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Tax Buoyancy in Indonesia: An Evaluation of Tax Structure and Policy Reforms

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Abstract: This study investigates tax buoyancies in Indonesia. It analyzes the cointegration relationship between the regional gross domestic product (RGDP), along with several control variables, and tax revenues. Focusing on personal income tax (PIT), corporate income tax (CIT), and value-added tax (VAT), it employs a dynamic analysis from 2015 to 2021. This research utilizes the Wald test to evaluate long-term buoyancies and the PMG-ARDL model to assess tax dynamics and cointegration coefficients. The results revealed tax revenues' consistent tendency toward equilibrium in the long term, with fluctuations across Indonesian provinces. PIT displayed the highest buoyancy and adjustment speed, followed by VAT and CIT. This analysis highlights tax types' diverse responses to underlying factors, offering crucial insights into fiscal dynamics. The research illuminates the intricate relationship between economic indicators and tax categories, providing valuable lessons for future policies, especially concerning structural changes like tax amnesty programs and tax rate modifications.

Keywords: tax buoyancy; tax structure; tax policy; panel ARDL; Indonesia

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1. Introduction

The complex relationship between tax revenues and economic fluctuations, a subject extensively explored by scholars, is influenced by diverse factors (Ahmed and Muhammad 2010; Baiardi et al. 2019; Dudine and Jalles 2018; Filipova and Tanchev 2021; Jalles 2017). One crucial dimension shaping this complex interplay is the concept of tax buoyancy, denoting the degree to which tax revenues respond to changes in economic activity. This phenomenon, coupled with various factors like economic structures, formal vs. informal economies, and demographic elements, intricately shapes tax revenue dynamics. Moreover, the construction and administration of the tax system, encompassing elements like the breadth of the tax base, exemptions, tax rates' progressivity, and mechanisms for taxpayer registration, significantly contribute to the intricate web of influences. Against this backdrop, the case of Indonesia stands out, as the nation continually refines its tax policies, including initiatives like the 2016 tax amnesty policy, where participants could absolve their tax liabilities by disclosure and payment, and the recent adjustments in response to the COVID-19 crisis, alongside permanent alterations such as reduced corporate income tax rates and revamped VAT collection mechanisms for e-commerce transactions. Within this context, understanding tax buoyancy is vital, offering nuanced insights for policymakers and researchers.

The connection between tax revenues and economic growth is intricate and often defies simple expectations. Government attempts to boost economic growth through increased spending do not always lead to the expected rise in tax revenues. Delays in tax revenue responsiveness to economic growth further complicate this relationship, prompting

inquiries into the reasons behind these delays. Additionally, the analysis becomes more complex when considering different tax types. The timing of tax revenue adjustments is crucial, especially during economic recoveries. Although economic resurgence can increase tax revenues, reaching equilibrium is a prolonged process. Furthermore, the rates of adjustment vary across tax categories, adding further complexity to this phenomenon.

Understanding how taxes respond to economic changes is crucial for various purposes: analyzing tax collection trends, making revenue projections, national budgeting, and international comparisons (Arachi et al. 2015; Baiardi et al. 2019; Blanchard et al. 2010; Blanchard and Perotti 2002). Government decisions on tax policies require a deep grasp of these dynamics, guiding adjustments in tax rates and bases. In Indonesia, studying tax buoyancy is particularly significant. It helps policymakers predict the impact of economic growth on tax revenues, enabling well-informed tax policy decisions. Additionally, examining the buoyancy of different tax types highlights the tax system's strengths and weaknesses and provides insights into how various tax categories adapt to economic fluctuations.

This study employs the autoregressive distributed lag (ARDL) technique, specifically the pooled mean group (PMG) ARDL model developed by Pesaran et al. (1999), to delve into the intricate relationship between regional GDP growth and tax revenues in Indonesia over the long term. The use of this model, which accommodates varying cointegrating terms across regions, ensures robust and reliable estimations. Through dynamic panel heterogeneity analysis, this research scrutinizes the enduring effects of regional GDP growth on tax revenues, shedding light on the rate at which adjustments move toward long-term equilibrium.

The subsequent sections of this paper are organized as follows: Section 2 provides a brief literature review, while Section 3 is devoted to an overview of Indonesia's tax system and policy alterations between 2015 and 2021. Section 4 outlines the data and methodology employed in this research. The findings derived from the panel ARDL estimations are explicated in Section 5, while Section 6 furnishes the paper's conclusions.

2. Literature Review

The literature encompasses multifaceted and crucial aspects regarding tax buoyancy in various countries and economic contexts. For instance, Gupta et al. (2021) estimated tax buoyancy in 44 sub-Saharan African countries during the period 1980 to 2017. Their findings revealed that the long-term tax buoyancy in most of these countries approached or slightly exceeded one. However, nations with fragile institutions exhibited lower short-term tax buoyancy, indicating weaknesses within their institutional systems. These findings signify a diminished automatic stabilizer effect in the short term and fiscal sustainability in the long term. Jalles' (2017) study on 37 sub-Saharan African countries indicated that only a small fraction of these nations had tax systems functioning as stabilizers during the period 1990 to 2015. On the other hand, Dudine and Jalles' (2018) research highlighted the impact of business cycles, particularly in the context of the global financial crisis. Their study found that advanced economies tended to have higher tax buoyancy in corporate income tax during economic contractions, indicating this tax's stabilizer function in times of economic downturn.

Specifically, Hill et al.'s (2022) research delved into tax buoyancy amid economic shifts, notably after the significant impacts of the COVID-19 pandemic. Analyzing developing Asian economies spanning from 1998 to 2020, the study revealed a tax buoyancy close to one, indicating a strong correlation between GDP and tax incomes. However, the pandemic led to a tenth reduction in tax revenue growth, signaling a negative effect. Individual analyses at the economy level echo these regional patterns, confirming the proximity to a tax buoyancy coefficient of around one in most instances. An alternate analysis estimated the excess loss of tax revenues in 2020 due to the pandemic, highlighting that, on average, these economies experienced a half percentage point decrease in tax revenues equivalent to their GDP. This finding correlates with observations linking the size of COVID-19 fiscal measures to declines in tax buoyancy.

Furthermore, studies have explored various factors influencing tax buoyancy. For instance, Sheikh et al.'s (2018) research in Pakistan identified economic variables affecting tax buoyancy in the country from 1996 to 2016. Their results showed diverse economic factors affecting tax buoyancy. Similarly, Ahmed and Muhammad's (2010) study underscored variables such as imports, the manufacturing sector, and budget deficits as influential factors in tax buoyancy in developing countries. Moreover, research has extended to non-oil and environmental taxation. Cotton's (2012) study in Trinidad and Tobago exhibited a positive response of non-oil tax revenue to economic growth, yet it highlighted administrative challenges impacting tax revenue during specific periods. Additionally, De Pascale et al.'s (2021) study evaluated the environmental tax responsiveness in Europe to economic cycles, finding that environmental taxes served as effective economic stabilizers with varying buoyancy in both the short and long term.

However, in the context of Indonesia, the literature on tax buoyancy remains limited. Classic studies like Tandjung's (1987) utilized a simple model by Singer, showing an elasticity coefficient of around 0.93 and a buoyancy coefficient of 1.03. Nevertheless, this performance is deemed in need of improvement for Indonesia to enhance its revenue collection efficiency. These studies provide profound insights into the dynamics of tax buoyancy in diverse global and local contexts, offering critical perspectives for policymakers and researchers to enhance the effectiveness of tax systems in supporting economic growth and sustainable development.

3. Indonesia Tax System

In Indonesia, tax administration falls under the purview of the Directorate General of Taxes (DGT), operating under the Ministry of Finance. The DGT comprises two primary components: the head office, responsible for policy formulation, technical regulations, coaching, and administrative support; and operational offices, which handle technical operations and support functions. DGT's operational structure includes 34 regional offices, 4 large taxpayer offices (LTO), 9 special taxpayer offices, 38 medium taxpayer offices (MTO), 301 small taxpayer offices (STO), 204 tax counseling and consultation service offices, and 4 technical implementation units. Between 2015 and 2021, the organizational structure underwent adjustments in response to regional economic developments, resulting in mergers, removals, additions, and reductions of offices. Taxpayers in Indonesia are categorized into LTO, MTO, STO, or Special Taxpayer Office registrants. LTOs consist of select large taxpayers, while Special Taxpayer Office registrants include foreign investment entities, foreigners, listed companies, and oil and gas firms in Indonesia. MTO registrants are significant taxpayers within specific regional areas, not registered with LTOs or Special Taxpayer Offices. STO registrants are taxpayers within STO's administrative regions, not registered with LTOs, MTOs, or Special Taxpayer Offices.[1]

3.1. Personal Income Tax

In Indonesia, the taxation system operates within a family-based framework, where the combined income of all family members is considered a single economic entity for taxation purposes, typically managed by the father. A family can consist of a maximum of three dependent children and the wife. Individuals in Indonesia are subject to income tax through various methods, depending on income sources and amounts. For instance, income from business activities below IDR 4.8 billion annually incurs a final tax of 0.5% of the gross income, eliminating the need for recalculations at year-end. Freelance business income below this threshold is taxed based on a deemed taxable income at the rate specified in Article 17 of the Income Tax Law. If their income exceeds IDR 4.8 billion per year, individuals are subject to a progressive tax rate based on net income. Additionally, payroll tax is applied to wages and salaries.

Taxable income encompasses all economically valuable earnings, regardless of origin within or outside Indonesia. However, specific categories, such as aid, grants, and inheritance, remain exempt from taxation. A portion of income remains non-taxable, determined

by marital status and the number of dependents at the start of the year. Notably, the non-taxable income threshold was adjusted once from 2015 to 2021, specifically in June 2016, as indicated in Table 1.

Table 1. Pre-specified non-taxable income.

Taxpayer's Status	Yearly Non-Taxable Income (IDR)	
	Before June 2016	Starting from June 2016
Single	36,000,000	54,000,000
Married	39,000,000	58,500,000
Married, and spouse earning income	75,000,000	112,500,000
Additional for each dependent (max 3)	3,000,000	4,500,000

Indonesia's progressive income tax system employs varying rates based on income levels, ranging from 5% to 30% between 2015 and 2021, as depicted in Table 2. The calculation involves multiplying taxable income by the applicable rate. Taxpayers may qualify for deductions, such as taxes already paid, which can offset owed taxes. Tax payments must be made to the state treasury before filing an annual tax return, which includes all income sources, assets, investments, and foreign income. The deadline for filing the tax return is within three months after the end of the tax year.

Table 2. Personal income tax rates.

Taxable Income Brackets (IDR)	Tax Rate
0–50 million	5%
more than 50 million–250 million	15%
more than 250 million–500 million	25%
more than 500 million	30%

3.2. Corporate Income Tax

In the realm of taxation, entities or corporations denote groups of individuals or capital functioning collectively, irrespective of their engagement in commercial activities. Comparable to individuals, corporations are accountable under income tax regulations. Taxable income is computed based on net income, derived by deducting business activity costs from gross income. These costs encompass various expenditures like materials, labor, interest, rent, royalties, travel, waste treatment, insurance premiums, promotions, administrative expenses, and more. However, specific costs such as dividend distributions, personal shareholder interest, and payments exceeding a fair value to related parties cannot be deducted. In cases where gross income minus costs results in a loss, this loss can be carried forward to offset income in subsequent years, typically for up to five years, or in specific industries or regions, up to ten years.

Effective from the 2020 tax year, the corporate income tax rate was uniformly set at 22%, indicating a reduction from the previous rate of 25%. Public companies meeting specific criteria and trading their shares on the Indonesia Stock Exchange are subject to a reduced tax rate of 3%. Furthermore, small companies may be eligible for a 50% discount on the tax rate for sales revenue up to IDR 4.8 billion. A small company is defined as a local business generating annual earnings of up to IDR 50 billion. A distinctive tax mechanism imposes a 0.5% tax rate on businesses earning IDR 4.8 billion annually. Corporate taxpayers can benefit from this facility for three years, while individual taxpayers are eligible for up to seven years. Similarly to individual taxpayers, corporate entities are mandated to file their annual tax returns, with the submission deadline set at four months after the conclusion of the tax year.

3.3. Value-Added Tax

Value-added tax (VAT) is obligatory for businesses offering taxable goods or services, necessitating their registration as VAT taxpayers. Entities earning less than IDR 4.8 billion annually have the option to abstain from registration. Registered taxpayers must collect VAT from buyers, providing a tax invoice as evidence. Multiple business locations typically mandate individual registration based on their respective locations. However, specific criteria allow registration at a single location.

A pivotal characteristic of VAT lies in its non-cumulative multi-stage levy. It is imposed at every production, distribution, and consumption stage, with the VAT owed calculated by deducting VAT paid on purchases (VAT input) from the tax charged to customers (VAT output). This mechanism ensures efficient VAT collection, even if the collection chain is disrupted. Non-registration or tax avoidance may escalate VAT revenue losses due to cascading effects. VAT computation utilizes the indirect subtraction method, deducting VAT input from VAT output for each taxable transaction. The DGT employs an automated system to verify accurate VAT collection and payment, ensuring regulatory compliance.

Taxes generally apply to most goods and services unless explicitly exempted. The negative list outlines goods and services exempt from taxation, including natural resources acquired through mining, essential items, restaurant food, money, gold, securities, as well as services in health, social sectors, finance, education, religion, arts, broadcasting, public transport, labor, hotels, and government services.

During the study period, a 10% VAT rate was applied, except for exported goods and services, which were zero-rated. Starting on 1 July 2020, a gradual VAT collection process commenced for 148 online businesses, which were predominantly foreign, delivering goods within Indonesia's customs area. These businesses collected VAT totaling IDR 731.4 billion, IDR 3.9 trillion, and IDR 5.51 trillion in 2020, 2021, and 2022, respectively. VAT payable is calculated monthly and must be reported by the end of the subsequent month following the tax period's conclusion.

3.4. Tax Policy Changes

In July 2016, Indonesia launched a comprehensive tax amnesty program, enabling individuals and businesses to disclose undisclosed assets and settle outstanding taxes by paying a specified redemption amount. This initiative, spanning income tax and VAT, allowed taxpayers to participate until 31 March 2017, with varying redemption rates based on the location of undisclosed assets. Notably, micro, small, and medium-sized (MSME) taxpayers were eligible for special rates, outlined in Table 3. The program resulted in substantial revenue, with a total of IDR 130 trillion collected, involving nearly one million taxpayers, including both new registrations and existing participants (Kominfo 2017; Kontan 2017).

Table 3. Tax amnesty redemption rates.

Tax Amnesty Periods	Location of Undisclosed Assets		Undisclosed Assets of MSME	
	Domestic	Overseas	<10 billion	>10 billion
July–September 2016	2%	4%	0.50%	2%
October–December 2016	3%	6%	0.50%	2%
January–March 2017	5%	10%	0.50%	2%

Furthermore, amid the economic challenges posed by the COVID-19 pandemic, Indonesia implemented exceptional tax policies to support national recovery efforts. These policies encompassed adjustments in corporate income tax rates, modifications in taxation procedures for electronic trading activities, extensions in the implementation period for rights and tax obligations, and customs facilities such as duty exemptions or reductions. Specifically, from the tax year 2020 onwards, the corporate income tax rate for

local businesses and permanent establishments was reduced from 25% to 22%, with a 3% reduced rate applicable to specific domestic public companies meeting defined criteria. Additionally, starting from 1 July 2020, the import of intangible taxable goods and services through electronic trading was subject to collection, remittance, and reporting by designated foreign traders or domestic marketplaces. These measures represent Indonesia's multifaceted approach to addressing both fiscal challenges and the evolving landscape of international trade.

4. Methodology

Utilizing a cointegration method, this study follows the method used by Dudine and Jalles (2018) as the main reference, to determine the long-term relationship between economic growth and tax revenues. The analysis employs quarterly data from 2015 to 2021 and focuses on the tax revenues of 34 provinces in Indonesia. In addition to total tax revenue, this research delves into various types of taxes, including personal income tax, corporation tax, and value-added tax.

This study categorizes tax codes 411121 (as outlined in Article 21 of Income Tax) and 411125 (as outlined in Article 25/29 of PIT) as PIT revenue. Additionally, tax codes 411122 (as outlined in Article 22 of Income Tax), 411123 (as outlined in Article 22 of Import Income Tax), and 411126 (as outlined in Article 25/29 of CIT) are classified as CIT revenue. Lastly, tax codes 411211 (relating to domestic VAT), 411212 (relating to Import VAT), and 411219 (other VAT), as VAT revenue[2]. In this study, we selected inflation, inequality, population, and trade openness as control variables based on previous literature (Dudine and Jalles 2018; Furceri and Jalles 2018; Jalles 2017; Lagravinese et al. 2020; Sheikh et al. 2018). These variables are province-specific and were not gathered at the national level, aligning with the provincial collection of tax revenues contextual to our study. Descriptive statistics of all data are shown in Table 4.

Table 4. Descriptive statistics.

VARIABLES	DESCRIPTION	MEAN	SD	MINIMUM	MAXIMUM
LNTOTAL	All types of tax revenues	28.11	1.27	25.51	32.00
LNPIT	Personal income tax revenues	26.46	1.26	21.31	30.02
LNCIT	Corporate income tax revenues	25.89	1.62	20.77	30.37
LNVAT	VAT revenues	27.21	1.30	24.19	31.19
LNRGDP	Regional GDP	31.59	1.15	29.48	34.26
LNCPI	Inflation rate	4.89	0.06	4.74	5.05
LNGINI	Gini ratio	−1.04	0.11	−1.41	−0.81
LNPOP	Population	15.28	1.01	13.37	17.75
LNTRADE	Trade openness	−2.05	1.49	−7.75	1.01
	Number of observations = 952				

Notes: all variables are in natural logarithm.

Based on the assumption of symmetric response behavior, this study aims to measure the buoyancy of a tax system, which represents the total change in tax revenues in response to changes in regional income and discretionary changes in tax policy over time. Generally, this is represented as the percentage amount that tax revenue increases or decreases when income changes by one percent. If T represents tax revenue and Y represents RGDP, both expressed in rupiah constant prices, tax buoyancy can be calculated as

$$b_{T,Y} = \frac{\partial T}{\partial Y} \times \frac{Y}{T} \quad (1)$$

The tax buoyancy can be computed through the utilization of the following regression equation:

$$T = \alpha + \beta Y + e_{it} \quad (2)$$

where α is a constant, β is the marginal tax rate, and e is the error term. Since $\frac{\partial T}{\partial Y} = \beta$, the buoyancy is $b_{T,Y} = \beta\left(\frac{Y}{T}\right)$. Additionally, another approach that can be employed for this purpose exists, as rewritten in Equation (2):

$$T = \alpha Y^{\beta}\varepsilon \tag{3}$$

In this study, buoyancy is measured by regressing the logarithm of tax revenue (either in total or per tax type) on the logarithm of RGDP.

$$\ln T = \ln \alpha + \beta \ln Y + \varepsilon \tag{4}$$

When estimating buoyancy, there are a couple of challenges to consider. First, it is important to determine the appropriate timeframe for measuring the response of tax revenue to RGDP. While buoyancy is expected to become equal to one in the long run, in the short term, it may vary between tax types. For example, personal income tax revenue may grow at a faster rate than the proportion of RGDP growth if inflation is not taken into account in the taxable income or non-taxable income layer. Similarly, after a recession, the growth in corporate income tax revenues may be slower than that of VAT due to tax rules that allow companies to use their losses from the recession to offset their taxes in the future.

Our next topic of concern pertains to the correlation between tax revenues and national income over time, and whether this correlation remains stable in the long term. Generally, we integrate the logarithms of tax revenues and RGDP, and assume that they are cointegrated. To investigate this matter, cointegration techniques are necessary. Accordingly, we construct the primary model (Model I) in the following way:

$$tax_{it} = a_i + \beta_1 rgdp_{it} + \beta_2 cpi_{it} + \beta_3 gini_{it} + \beta_4 pop_{it} + \beta_5 trade_{it} + \eta_{it} \tag{5}$$

The PMG ARDL method is a widely employed statistical technique that serves to address the issue of panel data heterogeneity, while also accounting for both the short- and long-term dynamics of all variables under consideration (Attiaoui et al. 2017; Hafsi et al. 2021; Pesaran et al. 1999). The PMG estimator takes into account individual heterogeneity, such as slope and intercept, in the short term and homogeneity in the long term. The PMG model for ECM can be defined as

$$\Delta tax_{it} = \alpha_i tax_{it-1} - \beta'_i X_{it-1} + \sum_{j=1}^{p-1} \lambda'_{ij} \Delta tax_{it-j} + \sum_{k=0}^{q-1} \delta'_{ik} \Delta X_{it-j} + v_i + \varepsilon_{it} \tag{6}$$

where tax_{it-1} is tax revenue in the natural logarithm. The long-term elements are the residues of

$$\alpha_i tax_{it-1} - \beta'_i X_{it-1} = e_{it-1} \tag{7}$$

Dividing Equation (7) by α_i, we obtain

$$tax_{it-1} - \phi_i X_{it-1} = \eta_{it-1} \tag{8}$$

where $\phi_i = \frac{\beta'_i}{\alpha_i}$, and $\eta_{it-1} = \frac{e_{it-1}}{\alpha_i}$ is the error term. If $\phi_i < 0$ then the following long-term relationship exists:

$$tax_{it-1} = \phi_i X_{it-1} + \eta_{it-1} \tag{9}$$

Model II is obtained by combining the equations with their respective control variables.

$$tax_{it} = \alpha_i + \alpha_1 tax_{it-1} + \beta_1 rgdp_{it} + \beta_2 cpi_{it} + \beta_3 gini_{it} + \beta_4 pop_{it} + \beta_5 trade_{it} + \eta_{it} \tag{10}$$

Model III is the residual equation:

$$\eta_{it-1} = tax_{it-1} - \begin{pmatrix} \alpha_i + \alpha_1 tax_{it-2} + \beta_1 rgdp_{it-1} + \beta_2 cpi_{it-1} + \\ \beta_3 gini_{it-1} + \beta_4 pop_{it-1} + \beta_5 trade_{it} \end{pmatrix} \quad (11)$$

where η_{it-1} is the error correction term and α_i is a measure of the speed of adjustment towards long-term equilibrium. Finally, model IV is the ARDL equation:

$$\Delta tax_{it} = \alpha_i \eta_{it-1} + \sum_{j=1}^{p-1} \lambda'_{ij} \Delta tax_{it-j} + \sum_{k=0}^{q-1} \delta'_{ik} \Delta X_{it-j} + v_i + \varepsilon_{it} \quad (12)$$

Equation (12) can be estimated on a per-province basis or for the entire provincial panel. Exploitation of panel dimensions has several advantages. First, it mitigates the limitations posed by a limited number of degrees of freedom inherent in the short time span at the cross-section level. Second, its hypothesis testing and inference are more powerful than time series techniques in a single province. Third, cross-sectional information reduces the tendency of pseudo-regression (Banerjee 1999).

To assess the potential issue of homogeneity, our analysis begins by estimating the parameters in Equation (10) through fully modified ordinary least squares (FMOLS) separately for each province. Then, we examine the key statistics of these estimates, categorized based on various types of tax revenue. FMOLS, as introduced by Philips and Hansen (1990), incorporates semi-parametric corrections to eliminate problems caused by long-run correlations between (a) deviations from long-run equilibrium and (b) innovations in the stochastic process characterizing each regression.

The parameter estimation in Equation (12) is determined using the panel data method. Specifically, we employ the group mean estimator proposed by Pesaran and Smith (1995), as well as the combined group mean estimator introduced by Pesaran et al. (1999). These methods, suited for dynamic panel analysis characterized by long time spans and cross-sectional dimensions, offer the advantage of accommodating both long-term equilibrium and the dynamic adjustment processes of heterogeneous contingencies. This estimator allows the correction of bias that may result from the estimation of the tax buoyancy coefficient using the standard fixed effect model. It achieves this correction by incorporating a non-stationary error term, thereby emphasizing the homogeneity of the parameters incorporated in the estimation equation.

Utilizing the long-term equation, the cointegration coefficient is shown by the parameter α_i. Models II and III are referred to as long-term equations, with the equation length being determined by p and q based on the optimal model with the lowest AIC value. Then, in order to discern the tax structure and examine the potential influences of any changes in tax policy on the regression outcomes, an exhaustive review of tax regulations and pertinent literature will be undertaken.

5. Results and Discussion

Prior to conducting the unit root test to ascertain stationarity, it is imperative to assess the presence of cross-sectional dependence within the dataset. The findings of this examination may influence the selection of appropriate unit root tests. Employing two widely recognized methodologies for assessing cross-sectional dependence, namely the Breusch–Pagan LM test and the Pesaran CD test, Table 5 shows the results that validate the existence of cross-sectional dependence across all variables under scrutiny.

Furthermore, to ensures robust estimation and inference, it is imperative for each variable to exhibit stationarity, while considering the cross-sectional dependence among the units (cross-sectional dimension) and allowing for individual-specific heterogeneity. In the realm of balanced panel data analysis, the Pesaran CIPS (cross-sectionally augmented IPS) tests, as elucidated by Pesaran (2007), serve as indispensable tools for assessing the presence of unit roots and thereby confirming stationarity, while considering cross-sectional dependence among the units. The results in Table 6, derived from panel unit root tests, affirm the stationarity of all variables, except the population and RGDP variables.

Table 5. Cross-sectional dependence test.

Variables	Breusch–Pagan LM	Pesaran CD
LNTOTAL	4597.598 ***	60.948 ***
LNPIT	2868.389 ***	37.791 ***
LNCIT	3295.809 ***	43.706 ***
LNVAT	2948.336 ***	37.361 ***
LNRGDP	13,954.80 ***	117.916 ***
LNCPI	15,348.57 ***	123.886 ***
LNGINI	3878.853 ***	31.143 ***
LNPOP	9871.887 ***	92.179 ***
LNTRADE	3676.743 ***	12.580 ***

Notes: Statistics marked *** indicate significance at 1% level.

Table 6. Panel unit root test with cross-sectional dependence: Pesaran–CIPS.

Variables	CIPS Test Statistic	Critical Value (1%)
LNTOTAL	−3.107 ***	−2.80
LNPIT	−3.253 ***	−2.80
LNCIT	−3.600 ***	−2.80
LNVAT	−2.924 ***	−2.80
LNRGDP	−2.525	−2.80
LNCPI	−3.056 ***	−2.80
LNGINI	−2.926 ***	−2.80
LNPOP	2.420	−2.80
LNTRADE	−3.011 ***	−2.80

Notes: Statistics marked *** indicate significance at 1% level.

Our inquiry into the long-term relationship among variables employed the panel cointegration test method proposed by Kao (1999). As presented in Table 7, employing the Newey–West and Bartlett kernel automatic bandwidth selection, our findings reject the null hypothesis of no cointegration at a 1% significance level.

Table 7. Panel cointegration test.

Kao Residual Cointegration Test	t-Statistic
ADF	−4.166 ***

Notes: Statistics marked *** indicate significance at 1% level.

We examined the long-term tax buoyancies' unity using a Wald test (H0: tax buoyancy = 1), as presented in Table 8. At a 1% confidence level, our analysis found no significant evidence to reject the null hypothesis. Hence, it can be inferred that all tax categories adhered to a tax buoyancy of one.

Table 8. Wald test of long-term buoyancies equaling one.

Test Statistic	Total Tax	PIT	CIT	VAT
t-statistic	2.111 **	2.213 **	−2.239 **	1.577
F-statistic	4.456 **	4.896 **	5.011 **	2.487
Chi-square	4.456 **	4.896 **	5.011 **	2.487

Notes: Null-hypothesis is C(1) = 1. Statistics marked ** indicate significance at 5% level.

Theoretical postulations suggest that long-term tax buoyancy should align with unity (Dudine and Jalles 2018; Lagravinese et al. 2020). However, empirical studies, confined to specific time frames, have demonstrated a fluctuating pattern in tax buoyancy (Belinga et al. 2014; Choudhry 1979; De Pascale et al. 2021; Gupta et al. 2021). These analyses highlight considerable variability, with the tax buoyancy surpassing or falling below the unitary

threshold. Such variability stems from diverse macroeconomic, budgetary, cultural, and political contexts, shaping tax responsiveness to GDP changes, as elucidated by Lagravinese et al. (2020). The Wald test results in Table 8 bolster these observations. Significantly, at a 99% confidence level, the analysis failed to provide compelling evidence to reject the hypothesis that all tax types exhibit unity in buoyancy. These findings underscore the intricate factors influencing the relationship between taxes and economic growth, emphasizing the nuanced nature of tax buoyancy in diverse socio-economic contexts.

In examining the potential long-term relationship between RGDP and tax revenues, the selection of appropriate models is crucial. The Akaike information criterion (AIC) is employed to assess various candidate models and determine the most suitable one, ensuring a delicate balance between model fit and complexity. Lower AIC values indicate a better fit, making the model with the lowest AIC preferable in comparative analyses (Akaike 1974). Table 9 presents the results of the dynamic model estimation, focusing on the four distinct tax types, with tax revenues serving as the dependent variable in the equation under scrutiny.

Table 9. Long-run tax buoyancies.

Variables	Total Tax (1,1,1,1,1,1)	PIT (1,1,1,1,1,1)	CIT (3,3,3,3,3,3)	VAT (3,1,1,1,1,1)
LNRGDP	1.252 ***	1.348 ***	0.937 ***	1.281 ***
LNCPI	−1.283 ***	−0.964 ***	3.539 ***	−1.148 **
LNGINI	0.007	−0.306	3.000 ***	2.239 ***
LNPOP	−0.118	−0.213	−9.772 ***	−0.001
LNTRADE	−0.024 **	0.084 ***	0.132 ***	−0.025 **
Speed of adjustment	−0.789 ***	−0.779 ***	−0.594 ***	−0.654 ***

Notes: coefficients marked *** and ** indicate significance at the 1% and 5% levels, respectively.

To ascertain the robustness of outcomes concerning model and methodology choices, we introduce inflation as a supplementary control to investigate the potential dependency of tax buoyancy on price fluctuations. Should there be no discernible association, an analogous relationship would emerge when employing real variables. The findings presented in Table 10 indicate that inflation introduces a significant negative coefficient, albeit exhibiting a significant positive association for CIT. Furthermore, the coefficients pertaining to buoyancy are notably augmented, save for CIT yet again. Consequently, tax buoyancy does not exhibit neutrality in relation to inflation, suggesting that tax buoyancy in real measures surpasses its nominal counterpart.

Table 10. Tax buoyancies with and without controlling for inflation.

Variables	Total Tax (1,1,1,1,1,1)	PIT (1,1,1,1,1,1)	CIT (3,3,3,3,3,3)	VAT (3,1,1,1,1,1)
Tax Buoyancy	1.252 ***	1.348 ***	0.937 ***	1.281 ***
without controlling for inflation	0.727 ***	0.958 ***	2.148 ***	0.863 ***
Speed of adjustment	−0.789 ***	−0.779 ***	−0.594 ***	−0.654 ***
without controlling for inflation	−0.798 ***	−0.790 ***	−0.704 ***	−0.677 ***

Notes: coefficients marked *** indicate significance at the 1% level.

Utilizing dynamic analysis, our study reveals a long-term relationship between tax revenue and various factors. While short-term fluctuations occur, the tax revenue tends to return to its equilibrium. Multiple elements, including RGDP, inflation, inequality, population, and trade openness, influence these fluctuations. Our focus was on RGDP's impact on taxation, showing a positive effect exceeding unity. Among tax categories, personal income tax (PIT) demonstrated the highest buoyancy, at 1.348, followed by VAT at 1.281, total tax at 1.252, and CIT at 0.937. Notably, inflation, population, and trade openness reduced total taxes, while higher inequality increased overall tax revenue. The concept of

tax buoyancy encompasses tax elasticity regarding RGDP changes and reflects complex tax structure dynamics, policy changes, and compliance factors.

The elevated buoyancy of PIT implies that the alterations in the tax structure and policies related to PIT during the evaluated period positively influenced the increase in tax revenues. PIT operates on a progressive rate system, where a rise of 1% in GDP can lead to a PIT increase exceeding 1%. This phenomenon arises due to the application of higher tax rates corresponding to higher income levels. Additionally, the PIT framework incorporates a withholding mechanism within payroll tax, a strategic approach that ensures systematic tax collection, while concurrently mitigating instances of tax evasion. Despite existing tendencies indicating a correlation between higher incomes and elevated levels of tax avoidance, the withholding mechanism compels taxpayers to adhere to tax regulations, fostering greater compliance (Lang et al. 1997; Prasetyo and Sinaga 2014).

Two significant changes occurred in the personal income tax (PIT) framework. First, the tax amnesty program implemented from 2016–2017 generated substantial revenue, totaling IDR 130 trillion. Individual taxpayers contributed the majority, with IDR 90.36 trillion from non-MSME taxpayers and IDR 7.56 trillion from MSME taxpayers (Kominfo 2017). This initiative also attracted 44,232 new registrants, and asset declarations reached IDR 4813.4 trillion, consequently expanding the tax base for subsequent fiscal periods. Second, the specified non-taxable income threshold was raised from IDR 36 million to IDR 54 million in June 2016. The impact on tax revenue depended on the extent of this adjustment.

Conversely, the diminished buoyancy of corporate income tax (CIT), falling below unity, underscores that the structural modifications and policy changes within CIT during the examined period had an adverse impact on CIT revenues. Unlike personal income tax (PIT), CIT follows a uniform single-rate system without progressivity. The computation of tax liability is conducted through a self-assessment method, entrusting taxpayers with the responsibility of calculating their tax obligations. This mechanism provides ample opportunities for the practice of tax avoidance. Two significant alterations were made to the CIT structure during the review period: first, the implementation of the tax amnesty program from 2016–2017; and second, the reduction in the CIT rate from 25% to 22%, effective from the 2020 tax year. Despite a substantial IDR 130 trillion being collected through the amnesty program, corporate contributions were limited. According to Kominfo (2017), non-MSME corporate taxpayers contributed IDR 4.31 trillion, whereas SME corporate taxpayers contributed IDR 0.62 trillion. This limited contribution rendered the impact of the tax amnesty program on CIT buoyancy negligible. The rate reduction is expected to further reduce CIT buoyancy.

During the review period, the value-added tax (VAT) system underwent significant changes due to two key policies: the tax amnesty program and a new VAT collection method for online businesses. The tax amnesty primarily attracted individual taxpayers, resulting in a modest impact on VAT revenue. While specific data are lacking, it is reasonable to assume that many individuals may not be VAT-registered. Conversely, the introduction of the VAT collection system for online businesses, launched in July 2020, showed remarkable success, with revenue increasing from IDR 731 billion in 2020 to IDR 3.9 trillion in 2021, as reported by the Directorate General of Taxes (DJP 2023).

The strong VAT buoyancy highlights its effectiveness. Indonesia's VAT system features a non-cumulative, multi-stage levy, serving as a protective measure and regulatory check. This structure allows for the detection of issues like broken VAT chains or tax evasion. Additionally, the use of the indirect subtraction method and the invoice system ensures meticulous monitoring of tax reporting and VAT payments, ensuring compliance with regulations. Furthermore, the gradual adoption of electronic tax invoices for VAT collection, starting in July 2014, has enhanced monitoring and enforcement, aligning the system with technological advancements and regulatory requirements.

The speed at which the four tax categories tend to return to equilibrium over the long term is indicated by negative cointegration coefficients ($\alpha_i < 0$), revealing an inherent corrective mechanism. When taxes exceed their long-term trajectory, they naturally decrease,

while if they fall below it, they autonomously increase, to restore equilibrium. Total tax has the highest coefficient (−0.789), followed by PIT (−0.780), VAT (−0.654), and CIT with the lowest value (−0.594). This discrepancy underscores the diverse tax structures governing each category, highlighting the nuanced nature of the inherent correctional mechanisms in the tax system.

Specifically, PIT demonstrates the most significant negative coefficient (−0.780), indicating its rapid return to long-term equilibrium. In contrast, both VAT and CIT also tend to revert to their equilibrium, albeit at a comparatively slower pace than PIT. This variation in adjustment speeds reflects the distinct characteristics of each tax type. For example, PIT's payroll tax mechanism enables swift settlement, unlike CIT's lengthy tax calculation process. CIT regulations governing financial loss compensation prolong the time needed for the CIT revenue to realign with its long-term trajectory, even after economic recovery. In contrast, VAT exhibits a relatively quicker return to equilibrium, highlighting distinct recovery dynamics among tax categories.

This study calculated cointegration coefficients (α_i) to assess adjustment speed across provinces. While Table 7 shows the overall tax revenue coefficients for Indonesia, Table 11 details province-specific coefficients. This analysis revealed nuanced tax revenue patterns within provinces, influenced by RGDP, inflation, inequality, population, and trade openness. Notably, not all provinces exhibited high tax adjustment. Cointegration conditions shed light on these variables' role in future tax revenue. When tax revenues deviate from long-term patterns, they naturally readjust. Further research is essential to understand the specific adjustment factors in each province.

Table 11. Cointegration coefficient per province.

	Province	Totax	PIT	CIT	VAT
1	Nangroe Aceh Darussalam	−1.097 ***	−0.428 ***	−0.612 ***	−1.262 ***
2	North Sumatera	−1.244 ***	−0.808 ***	−3.306 ***	−2.061 ***
3	Riau	−1.201 ***	−0.769 ***	−0.115 ***	0.097 *
4	West Sumatera	−0.671 ***	−1.007 ***	−0.722 ***	−0.525 ***
5	Jambi	−1.171 ***	−0.716 ***	−0.614 ***	−0.581 ***
6	South Sumatera	−1.258 ***	−0.961 ***	0.440 ***	−0.765 ***
7	Bangka Belitung Islands	−0.391 ***	−0.557 ***	−0.265 **	−0.098
8	Bengkulu	−0.720 ***	−1.222 ***	−3.863 ***	−1.869 ***
9	Lampung	−0.875 ***	−0.265 ***	−0.342 ***	−0.529 ***
10	Riau Islands	−1.115 ***	−0.601 ***	0.530 ***	−0.581 ***
11	Jakarta	−1.114 ***	−0.761 ***	−0.075 **	−0.364 ***
12	Banten	−0.156 ***	−0.882 ***	−0.614 ***	0.002
13	West Jawa	−0.618 ***	−1.229 ***	−0.321 ***	−0.215 ***
14	Central Jawa	−1.225 ***	−1.041 ***	−1.633 ***	−1.126 ***
15	Yogyakarta	−1.277 ***	−0.580 ***	−0.151 **	−1.405 ***
16	East Jawa	−1.399 ***	−0.935 ***	−0.312 ***	0.137 ***
17	West Kalimantan	−0.911 ***	−0.663 ***	−0.040	−0.22 **
18	South Kalimantan	−0.648 ***	−0.726 ***	−0.153 **	−0.387 **
19	Central Kalimantan	−0.475 ***	−0.783 ***	−0.038 ***	0.092
20	East Kalimantan	−1.135 ***	−0.888 ***	−0.487	−0.575 ***
21	North Kalimantan	−0.383 ***	−1.015 ***	−0.474 ***	−0.528 ***
22	South Sulawesi	−0.431 ***	−0.567 ***	−1.757 ***	−0.870 ***

Table 11. *Cont.*

	Province	Totax	PIT	CIT	VAT
23	West Sulawesi	−0.266 ***	−0.130 **	0.041	−0.253 ***
24	South East Sulawesi	−0.313 ***	−0.358 ***	−0.046	−0.513 ***
25	North Sulawesi	−0.360 ***	−0.795 ***	−0.304 ***	−0.472 ***
26	Central Sulawesi	−0.826 ***	−0.675 ***	−1.413 ***	−0.999 **
27	Gorontalo	−0.559 ***	−1.018 ***	−0.378 ***	−0.575 ***
28	North Maluku	−0.640 ***	−1.256 ***	−0.353 ***	−0.168 **
29	Bali	−0.803 ***	−1.198 ***	−0.579	−1.288 ***
30	West Nusa Tenggara	−0.707 ***	−0.617 ***	−0.304 **	−1.247 ***
31	East Nusa Tenggara	−0.887 ***	−0.644 ***	−1.616 ***	−1.218 ***
32	Papua	−1.009 ***	−0.991 ***	−0.619 ***	−1.122 ***
33	West Papua	−0.489 ***	−0.828 ***	0.177 ***	−0.439 ***
34	Maluku	−0.435 ***	−0.587 ***	0.107 **	−0.290 ***
	Average	−0.789 ***	−0.780 ***	−0.594 ***	−0.654 ***

Notes: coefficients marked ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

6. Conclusions

This study investigated the impact of RGDP and several control variables, i.e., inequality, inflation, population, and trade openness, on tax revenue through a dynamic analysis. The study established a cointegration relationship between tax revenues and these determinants, indicating a long-term association. Detailed fluctuations in tax revenues across Indonesian provinces were observed.

According to the Wald test results, the long-term buoyancies of personal income tax (PIT), corporate income tax (CIT), and total tax aligned with theoretical expectations, exhibiting no significant deviation from unity. However, this conformity was not observed in the case of value-added tax (VAT). Among the tax categories, PIT demonstrated the highest tax buoyancy coefficient (1.348), followed by VAT (1.281) and total tax (1.252), with CIT registering the lowest value (0.937). These findings shed light on the varied responsiveness of different tax types to the underlying factors, providing valuable insights into the fiscal dynamics of Indonesian provinces. In contrast to antecedent studies exploring analogous inquiries within disparate national contexts, the revelations derived from this study within the framework of Indonesia's economic landscape offer a novel dimension of understanding. Indonesia's economy, characterized by distinctive features, policy frameworks, and economic structures, served as a unique backdrop for this investigation, thereby yielding fresh insights discernible in the ensuing elucidation.

The elevated buoyancy of personal income tax (PIT) signifies that alterations in the tax structure and its subsequent modifications during the studied period yielded a favorable impact on augmenting tax revenues. The progressive rate system employed in PIT played a pivotal role in this regard. Under this system, a one percent increase in RGDP can result in a PIT revenue growth of more than one percent, owing to the higher rates imposed on additional income. Additionally, the implementation of a withholding mechanism in payroll tax was instrumental in ensuring efficient tax collection, while mitigating instances of tax evasion. During the period under examination, two significant changes were introduced in the PIT structure. First, the implementation of the tax amnesty program in 2016–2017, aimed at providing a framework for taxpayers to regularize their tax affairs. Second, there was an increase in the non-taxable income threshold, effective from June 2016, which further influenced the dynamics of PIT collection. These structural adjustments played a pivotal role in shaping the trajectory of PIT revenues during the specified timeframe.

Conversely, the diminished buoyancy, slightly below unity, observed in corporate income tax (CIT) also mirrors the tax structure and its modifications throughout the examined period. Unlike personal income tax (PIT), CIT adheres to a fixed-rate system. Within the scope of the study, two notable alterations were introduced to the CIT framework. First, the implementation of the tax amnesty program in 2016–2017 represented a significant structural shift. Second, a reduction in the CIT rate, from 25% to 22%, was implemented commencing from the 2020 tax year. These changes significantly impacted the dynamics of CIT collections during the specified timeframe.

The elevated buoyancy observed in value-added tax (VAT) underscores the continued effectiveness of its tax structure. One of the defining features of VAT in Indonesia is its multi-stage levy system, which is non-cumulative in nature. Furthermore, the application of the indirect subtraction method alongside an invoice system ensures rigorous oversight of tax invoice reporting and VAT payments, aligning with regulatory requirements. Additionally, the Directorate General of Taxes (DGT) mandated the gradual adoption of electronic tax invoices for VAT collection, beginning in July 2014, further enhancing the monitoring and enforcement mechanisms. Within the timeframe studied, two significant tax policies were implemented. The first was the tax amnesty program, aimed at encouraging tax compliance, and the second involved the introduction of a new mechanism for VAT collection in online businesses. These initiatives played a pivotal role in shaping the VAT landscape during the specified period.

The control variables exhibited diverse impact orientations. Inflation escalation led to a decrease in personal income tax (PIT) and value-added tax (VAT) but resulted in an increase in corporate income tax (CIT). The rationale behind these relationships can be elucidated by considering the nominal nature of the GRDP and tax revenue data utilized in this study, coupled with the inherent characteristics of each tax type. Given its nature as a consumption tax, value-added tax (VAT) experienced a negative influence due to inflation. Inequality contributed to the escalation in both CIT and VAT, with no statistically significant effect discerned in the case of PIT. Furthermore, population growth exerted a discernible negative impact solely on CIT. Conversely, trade openness demonstrated a positive influence across variables, with the exception of VAT, where its impact was non-beneficial. These nuanced patterns underscore the complexity of the interplay between economic indicators and different tax categories, highlighting the intricate dynamics at play in the fiscal landscape.

The cointegration coefficients, indicating the speed of adjustment, exhibited negative values for all four tax categories, signifying a consistent tendency for tax revenues to revert to equilibrium. The cointegration coefficient for total tax stood at -0.789. Among the three tax types, personal income tax (PIT) displayed the most substantial absolute value (-0.780), followed by value-added tax (VAT) at -0.654, with corporate income Tax (CIT) registering the lowest value of -0.594.

This research reveals that tax revenues within individual provinces exhibit fluctuations but consistently revert to equilibrium. The assessment of tax revenue can be conducted using specific determinants such as RGDP, inequality, inflation, population, and trade openness at the provincial level. Alterations in these determinants can serve as guidelines for formulating future tax revenue strategies. It is anticipated that by modifying these determinants, an enhancement in tax revenue can be achieved. Consequently, tax authorities in each province need to devise more suitable strategies, to ensure higher future tax revenues.

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Appendix A

Table A1. Tax account codes in Indonesia.

Number	Tax Account Code	Tax Category
I		Non-Oil and Gas Income Tax
1	411121	Article 21 Income Tax
2	411122	Article 22 Income Tax
3	411123	Article 22 Import Income Tax
4	411124	Article 23 Income Tax
5	411125	Article 25/29 Personal Income Tax
6	411126	Article 25/29 Corporate Income Tax
7	411127	Article 26 Income Tax
8	411128	Final Income Tax
9	411129	Others Non-Oil and Gas Income Tax
10	411131	Overseas Fiscal (has been removed since 2011)
11	411141	Borne by Government Income Tax
II		Value-Added Tax (VAT) and Luxurious Sales Tax (LST)
1	411211	Domestic VAT
2	411212	Import VAT
3	411219	Others VAT
4	411221	Domestic LST
5	411222	Import LST
6	411229	Others LST
III		Property Tax
1	411313	Plantation Property Tax
2	411314	Forestry Property Tax
3	411315	Mineral Mining Property Tax
4	411316	Oil Mining Property Tax
5	411319	Others Property Tax
IV		Other Taxes
1	411611	Stamp Duty
2	411612	Sale of Stamp Objects
3	411613	Coal Sales Tax
4	411619	Other Indirect Taxes
5	411621	Income Tax Collection Interest
6	411622	VAT Collection Interest
7	411623	LST Collection Interest

Table A1. *Cont*.

Number	Tax Account Code	Tax Category
V		Oil and Gas Income Tax
1	411111	Crude Oil Income Tax
2	411112	Natural Gas Income Tax
3	411119	Other Oil and Gas Income Tax

Appendix B

Table A2. DGT regional offices and related provinces.

No	Provinces	DGT Regional Offices	Codes
1	Nangroe Aceh Darussalam	Aceh	010
2	North Sumatera	North Sumatera I	020
		North Sumatera II	030
3	Riau	Riau	040
4	West Sumatera	West Sumatera and Jambi	050
5	Jambi		
6	South Sumatera	South Sumatera and Bangka Belitung Islands	060
7	Bangka Belitung Islands		
8	Bengkulu	Bengkulu and Lampung	070
9	Lampung		
10	Riau Islands	Riau Islands	340
11	Jakarta	Central Jakarta	080
		West Jakarta	090
		South Jakarta I	100
		East Jakarta	110
		North Jakarta	120
		Special Jakarta	130
		South Jakarta II	320
12	Banten	Banten	140
13	West Jawa	West Jawa I	150
		West Jawa II	160
		West Jawa III	330
14	Middle Jawa	Middle Jawa I	170
		Middle Jawa II	180
15	Yogyakarta	Yogyakarta	190
16	East Jawa	East Jawa I	200
		East Jawa II	210
		East Jawa III	220
17	West Kalimantan	West Kalimantan	230
18	South Kalimantan	South Kalimantan and Middle Kalimantan	240
19	Middle Kalimantan		
20	East Kalimantan	East Kalimantan and North Kalimantan	250
21	North Kalimantan		
22	South Sulawesi	South Sulawesi, West Sulawesi, and South East Sulawesi	260

Table A2. *Cont.*

No	Provinces	DGT Regional Offices	Codes
23	West Sulawesi		
24	South East Sulawesi		
25	North Sulawesi	North Sulawesi, Middle Sulawesi, Gorontalo, and North Maluku	270
26	Middle Sulawesi		
27	Gorontalo		
28	North Maluku		
29	Bali	Bali	280
30	West Nusa Tenggara	Nusa Tenggara	290
31	East Nusa Tenggara		
32	Papua	Papua, West Papua, and Maluku	300
33	West Papua		
34	Maluku		
		Large Taxpayers	310

Note: This research did not consider the Special Jakarta Regional Office (code 130) or the Large Taxpayer Regional Office (code 310).

Notes

[1] The listing of the regional offices of the Directorate General of Taxes and the respective provinces they are situated in can be referenced in the Appendix B.

[2] A comprehensive categorization of tax codes in Indonesia is available in Appendix A.

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