZs, FTZs, FTAs and other zone types	Author's computation

Functionality: Multisector	Dummy	1 if the SEZ covers multiple sectors	Author's computation
Functionality: Specialized	Dummy	1 if the SEZ is sector-specific	Author's computation
Area under 500ha	Dummy	1 if SEZ area is below 500 hectares	Author's computation
Area 500–1000ha	Dummy	1 if SEZ area is between 500 and 1000 hectares	Author's computation
Area above 1000ha	Dummy	1 if SEZ area exceeds 1000 hectares	Author's computation
Governance: PPP	Dummy	1 if SEZ governed through public–private partnership	Author's computation
Governance: Public	Dummy	1 if SEZ publicly managed	Author's computation
Governance: Private	Dummy	1 if SEZ privately managed	Author's computation
Tax revenue (% GDP)	Percent of GDP	Total tax revenue excluding natural resource taxes and social contributions	UNU-WIDER GRD
Government revenue (% GDP)	Percent of GDP	Total government revenue including resource revenue	UNU-WIDER GRD
Resource taxes (% GDP)	Percent of GDP	Tax revenue derived from natural resources	UNU-WIDER GRD
Non-resource tax incl. social contributions	Percent of GDP	Tax revenue excluding resource revenue but including social contributions	UNU-WIDER GRD
Direct taxes (% GDP)	Percent of GDP	Revenue from direct taxes (personal and corporate income taxes)	UNU-WIDER GRD
Indirect taxes (% GDP)	Percent of GDP	Revenue from taxes on goods and services	UNU-WIDER GRD
Personal income tax (% GDP)	Percent of GDP	Revenue from personal income taxes	UNU-WIDER GRD
Corporate income tax (% GDP)	Percent of GDP	Revenue from corporate income taxes	UNU-WIDER GRD
Property tax (% GDP)	Percent of GDP	Revenue from property taxes	UNU-WIDER GRD
Taxes on goods and services (% GDP)	Percent of GDP	Domestic taxes on goods and services	UNU-WIDER GRD
VAT (% GDP)	Percent of GDP	Revenue from value-added tax	UNU-WIDER GRD
Trade taxes (% GDP)	Percent of GDP	Taxes on international trade	UNU-WIDER GRD
Export taxes (% GDP)	Percent of GDP	Taxes levied on exports	UNU-WIDER GRD
Tax effort	Index (0-1)	Ratio between real and potential tax performance.	Author's computation
FDI (% GDP)	Percent of GDP	Net foreign direct investment inflows as percentage of GDP	WDI
Financial deepening	Percent of GDP	Domestic credit to private sector (% of GDP)	WDI
Investment	Percent of GDP	Gross fixed capital formation (% of GDP)	WDI
Fixed telephone subscriptions	Per 100 people	Number of fixed telephone subscriptions per 100 inhabitants	WDI
Inflation (%)	Annual percent	Consumer price index annual inflation rate	WDI
ODA (% GNI)	Percent of GNI	Net official development assistance received	WDI
Government consumption (% GDP)	Percent of GDP	General government final consumption expenditure	WDI
Exchange rate (log)	Log value	Official exchange rate (logarithmic transformation)	WDI
GDP per capita	Constant USD	Real GDP per capita	WDI
Lag natural resource rents	Percent of GDP (t-1)	Total natural resource rents lagged one period	WDI

Trade (% GDP)	Percent of GDP	Trade openness (exports + imports as % of GDP)	WDI
School enrolment secondary	Gross pierce	Gross secondary school enrolment rate	WDI
Control of Corruption Estimate	Index (-2.5 to 2.5)	Perceived control of corruption	WGI
Internet	Percent of population	Individuals using the Internet	WDI
Agriculture forestry fishing	Percent of GDP	Value added in agriculture, forestry, and fishing	WDI
Rural population growth	Annual percent	Annual growth rate of rural population	WDI
Age dependency ratio	Percent of working-age population	Age dependency ratio	WDI
Labor force participation rate	Percent of population 15+	Labor force participation rate	WDI
Remittances (% GDP)	Percent of GDP	Personal remittances received	WDI
Rule of Law	Index (-2.5 to 2.5)	Perceived strength of rule of law	WGI
Population density	People per sq. km	Population density	WDI
Time to pay taxes	Hours per year	Time required to comply with tax payments	World Bank Doing Business
State fragility index	Composite index	Index measuring state fragility	Fund for Peace
Index of Globalization	Index (0–100)	KOF Globalization Index	KOF Swiss Economic Institute
Democracy	Polity2 index	Democracy score	QOG
Vulnerability	ND-GAIN index	Climate and economic vulnerability index	ND-GAIN
Investment Freedom	Index (0–100)	Investment freedom score	Heritage Foundation
Financial Freedom	Index (0–100)	Financial freedom score	Heritage Foundation
Landlocked	Dummy	1 if country is landlocked	CEPII
French origin	Dummy	1 if country has French legal origin	QOG
English origin	Dummy	1 if country has English legal origin	QOG

Source; Author's.

Table A3:Descriptives statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Adoption of SEZ	1170	.537	.499	0	1
Number of SEZ	1170	2.658	6.582	0	68
Special areas	1170	.358	.984	0	8
Industrial Parks	1170	.643	2.084	0	18
Other zones	1170	1.652	6.352	0	68
Functionality: Multisector	1170	2.421	6.505	0	68
Functionality: Specialized	1170	.174	.959	0	13
Area under 500ha	1170	2.156	6.386	0	68
Area 500–1000ha	1170	.336	.703	0	3
Area above 1000ha	1170	.151	.527	0	5
Governance: PPP	1170	1.546	6.142	0	68
Governance: Public	1170	.627	1.788	0	9
Governance: Private	1170	.358	2.069	0	18
Tax revenue (% GDP)	1170	12.253	7.329	.536	60.95
Government revenue (% GDP)	1118	21.191	11.054	1.014	71.81
Resource taxes (% GDP)	1118	1.494	4.363	0	39.17
Non-resource tax incl. social contributions	910	13.079	6.399	1.278	35.03

Direct taxes (% GDP)	1170	3.998	3.008	.168	20.03
Indirect taxes (% GDP)	1170	8.405	4.989	.374	48.62
Personal income tax (% GDP)	1144	4.463	3.138	.178	24.07
Corporate income tax (% GDP)	1014	2.028	1.478	.059	11.15
Property tax (% GDP)	988	.118	.219	0	1.395
Taxes on goods and services (% GDP)	1144	5.006	2.783	.221	16.47
VAT (% GDP)	1118	2.089	1.973	.025	13.38
Trade taxes (% GDP)	884	3.727	2.022	0	8.677
Export taxes (% GDP)	1170	3.098	3.991	0	40.86
Tax effort	962	.221	.449	0	2.614
FDI (% GDP)	1170	3.62	7.227	0	161.824
Financial deepening	1170	22.345	24.408	.002	142.422
Investment	1118	21.938	9.491	-2.424	76.782
Fixed telephone subscriptions	1170	3.223	5.391	0	36.885
Inflation (%)	1170	14.323	126.079	-16.86	4145.106
ODA (% GNI)	1170	7.04	7.308	0	71.785
Government consumption (% GDP)	1118	15.004	6.862	2.047	61.167
Exchange rate (log)	1144	4.761	2.211	.12	9.125
GDP per capita	1170	11.794	1.954	6.563	15.789
Lag natural resource rents	1170	12.398	12.358	.002	88.592
Trade (% GDP)	1118	67.282	29.202	20.964	175.798
School enrollment secondary	1144	44.241	23.621	5.061	111.802
Control of Corruption Estimate	1170	-.627	.595	-1.648	1.245
Internet	1170	11.492	16.821	0	88.13
Agriculture forestry fishing	1170	20.167	13.146	.893	61.416
Rural population growth	1170	1.458	1.267	-6.368	14.906
Age dependency ratio	1170	82.131	16.074	40.421	111.477
Labor force participation rate	1170	15.025	1.456	11.63	18.077
Remittances (% GDP)	1170	3.493	6.976	0	98.39
Rule of Law	1170	-.66	.608	-1.918	1.044
Population density	1170	88.081	121.441	2.004	634.118
Time to pay taxes	1170	329.981	177.143	90.5	889
State fragility index	1170	14.122	5.099	0	24
Index of Globalization	1170	46.749	9.702	22.925	71.932
Democracy	1170	4.98	2.456	.75	10
Vulnerability	1170	.515	.071	.355	.661
Investment Freedom	1170	47.277	16.559	0	90
Financial Freedom	1170	41.593	15.069	10	70
Landlocked	1170	.333	.472	0	1
French origin	1170	.667	.472	0	1
English origin	1170	.289	.453	0	1

Source: Author's

Table A4: BMA and Lasso methods for selecting relevant determinants of tax revenue (%GDP)

Tax Revenue (% GDP)	**BMA**			**LASSO**		
	PIP	**PSM**	**PSD**	**Adaptive**	**BIC**	**CV**
Financial development	**1**	**0.087**	**0.007**	**x**	**x**	x
Size of government	**1**	**0.445**	**0.024**	**x**	**x**	x
Natural resource rents (% GDP)	**1**	**-0.124**	**0.012**	**x**	**x**	x
Trade openness (% GDP)	**1**	**0.046**	**0.008**	**x**	**x**	x
Control of corruption	**1**	**1.848**	**0.553**	**x**	**x**	x
Labor force participation	**1**	**0.585**	**0.107**	**x**	**x**	x
Personal remittances (% GDP)	**1**	**0.239**	**0.018**	**x**	**x**	x
Rural population growth	***0.994***	***-0.506***	***0.137***			
Fixed telephone subscriptions	***0.990***	***-0.152***	***0.044***			
Log GDP per capita	***0.904***	***-0.281***	***0.143***			
Vulnerability index	***0.753***	***8.202***	***5.647***			
Agriculture, forestry & fishing (% GDP)	***0.727***	***-0.044***	***0.031***			
Rule of Law	***0.556***	***-0.616***	***0.629***			
Investment	0.462	-0.017	0.021			
School enrollment secondary (%)	0.411	0.010	0.013			
Inflation (%)	0.278	-0.001	0.001			
Exchange rate (log)	0.206	0.043	0.096	x	x	
Population density	0.118	0.0003	0.0008			
Time to pay taxes	0.117	0.0002	0.0006			
State fragility index	0.042	0.003	0.016			
Investment freedom	0.039	-0.0004	0.003			
Globalization index	0.034	0.0008	0.006			
Democracy	0.028	-0.001	0.014			
Financial freedom	0.027	0.0002	0.002			
Foreign direct investment (% GDP)	0.025	-0.0003	0.003			
Age dependency ratio	0.024	-0.0001	0.003			
Official development assistance (% GNI)	0.022	0.0002	0.003			
Fixed effects (country and year)	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1066	1066	1066	1066	1066	1066
Mean model size (BMA)	13.77					
MCMC draws (after burn-in)	40000					
Burn-in	5000					
Acceptance rate	0.169					
Out-of-sample R^2 (LASSO CV)				0.865		
In-sample R^2 (LASSO BIC)				0.823		

Notes: PIP denotes posterior inclusion probability obtained from BMA. Posterior means (PSM) and standard deviations (PSD) are computed across 1,874 visited models using MC^3 sampling with Zellner's unit-information g-prior. All BMA and LASSO estimations include country and year fixed effects to control for unobserved heterogeneity and common time shocks. LASSO results are reported for adaptive selection, Bayesian Information Criterion (BIC), and 10-fold cross-validation (CV). The optimal penalty parameter ($\lambda = 0.8$) was selected via cross-validation. R^2 values correspond to post-selection OLS estimates. Variables with PIP = 1 are retained in the baseline specification. Variables with $0.5 \leq PIP < 1$ are used in robustness checks (additional controls variables).

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References

Abagna, M. A., Hornok, C., & Mulyukova, A. (2025). Place-based Policies and Household Wealth in Africa. *Journal of Development Economics*, *176*, 103482. https://doi.org/10.1016/j.jdeveco.2025.103482

Aggarwal, A. (2010). Economic impacts of special economic zones: Theoretical approaches and analysis of newly notified SEZs in India. *World Development, 38*(6), 867–880. https://doi.org/10.1016/j.worlddev.2009.12.019

Aghion, P., Akcigit, U., & Howitt, P. (2015). Lessons from Schumpeterian growth theory. *American Economic Review, 105*(5), 94–99.

Aizenman, J., & Jinjarak, Y. (2008). The collection efficiency of the value added tax: Theory and international evidence. *Journal of International Trade & Economic Development, 17*(3), 391–410.

Alfaro, L., Chanda, A., Kalemli-Ozcan, S., & Sayek, S. (2004). FDI and economic growth: The role of local financial markets. *Journal of International Economics, 64*(1), 89–112.

Antràs, P., & Helpman, E. (2004). Global sourcing. *Journal of Political Economy, 112*(3), 552–580.

Apeti, A. E., & Edoh, E. D. (2023). Tax revenue and mobile money in developing countries. *Journal of Development Economics, 161*, 103014. https://doi.org/10.1016/j.jdeveco.2022.103014

Baldwin, R. (2012). Global supply chains: Why they emerged, why they matter, and where they are going. *CEPR Discussion Paper*.

Baunsgaard, T., & Keen, M. (2010). Tax revenue and trade liberalization. *Journal of Public Economics*, 94(9–10), 563–577.

Baunsgaard, T., & Keen, M. (2010). Tax revenue and trade liberalization. *Journal of Public Economics, 94*(9–10), 563–577.

Besley, T., & Persson, T. (2013). Taxation and development. In A. J. Auerbach, R. Chetty, M. Feldstein, & E. Saez (eds.), *Handbook of Public Economics* (Vol. 5, pp. 51–110). Elsevier.

Besley, T., & Persson, T. (2014). Why do developing countries tax so little? *Journal of Economic Perspectives*, 28(4), 99–120.

Bird, R. M., Martinez-Vazquez, J., & Torgler, B. (2008). Tax effort in developing countries and high-income countries: The impact of corruption, voice and accountability. *Economic Analysis and Policy, 38*(1), 55–71.

Borensztein, E., De Gregorio, J., & Lee, J. W. (1998). How does foreign direct investment affect economic growth? *Journal of International Economics, 45*(1), 115–135.

Camara, Y. (2023). Foreign direct investment and tax revenue. *Economic Modelling*, 120, 106–118.

Cheng, L. K., & Kwan, Y. K. (2000). What are the determinants of the location of foreign direct investment? The Chinese experience. *Journal of International Economics, 51*(2), 379–400.

Crivelli, E., & Gupta, S. (2014). Resource blessing, revenue curse? *European Journal of Political Economy*, 35, 88–101.

Devereux, M. P., & Griffith, R. (1998). Taxes and the location of production: Evidence from a panel of US multinationals. *International Tax and Public Finance, 5*(3), 335–367.

Djeufack Dongmo, A., Possi Tebeng, E. X., Nyamou, J. C. M., & Asongu, S. A. (2026). The effect of ICT on tax revenue mobilization: A global perspective. *Telecommunications Policy*.

Dunning, J. H. (1988). The eclectic paradigm of international production. *Journal of International Business Studies, 19*(1), 1–31.

Duranton, G., & Puga, D. (2004). Micro-foundations of urban agglomeration economies. In J. V. Henderson & J. F. Thisse (Eds.), *Handbook of Regional and Urban Economics* (Vol. 4, pp. 2063–2117). Elsevier.

Ehrhart, H. (2009). Democracy and tax revenue. *Public Choice*, 139(3–4), 357–378.

Farole, T. (2011). Special economic zones in Africa: Comparing performance and learning from global experiences. World Bank.

Fenochietto, R., & Pessino, C. (2013). Understanding countries' tax effort. *IMF Working Paper*, 13/244.

Frick, S. A., & Rodríguez-Pose, A. (2023). What draws investment to special economic zones? Lessons from developing countries. *Regional Studies*, *57*(11), 2136-2147.

Gnangnon, S. K. (2019). Trade openness and tax revenue in developing countries. *The World Economy, 42*(12), 3513–3536.

Gordon, R., & Li, W. (2009). Tax structures in developing countries. *Journal of Public Economics, 93*(7–8), 855–866.

Gupta, A. S. (2007). Determinants of tax revenue efforts in developing countries. *IMF Working Paper*, 07/184.

Gwaindepi, C. (2021). Domestic revenue mobilisation in developing countries. *Journal of International Development*, 33(8), 1462–1483.

Hainmueller, J. (2012). Entropy balancing for causal effects: A multivariate reweighting method to produce balanced samples in observational studies. *Political Analysis, 20*(1), 25–46.

Hirano, K., & Imbens, G. W. (2004). The propensity score with continuous treatments. In *Applied Bayesian modeling and causal inference from incomplete-data perspectives*. Wiley.

Imbens, G. W., & Wooldridge, J. M. (2009). Recent developments in the econometrics of program evaluation. *Journal of Economic Literature*, 47(1), 5–86.

Keen, M., & Konrad, K. A. (2013). The theory of international tax competition and coordination. *Handbook of public economics*, *5*, 257-328.

Klemm, A., & Van Parys, S. (2012). Empirical evidence on tax incentives. *International Tax and Public Finance, 19*(3), 393–423.

Krugman, P. (1991). Increasing returns and economic geography. *Journal of Political Economy, 99*(3), 483–499.

La Porta, R., & Shleifer, A. (2014). Informality and development. *Journal of Economic Perspectives, 28*(3), 109–126.

Mascagni, G. (2018). From the lab to the field: A review of tax experiments. *Journal of Economic Surveys, 32*(2), 273–301.

Melitz, M. J. (2003). The impact of trade on intra-industry reallocations and aggregate industry productivity. *Econometrica, 71*(6), 1695–1725.

Moore, M. (2014). Revenue reform and statebuilding in Anglophone Africa. *World Development, 60*, 99–112.

Moore, M., & Prichard, W. (2020). How can governments strengthen tax systems in developing countries? *World Development, 135*, 105044.

Musgrave, R. A. (1959). *The theory of public finance*. McGraw-Hill.

Nguyen, H., et al. (2022). FDI and tax performance. *World Development*, 150, 105–118.

OECD. (2020). *Revenue statistics in Africa 2020*. OECD Publishing.

OECD. (2022). *Tax Administration 2022: Comparative Information on OECD and Other Advanced and Emerging Economies*. OECD Publishing.

OECD (2025), *Global Outlook on Financing for Sustainable Development 2025: Towards a More Resilient and Inclusive Architecture*, OECD Publishing, Paris, https://doi.org/10.1787/753d5368-en.

Otchia, C. S., & Wiryawan, B. A. (2025). The impact of special economic zones on structural change. *The Journal of International Trade & Economic Development*, *34*(1), 34-54.

Phelps, N.A., 2017. Interplaces: an Economic Geography of the Inter-urban and International Economies. Oxford University Press.

Phelps, N.A., Atienza, M., Arias, M., 2015. Encore for the enclave: the changing nature of the industry enclave with illustrations from the mining industry in Chile. Econ. Geogr. 91 (2), 119–146.

Prichard, W. (2015). *Taxation, responsiveness and accountability in sub-Saharan Africa*. Cambridge University Press.

Rodríguez-Pose, A., & Hardy, D. (2017). Addressing poverty and inequality in the rural economy from a global perspective. *Applied Geography, 88*, 43–58.

Rodríguez-Pose, A., & Hardy, D. (2017). Special economic zones and local economic development in Africa. World Development, 96, 341–356.

Rodríguez-Pose, A., Bartalucci, F., Frick, S. A., Santos-Paulino, A. U., & Bolwijn, R. (2022). The challenge of developing special economic zones in Africa: Evidence and lessons learnt. *Regional Science Policy & Practice*, *14*(2), 456-482.

Rodrik, D. (2008). Normalizing industrial policy. *World Bank Research Observer, 23*(2), 143–169.

Rosenbaum, P. R., & Rubin, D. B. (1983). The central role of the propensity score in observational studies for causal effects. *Biometrika*, 70(1), 41–55.

Tafese, T., Lay, J., & Tran, V. (2025). From fields to factories: Special economic zones, foreign direct investment, and labour markets in Vietnam. *Journal of Development Economics*, *174*, 103467. https://doi.org/10.1016/j.jdeveco.2025.103467

Talla Fokam, D. N. D., Youmto, E., & Fomba Kamga, B. (2026). Special Economic Zones and Export Diversification in Africa: The Role of Infrastructure and Human Capital. *The International Trade Journal*, 1-16.

Tamno Tekam, J. E., & Keneck-Massil, J. (2025a). Foreign direct investment attractiveness in Africa: The role of special economic zones. *The World Economy*.

Tamno Tekam, J. E., & Keneck-Massil, J. (2025b). Africa's participation in global value chains: What contribution can special economic zones make? *International Economics*.

Tamno Tekam, J. E., & Keneck-Massil, J. (2025c). Do special economic zones help the export diversification of African economies? *Review of World Economy*.

Tanzi, V. (1988). The impact of macroeconomic policies on the level of taxation. *IMF Staff Papers*, 35(3), 633–656.

Tanzi, V. (1992). Structural factors and tax revenue in developing countries. *IMF Working Paper*.

Timmons, J. F. (2010). Taxation and representation in recent history. *Journal of Politics, 72*(1), 191–208.

Tübbicke, S. (2022). Entropy balancing for continuous treatments. *Journal of Econometric Methods*, 11(1), 71–89.

UNCTAD. (2021). Handbook on special economic zones in Africa: Towards economic diversification across the continent. United Nations Conference on Trade and Development.

UNCTAD. (2021). *Handbook on special economic zones in Africa: Towards economic diversification across the continent*. United Nations Conference on Trade and Development.

Wang, J. (2013). The economic impact of special economic zones: Evidence from Chinese municipalities. *Journal of Development Economics, 101*, 133–147.

Waruguru Ndubai-Ngigi, J., & Readhead, A. (2024). *The global minimum tax and special economic zones*. International Institute for Sustainable Development.

World Bank. (2022). *World development indicators*. World Bank.

Zeng, D. Z. (2016). *Global experiences with special economic zones: Focus on China and Africa*. World Bank.

Zodrow, G. R., & Mieszkowski, P. (1986). Pigou, Tiebout, property taxation. *Journal of Urban Economics, 19*(3), 356–370.