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The Tax Revenue from Agriculture and Manufacturing Sectors in Lower Middle-Income Countries with Exchange Rate as a Moderating Variable

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ABSTRACT: Middle-income trap triggers the middle-income countries to boost their economic growth. As tax revenue has causal relationship with economic growth, it is essential to conduct a study on how to improve tax revenue. Considering the potential of agriculture and manufacturing sectors in lower middle-income countries, particularly in East Asia and Pacific Regions one of which is Indonesia, this study aims to determine the effects of both sectors on tax revenue in the respective regions. This study uses exchange rate as moderating variable and foreign direct investment (FDI) as control variable. The utilization of the two variables becomes the novelty of this study since researches that uses the two variables have never been conducted. In addition, no references of former studies concerning the effects of the two sectors on tax revenue in lower middle-income countries found. The research is conducted from 2002 to 2019 by using panel data multiple linear regression analysis method. By using fixed effect model and ridge regression model, it is indicated that before the moderation is carried out, agriculture has a negative effect and manufacture has a positive effect on tax revenue. However, after the variables are moderated with exchange rate, the interaction of agriculture and exchange rate has positive effect on tax revenue, while the interaction of manufacture and exchange rate has negative effect on tax revenue. This study implies that to optimize a country's tax revenue, apart from focusing on optimizing agriculture or manufacture, exchange rate condition needs to be considered.

Keywords: Agriculture, Exchange Rate, FDI, Manufacturing, Tax Revenue

INTRODUCTION

Bulman et al. (2017) uses "middle-income trap" term to define a phenomenon in which a country could be trapped in middle-income status due to the differences in effective growth strategies implemented by low-income countries to achieve high-income status. It implies that a very strong driving force is needed to achieve high-income status so that there can be a shift from a low-income country to a high-income country. The transition to a high-income status requires the policy makers and the society to focus on the fundamental determinants of the growth itself (Eichengreen et al., 2017).

World Bank (2022) divides middle-income countries into two types. Countries with a Gross National Income (GNI) between USD1,036 and USD4,045 defined as lower-middle income economies, and countries with GNI between USD4,046 and USD12,535 referred to as upper middle-income economies. In 2020, there are 36 lower-middle income countries and 57 upper-middle income countries (OECD, 2021). In recent years, around 75 percent of the world's population and 62 percent of the world's poor population are considered middle-income countries (MICs). Furthermore, around one-third of global Gross Domestic Product (GDP) comes from MICs (World Bank, 2022).

Clearly, high-income countries have different conditions from low-income countries. This condition can be seen from the proportion of low-income, lower middle-income, upper middle-income, and high-income countries' tax revenues to the GDP of each type of country. This is in line with what was stated by OECD (2022) that tax revenues in middle-income countries are of a smaller percentage of GDP than those in high-income countries.

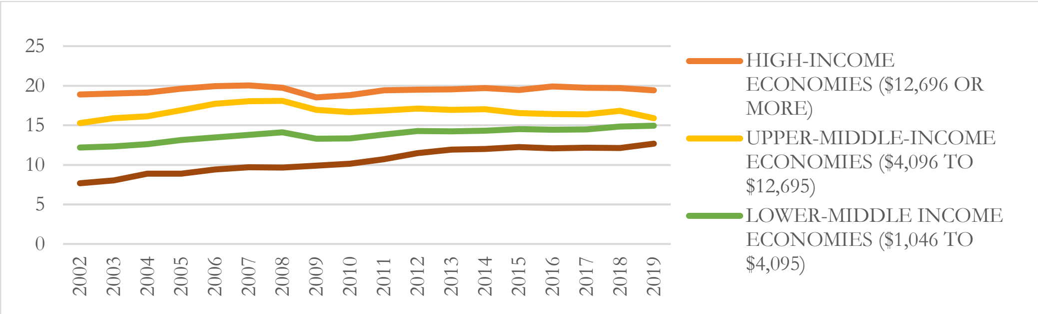

Chart 1 Tax revenue percentage to GDP in each type of countries
Source: World Bank (2023b)

However, from 2002 until 2019, the trend in the tax revenue of lower middle-income countries (including Indonesia) had increased (World Bank, 2023b).

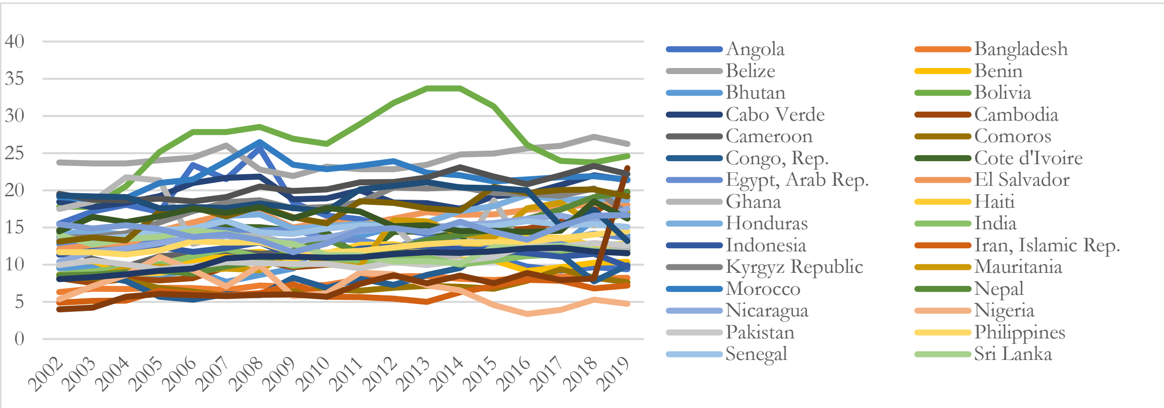

Chart 2 Tax revenue growth in lower middle-income countries from 2002–2019
Source: World Bank (2023b)

In his study, Arvin et al. (2021) stated that in low-income and lower middle-income countries, tax revenue and economic growth (measured by GDP per capita) had a causal relationship both in short term and long term. High tax revenue is supported by high economic growth, and vice versa, high economic growth supports high tax revenue.

In most low-income and middle-income countries, the economy depends on agriculture and other primary product activities, so that since 1990, the expansion of agricultural land has been increasing (Barbier, 2020). Middle-income countries contribute around 40 percent of global agricultural production and growth reaching more than 3.5 percent annually (Economic Study Service, 2017). According to World Bank (2023a), agriculture is a sector that has the potential to eradicate extreme poverty projected to provide welfare for around 9.7 billion people in 2050. The ability to increase the income of the poor from agriculture sector is considered two to four times more effective than the other sectors. Agriculture contributes around 4 percent to global GDP and in some developing countries, and more than 25 percent to GDP (World Bank, 2023a). Furthermore, large agricultural output is one of the reasons for a country to have a large tax potential (Mawejje & Sebudde, 2019).

Besides agriculture, the manufacturing sector in lower middle-income countries also gets the attention. From 2002 until 2019, in lower middle-income countries, the average contribution of the manufacturing sector to GDP was greater than that of the agricultural sector to GDP (World Bank, 2023b).

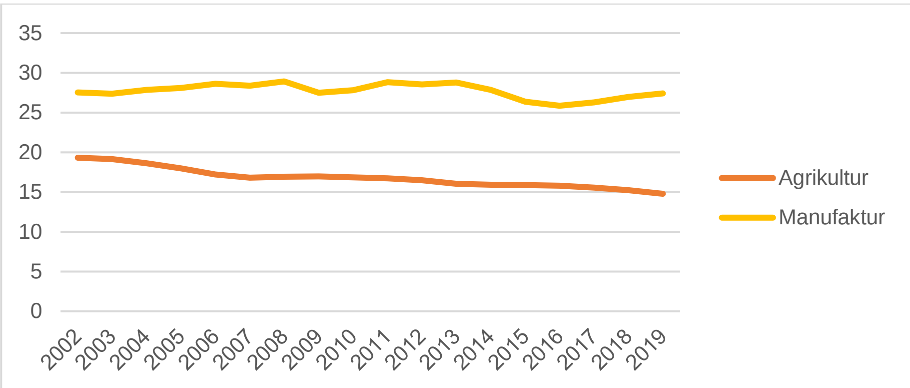

Chart 3 The growth of agriculture and manufacturing sectors' contribution to GDP in lower middle-income countries from 2002–2019
Source: World Bank (2023b)

In addition, Eichengreen et al. (2017) revealed that the manufacturing sector in middle-income countries was superior to the service sector. Followed by the findings of Mazhar & Rehman (2020) that an increase in the service sector reduces the growth rate of national income per capita both in low-income countries and middle-income countries. On the other hand, the manufacturing sector acts as a growth escalator. A study conducted in high-income countries in Asia when entering and leaving middle-income countries, it was found that the value-added contribution of the manufacturing sector to GDP increases the income per capita in a sustainable manner. (Huang et al., 2017).

Apart from the positive contribution and potential of agriculture to the country's economy, studies on examining the effect of the agricultural sector on tax revenues conducted by Karagöz (2013), Castro & Camarillo (2014), Gaalya (2015), Alabede (2018), dan Rodriguez (2018) indicated a significant negative effect. On the other hand, the researches by Karagöz (2013), Castro & Camarillo (2014), Gaalya (2015), dan Minh Ha et al. (2022) showed a significant positive effect from the manufacturing sector on tax revenues. However, these studies have not been carried out specifically for lower middle-income countries. Furthermore, no study has been conducted using the exchange rate as a moderating variable and foreign direct investment (FDI) as a control variable.

Exchange rate can also affect tax revenue. Seade (1990) in his Fiscal Policy of Open Developing Economies stated that devaluation would increase tax revenue if import activities of a country were dominated by necessities when income is inelastic. However, devaluation will also tend to reduce tax revenue or will even cause losses if tax revenue is more dominantly dependent on taxes on wages (Seade, 1990). In his study, Gaalya (2015) concluded that the exchange rate had a significant positive effect on tax revenues, whereas Ofori et al. (2018), Rutto (2020), and Tsaurai (2021) concluded the opposite i.e., the exchange rate had a significant negative effect on tax revenue.

Similar to the exchange rate, FDI affects tax revenue. A number of studies have been conducted to examine this effect. Okey (2013), Castro & Camarillo (2014), Pratomo (2020), Tsaurai (2021), Camara (2022), Gaspareniene et al. (2022), dan Minh Ha et al. (2022) concluded that FDI had a significant effect on tax revenue. Only Castro & Camarillo (2014) found a negative effect, while the others found a positive one. However, Gaspareniene et al. (2022) indicated a positive effect from outward FDI and a negative effect from inward FDI on tax revenues.

To describe further, the exchange rate and FDI also affect the tax revenue in addition to the agriculture and the manufacturing sectors. Nevertheless, there haven't been any researches conducted specifically to study those effects in lower middle-income countries. Thus, this study will examine the effect of the agriculture and manufacturing sector on tax revenue in some lower middle-income countries for the last 18 years. The exchange rate as a moderating variable and FDI as a control variable employing panel data multiple linear regression analysis method were selected. The years 2020 to 2022 were excluded in this study due to the 2019 (COVID-19) pandemic in which Corona Virus impacted the consistency of the observed data. The results of this study are to describe the strategies set by lower middle-income countries in optimizing their tax revenue, either from the agricultural sector or from the manufacturing sector by considering the exchange rate.

METHOD

This is a quantitative study that analyzes the data by using multiple linear regression panel data. The quantitative study uses statistical procedures or other methods of quantification in analyzing the relationship between study variables (Jaya, 2020). To support the research, the multiple linear regression method is used to determine the linear relationship between the dependent variable and more than one independent variable (Suyono, 2018). The data used is panel data since it is a combination of time series and cross section data (Sihombing, 2022). Panel data comprises agriculture, manufacturing, exchange rate, tax revenue, and the numeric data of several countries from 2002 to 2019. These items are categorized as panel data as these can only be studied by using the quantitative method. Additionally, the secondary data were taken from World Development Indicators data of World Bank (2023b). The observed countries are selected based on stratified sampling i.e., the samples selection which is done by dividing the population into subgroups (Fink, 2005). Firstly, the entire population i.e., all countries in the world, is categorized into high-income economies, upper middle-income economies, lower middle-income economies, and low-income economies based on World Bank (2023b). After selecting the lower middle-income countries, the data are then filtered by the country region and chosen for the East Asia and Pacific region. There are five countries chosen for this study i.e., Cambodia, Indonesia, the Philippines, Timor Leste, and Vietnam.

The dependent variable is the percentage of tax revenue to Gross Domestic Product (GDP), while the independent variables are the percentage of agriculture to GDP and the percentage of manufacturing to GDP. It can be summed up that the dependent variable is a variable affected by the independent variable and vice versa.(Mukhid, 2021). Moreover, this study uses a moderating variable i.e., the exchange rate and control variable i.e., foreign direct investment (FDI). Moderating variable is the variable that strengthen or weaken the relationship between the dependent variable and the independent variable, while the control variable is a variable determined by the researcher so that non-study variables do not affect the relationship between the dependent variable and the independent variable (Duli, 2019). The details of the variables used in this study are as follows.

Table 1 Study Variables

Variables	Details	Units
Tax revenue (TAX) (Y)	All mandatory transfers to the central government for public purposes excluding fines, penalties, and most social security contributions, minus refunds of over payments of taxes and corrections of tax revenues.	%GDP
Agriculture, forestry, and fishing, value added (AGRI) (X_1)	Value added (all outputs minus intermediate inputs) from agriculture, forestry, and fishery sectors.	%GDP
Industry, including construction, value added (IND) (X_2)	Value added from mining, manufacturing, construction, electricity, water, and gas sectors.	%GDP
Official exchange rate (EXCH) (Z)	The official exchange rate set by the state authority or by the official exchange rate	LCU per

	market. Calculated on an annual or monthly average.	USD
Foreign Direct Investment, net inflows (FDI) (control variable)	Net inflows from investment which is the sum of equity capital, reinvestment income, other long-term capital, and short-term capital in the balance of payments.	%GDP

Source: World Bank (2023b)

Before carrying out the regression analysis, the classical assumptions tests are made to measure normality, heteroscedasticity, multicollinearity, and autocorrelation. This test was carried out to obtain a regression model that produces reliable and unbiased estimates (Purnomo, 2017). The classic assumption tests performed are described in the table below.

Table 2 Classic Assumptions Test

Classic Assumptions	Details	Test Tools
Normality	Performed to test whether the residual values in the model are distributed normally nor not. H_0 : data is distributed normally (Prob>chi2 > α) H_1 : data is not distributed normally (Prob>chi2 < α)	Skewness and kurtosis test
Heteroscedasticity	Performed to detect whether there is a change in the variance of the residual over time. H_0 : homogeneous data variants (Prob>chi2 > α) H_1 : heteroscedastic data variant (Prob>chi2 < α)	Breusch-Pagan/Cook-Weisberg test
Multicollinearity	Performed to determine whether there is a correlation between independent variables. H_0 : there is no high multicollinearity between independent variables (VIF < 10) H_1 : there is high multicollinearity between independent variables (VIF > 10)	Variance Inflation Factor (VIF)
Autocorrelation	Performed to detect whether there is a relationship between the value at time t with the value at time t-1 H_0 : the model contains autocorrelation (Prob>F > α) H_1 : the model does not contain autocorrelation (Prob>F < α)	Breusch-Godfrey/Lagrange Multiplier test

Source: Ghozali (2016), Purnomo (2017), Ismanto & Pebruary (2021), and Sihombing (2022)

The panel data model used is the fixed effect model, the best model based on the selection in the tests conducted. These tests include the Chow Likelihood Ratio test, Breusch Pagan's Lagrange Multiplier test, and the Hausman test as suggested by Sihombing (2021). The details are shown in the following table.

Table 3 The Best Model Selection Test

Tests	Details
Chow Likelihood Ratio	Performed to choose which model is better: the common effect model or the fixed effect by using F test. H_0 : common effect model is better than fixed effect model (Prob>F > α) H_1 : fixed effect model is better than common effect model (Prob>F < α)
Lagrange Multiplier Breucsh Pagan	Performed to choose which model is better: the common effect model or random effect model by using chi square LM test. H_0 : common effect model is better than random effect model (Prob>chibar2 > α) H_1 : random effect model is better than common effect model (Prob>chibar2 < α)
Hausman	Performed by using chi square test to choose which model is better: the random effect model or the fixed effect model . H_0 : random effect model is better than fixed effect model (Prob>chi2 > α) H_1 : fixed effect model is better than random effect model (Prob>chibar2 < α)

Source: Sihombing (2021) and Sihombing (2022)

In conducting the analysis, the ridge regression model is used. Ridge regression is a regression model indicated whether the independent variables in the study are collinear or multicollinearity (Chatterjee & Hadi, 2006). This model demonstrates slight changes in the standard regression model is as follows:

$$\tilde{Y} = \beta_1 \tilde{X}_1 + \beta_2 \tilde{X}_2 + \cdots + \beta_p \tilde{X}_p + \varepsilon' \tag{1}$$

by estimating the equation for the coefficient to be:

$$\begin{aligned}
(1+k)\beta_1 + \quad r_{12}\ \ \beta_2 + \cdots + \quad r_{1p}\ \ \beta_p &= r_{1y},\\
r_{21}\ \ \beta_1 + (1+k)\beta_2 + \cdots + \quad r_{2p}\ \ \beta_p &= r_{2y},\\
\vdots \qquad\qquad \vdots \quad \vdots \qquad &\ \ \vdots\\
r_{p1}\ \ \beta_1 + \quad r_{p2}\ \ \beta_2 + \cdots + (1+k)\beta_p &= r_{py},
\end{aligned} \tag{2}$$

where r_{ij} is the correlation between the ith independent variable and the jth independent variable and r_{iy} is the correlation between the ith independent variable and Y dependent variable. The solution for equation (2), $\hat{\beta}_1, \ldots, \hat{\beta}_p$ is the estimated ridge regression coefficient (Chatterjee & Hadi, 2006).

The study method used to test the hypothesis formulated are as follows:

The effect of agriculture on tax revenue

Although Asai & Malgioglio (2019) stated that agriculture is more developed in countries with low-income residents, all literature states that agriculture has a negative relationship with tax revenue. Agriculture is mostly a selected sector only for subsistence purpose (subsistent agriculture). Besides, agriculture is difficult to tax because it operates informally (Alabede, 2018). It also has a small-scale production (Castro & Camarillo, 2014) so that there are only a small number of taxpayers who pay income tax from agricultural (Gaalya, 2015). Most agricultural products are exempt from indirect taxes due to their characteristics (Rodriguez, 2018). In addition to that, there will be very high costs required to verify income from the agricultural sector to be taxed (Gaalya, 2015). Consequently, the first hypothesis in this study is:
H_1 : Agriculture has a negative effect on tax revenue.

The effect of manufacturing on tax revenue

From the existing literature, there are two different views regarding the effect of manufacturing on tax revenue. However, most of the literature stated that this effect is positive. It is supported by the fact explained Su & Yao (2016) that the manufacturing sector is the main driver of economic growth in middle-income countries. The manufacturing sector allows businesses to generate a lot of profit (Karagöz, 2013) in addition to the added value of the products (Gaalya, 2015). These conditions make the manufacturing sector easier to tax than the agricultural sector (Castro & Camarillo, 2014; Minh Ha et al., 2022). Therefore, the second hypothesis of this study is:
H2 : Manufacturing has a positive effect on tax revenue.

The effect of exchange rate on tax revenue

Exchange rate plays an important role in economy because its changes can affect prices and costs in the foreign exchange market, thus it will have an impact on exports (Zhao, 2020). In general, the existing literature state that the exchange rate has a negative effect on tax revenue. An increase or decrease in the exchange rate will affect the amount of goods exported which will ultimately cause the opposite impact to tax revenue (Gaalya, 2015; Ofori et al., 2018; Rutto, 2020; Tsaurai, 2021). Therefore, the third hypothesis regarding the effect of the moderating variable in this study is:
H_3 : Exchange rate has a negative effect on tax revenue.

The effect of interaction of agriculture and the exchange rate on tax revenue

By considering the effect of the exchange rate as a moderating variable, the interaction between agriculture and the exchange rate is expected to clarify the effect of the agricultural sector on tax revenues, before interacting with the moderating variable. In other words, the arising effect is similar to the previous one, thus the fourth hypothesis in this study is:
H_4 : The interaction of agriculture and exchange rate have a positive effect on tax revenue.

The effect of interaction of manufacturing and the exchange rate on tax revenue

From the fourth hypothesis, the fifth one is similar to the fourth one.
H_5 : The interaction of manufacturing and exchange rate have a positive effect on tax revenue.

RESULTS AND DISCUSSIONS

Based on the data collected in this study, tax revenue, agriculture, and manufacturing have higher average values than the standard deviation. It indicates that the distribution of independent variables and the dependent variable is even. In contrast, the moderating variable of the exchange rate -the interaction variable between agriculture and the exchange rate- as well as the interaction variable between manufacturing and the exchange rate indicate higher standard deviation than the average value. It shows that the data distribution of the moderating variable and the interaction variable is not even. In addition, the analysis of the data distribution in all variables can also be seen from the range between the average value and the minimum value and the range between the average value and the maximum value. The independent variables and all dependent variables have balanced ranges between the average values and their minimum and maximum values. Conversely, the moderating variable and all interaction variables have an unequal range between the average value and the minimum and maximum values. These results indicate that the independent variables and dependent variable used in this study show an adequate data distribution.

Table 4 Descriptive Statistics Results

Variables	Mean	Std. Dev.	Min.	Max.
TAX	11,94785	3,700713	3,992409	22,97874
AGRI	19,59085	7,14201	8,820324	34,55732
IND	29,988	11,02727	5,049626	48,06075
EXCH	6.759,704	7.457,763	1	23.050,24
AGRI*EXCH	122.590,3	128.883,5	14,18536	401.329,7
IND*EXCH	247.392,3	274.593,1	5,049626	794.995,1
FDI	4,251471	3,737957	-0,2542563	14,14573

Source: Processed by using STATA application

The classical assumptions tests demonstrates that the model passes the heteroscedasticity test and the autocorrelation test, but it fails to pass the normality test and the multicollinearity test. In other words, the variance of the data of the model is homogeneous (the model is free from the heteroscedasticity assumption) and the value of the variable at t-time is not correlated with the variable at t-1 time (the model is free from the autocorrelation assumption). However, the data are not normally distributed (the model is not free from the normality assumption) and there is a correlation between variables (the model is not free from the multicollinearity assumption).

Table 5 Classical Assumptions Test Results

Classic Assumptions Tests	Results	Interpretation
Normality	Prob>chi2 = 0,0000 $<$ α = 5%	H_0 is rejected; data is not distributed normally
Heteroscedasticity	Prob>chi2 = 0,5914 $>$ α = 5%	$H_{0\neq}$ is not rejected; the model is free from heteroscedasticity assumption (homogeneous data variants)
Multicollinearity	VIF = 46,95 $>$ 10	H_0 is rejected; the model contains multicollinearity

Autocorrelation	Prob>chi2 = 0,0545 > α = 5%	H_0 is not rejected; the model is free from autocorrelation assumption

Source: Processed by using STATA application

Hence, to determine the best regression model, the Chow Likelihood test, the Lagrange Multiplier Breusch Pagan test, and the Hausman test are conducted. The results of the tests indicate that the best model is the fixed effect model with details as follows:

Table 6 The Best Model Selection Tests Results

Tests	Hasil	The Chosen Models
Chow Likelihood test	Prob>F = 0,0000 < α = 5%	Fixed effect model
Lagrange Multiplier Breusch Pagan test	Prob>chibar2 = 1,0000 > α = 5%	Common effect model
Hausman test	Prob>chi2 = 0,0001 < α = 5%	Fixed effect model

Source: Processed by using STATA application

The fixed effect model shows the overall R-squared of 0.5293 which indicates that the independent variables of agriculture and manufacturing affect the dependent variable of tax revenue by 52.93%. Other independent variables that are not included in the study model only affect the dependent variable by 47.07%.

The data which are not distributed normally in accordance to the results of the normality assumption test are ignored because basically the normality assumption test on panel data can be taken away (Kusumaningtyas et al., 2022). However, to overcome the multicollinearity in the data, the ridge regression model is used. This is in line with Suyono (2018) who stated i.e., the multicollinearity can be overcome by using a ridge regression model. The table below shows the ridge regression results.

Table 7 Ridge Regression Results

Variables	Coefficients	P>|t|	Prob>F
AGRI	-0,4014813	0,000**	0,000**
IND	0,0699612	0,004**	
EXCH	-0,0002728	0,194	
AGRI*EXCH	0,0000353	0,000**	
IND*EXCH	-0,00000587	0,189	
FDI	0,496454	0,000**	
Constanta	14,57284	0,000**	

**Significant at α = 5%; *Significant at α = 10%

Source: Processed by using STATA application

The regression model equation obtained is as follows:

$$TAX_{it} = 14{,}57284 - 0{,}4014813 AGRI_{it} + 0{,}0699612\, IND_{it} - 0{,}0002728\, EXCH_{it} + 0{,}0000353 AGRI * EXCH_{it} - 0{,}00000587\, IND * EXCH_{it} \quad (3)$$

The model implies that: 1) an increase in agriculture by 1 percent of GDP will reduce tax revenue by 0.4014813 percent of GDP and vice versa; 2) an increase in manufacturing by 1 percent of GDP will increase tax revenues by 0.0699612 percent of GDP and vice versa; 3) an increase in the exchange rate by 1 LCU per USD will decrease tax revenue by 0.0002728 percent of GDP and vice versa; 4) an increase in the interaction between agriculture and the exchange rate by 1 unit will increase tax revenue by 0.0000353 percent of GDP and vice versa; and 5) an increase in the interaction between manufacturing and the exchange rate by 1 unit will decrease tax revenue by 0.00000587 percent of GDP and vice versa.

The P>|t| and Prob>F values listed in the table have been adjusted by dividing P>|t| and Prob>F from the STATA application with two. It is such performed since the study conducted a one-tailed statistical test (one tail), illustrated by the study hypothesis used. The estimation shows whether or not the independent variables affect the dependent variable, and if the effect is positive or negative. This is in line with a statement by Kasim (2008) i.e., a one-tailed statistical test occurred when the alternative hypothesis determine one thing is higher or lower than the others. The p-value in one-tailed statistical test is twice the p-value in two-tailed statistical test (Kasim, 2008).

The above explanation summarizes, the t-test results before moderation show that all independent variables have a significant effect on tax revenue. In this case, agriculture has a negative effect on tax revenue, while manufacturing has a positive effect. However, after moderation with the exchange rate variable, the interaction between agriculture and the exchange rate has a positive effect on tax revenue, while the interaction between manufacturing and the exchange rate has a negative effect. Furthermore, the F-test results show that all independent variables have a significant effect on the dependent variable of tax revenue simultaneously.

The effect of agriculture on tax revenue

The first hypothesis testing results indicate that before moderating the exchange rate variable, the agricultural sector has a negative effect on tax revenue. This is similar to the study conducted by Alabede (2018), Castro & Camarillo (2014), Gaalya (2015), and Rodriguez (2018). The agricultural sector in lower middle-income countries is generally carried out only for livelihood purposes (subsistence agriculture) (Alabede, 2018). This sector is difficult to tax because it generally operates informally (Alabede, 2018) and tends to be a small-scale, resulting in a small number of taxpayers paying income tax on agricultural sector (Castro & Camarillo, 2014; Gaalya, 2015). Moreover, most agriculture products are exempt from value added tax due to their characteristics (Rodriguez, 2018). As a result, the cost of verifying agricultural sector income to be taxed is very high (Gaalya, 2015). Despite the fact that the agricultural sector is the low-income countries' icon due to its major contributions to the economies (Asai & Malgioglio, 2019; Economic Study Service, 2017), the potential problems that can occur due to limited access to technology, high investment costs, lack of skills, knowledge, and a supportive environment (McCampbell, 2022) and the conditions mentioned, draw the conclusion that the agricultural sector has a negative effect on tax revenue.

The effect of manufacturing on tax revenue

The second hypothesis testing results show that before moderating the exchange rate variables, the manufacturing sector has a positive effect on tax revenue. This is in line with the study conducted by Castro & Camarillo (2014), Karagöz (2013), Gaalya (2015), and Minh Ha et al. (2022). In contrast to the agricultural sector, the manufacturing sector is one of the sectors easier to tax. Manufacturing allows businesses to generate a lot of profit besides adding value to the products they produce. Even though this effect will depend on the conditions of the manufacturing sector in each country (Hamdan & Rana, 2021), manufacturing serves as the basic capital for a country to create added value to the raw materials. They are processed into finished products and profits generation is made possible. Therefore, manufacturing can boost economic growth both from the sector itself and from its contribution to drive other sectors (Huang et al., 2017; Mital et al., 2014; Okeyo, 2022; Su & Yao, 2016; Wicaksono et al., 2023).

The effect of exchange rate on tax revenue

The third hypothesis testing results show that the exchange rate has no effect on tax revenue. This is not in line with the study conducted by Gaalya (2015), Rutto (2020), Tsaurai (2021), and Ofori et al. (2018) who stated that the exchange rate has a negative effect on tax revenue. Apart from the statement that the exchange rate have an impact on the economy (Gragnon & Hinterschweiger, 2011; Zhao, 2020), the study results indicate that this role does not make the exchange rate affect tax revenues. However, when the exchange rate moderates the effect between the agricultural sector and the manufacturing sector on tax revenues, there is a change in the direction of the effect of the two sectors.

The effect of the interaction between agriculture and the exchange rate on tax revenue

The fourth hypothesis testing results indicate that the interaction between the exchange rate and the agricultural sector has a positive effect on tax revenues. This is the inverse effect of the previous direction before the moderation. This condition can occur as stated by Seade (1990) that if imports of a country rely on the income-inelastic goods i.e., the basic agricultural goods, imports of these goods will not undergo changes when a devaluation occurred. Consequently, if devaluation strikes, the increase in the price of imported goods will boost the import duty revenue which in turn can enhance tax revenue. The underlying reason behind the changing of the effect of the agricultural sector on tax revenue is one condition, from negative to positive.

The effect of the interaction between manufacturing and the exchange rate on tax revenue

The fifth hypothesis testing results show that the interaction between the exchange rate and the manufacturing sector has a negative effect on tax revenue. This is also the inverse effect of the previous direction before the moderation. Exchange rate volatility creates uncertainty and costs of the avoidance risks of the business actors (Ofori et al., 2018). In this case, the overvaluation causes the price of goods to be more expensive. Despite high manufacturing production, high raw material prices due to the overvaluation lower the profits. As a result, tax revenues will also be low. Furthermore, the interaction between the manufacturing sector and the exchange rate changes the direction of the effect before the moderation i.e., from positive to negative.

CONCLUSIONS

Before moderating the exchange rate, agriculture has a negative effect on tax revenue and manufacturing has a positive effect. However, after being moderated by the exchange rate, agriculture has a positive effect on tax revenue and manufacturing has a negative effect. The results of this study imply that to optimize the tax revenue, besides focusing on optimizing the agricultural sector or the manufacturing sector, the exchange rate conditions need to be considered as well. A controlled exchange rate can avoid the effect of declining tax revenues due to the positive or negative effects of each sector on tax revenue.

This study is limited to only one-way effect between one variable and the others. In fact, there is a two-way effect between variables. This effect can be identified by using Panel Vector Auto-regressive (PVAR) method or Panel Vector Error Correction Model (PVECM) method to identify the long-term and short-term effects. In addition, the manufacturing variable used in this study covers several sectors compared to the manufacturing sector itself such as mining, construction, electricity, water, and gas sectors. Further study can be carried out by employing only manufacturing variable data to avoid bias in its results.

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