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MACROECONOMIC DETERMINANTS OF TAX REVENUE AND TAX EFFORT IN SOUTHEAST ASIAN COUNTRIES

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ABSTRACT

This paper analyzes macroeconomic indicators that determine tax revenues in six Southeast Asian countries during 2008 – 2019. The estimation results are then used to predict the value of taxable capacity to construct the index of tax effort. Using the FE model equipped with the Driscoll-Kraay standard errors, this study finds positive and significant effects of per capita income, manufacturing, and trade openness on the actual tax-to-GDP ratio and tax effort. In contrast, inflation is considered a superfluous determinant because of its insignificant effect on the two measures of tax performance. In addition, the authors also classify countries into three different groups based on the actual level of tax revenue and the effort put into collecting taxes. The benchmarks used to rank countries are all sample countries' median actual tax revenue and the tax effort index 1. Regardless of the classification, several policy implications are offered to increase tax collection productivity by focusing on the revenue bases used in the estimation model.

Keywords: *Tax Revenue, Tax Capacity, Tax Effort, Southeast Asia, Panel Data*
JEL: H2, O1, O2

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Introduction

Tax performance in Southeast Asia is relatively low. The average tax revenue in the countries has been only around 13% of GDP in the last decade (World Bank, 2021). At the same time, World Bank suggests that the "tipping point" of a country's tax revenues is at 15% of GDP (Junquera-Varela & Haven, 2018). Tax revenues above this threshold are seen as a critical element for economic growth and, ultimately, poverty reduction. This idea gains support from recent studies. Gaspar, Jaramillo and Wingender (2016) empirically proved that countries with tax revenues above 15% of GDP could achieve a per capita income that was 7.5 per cent higher than expected for ten years. This level of taxation ensures that countries have the money they need to invest in the future and achieve sustainable economic growth.

Countries that are below the "tipping point" imply a worrying fiscal condition. Insufficient levels of fiscal income can hinder and jeopardize the achievement of the necessary governments' development functions, primarily to provide adequate public services and meet the community's basic needs. Regarding health, education, and infrastructure, not least in setting

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the development agenda related to the economy's structural transformation to encourage growth (Dioda, 2012). Unsustainable state finances also make it difficult for any government to address social and environmental problems (Sawhney, 2018). Such situations illustrate the government's weak accountability, which will lead to the destruction of public trust due to the low level of citizen satisfaction with the quality of public services (Zhao & Hu, 2015).

Therefore, studying the concept of tax performance in more depth is very important. Most studies involve the factors that determine tax revenue to achieve that goal. It is the primary motivation and focus of this paper. An empirical analysis based on a regression model by considering four macroeconomic indicators that directly represent the revenue bases is used to apply it technically. The underlying assumption is that knowing each indicator's effect on tax revenue allows the public authorities to design policies to increase revenue productivity by focusing on those macroeconomic indicators.

At the regional level, studies related to the determinants of tax revenue have been carried out, such as in the countries of Sub-Saharan Africa (Botlhole, 2010), Latin America and the Caribbean (Dioda, 2012), Middle East Countries (Imam & Jacobs, 2014) and European Union (Kalaš et al., 2018). Southeast Asian countries are an ideal group of countries to study this issue for some reasons. Apart from its relatively weak tax performance (as noted earlier), corresponding papers at the regional level rarely cover this regional group.

Syadullah (2015) and Anh & Thinh (2018) conducted studies in the Southeast Asia context, which investigated the impact of institutional and socio-economic factors on tax revenue, respectively. However, their analysis is limited to the causal effect on tax revenue. This study will make an effort to provide further research. We will estimate the taxable capacity and tax effort by harnessing the specified regression equation of tax revenue. With these two indicators, we can provide a more reliable measure of tax performance even though the economic structure of each country is different. In addition, we will group countries according to their tax performance and deliver a comparative analysis. Thus, through this study, there are more comprehensive results can be obtained.

The structure of this paper is as follows. Following this introduction, Section 2 presents the basic concepts of tax revenue and tax effort and a brief overview of recent studies (last five years) on the structural determinants of tax revenue in any country. Section 3 is devoted to discussing the specification of the model of tax revenue and the econometric model used to estimate the value of the taxable capacity for constructing tax efforts. Section 4 discloses the estimation results and delivers a discussion. Section 5 presents the conclusions and policy implications.

Literature Review

Most previous studies employ tax collection as a proportion of GDP to capture a country's tax effort and as a basis for comparison of tax performance across countries (Baer & Galvão, 2008). The use of these indicators may be relevant if trends and comparisons of tax revenues are applied to countries with similar economic structures and national income levels (Musgrave, 1987). The advantage of using this indicator is that it is simple and provides a brief overview of trends in tax collection worldwide (Le et al., 2008). However, when this indicator is used to measure the government's efforts to mobilize revenue bases, the tax-to-GDP ratio is vulnerable to misleading because of the economic structure, institutional and political environment, and demographic composition that varies across countries (Prest, 1977). In addi-

tion, this indicator does not capture the taxable capacity, so it is impossible to assess whether the tax collection efforts in that country are better/worse than in other countries.

To overcome this problem, Piancastelli (2001) argued that the measurement of tax effort should be associated with how a country's tax base can be exploited. In addition, a clear distinction needs to be made between taxable capacity and the government's success in exploring this capacity. An empirical approach involving the determinants of tax collection needs to be used to implement it. Concerning this issue, Piancastelli and Thirlwall (2020) posited that the factors used to determine tax collection should focus on the revenue bases typically represented by the economic structure. The use of other variables such as institutional and political environment can reduce the measured tax effort because taxable capacity is predicted to increase. Consequently, the measurement of tax effort needs to be treated with caution, especially when such variables are significant in determining tax revenue. Several later studies ignore this fundamental point when comprehensively analyzing tax performance across countries (see, e.g., Gupta, 2007; Le, Moreno-dodson and Bayraktar, 2012; Dioda, 2012).

The revenue bases commonly used in the literature as determinants of tax collection typically comprise four indicators: level of development, economic openness, the composition of economic sectors, and macroeconomic stability. The level of development is usually proxied by per capita income. Economic openness is generally measured by the percentage of total imports and exports in GDP. The composition of the financial sector usually consists of the industrial, agriculture, and service industries as a share of GDP. Macroeconomic stability is generally represented by the annual rate of inflation calculated by either the consumer price index (CPI) or the GDP deflator. This section will present some previous studies that have revealed the effect of each indicator on tax revenue. The studies we cite are those published in the last five years to ensure the relevant issues raised recently.

Brun and Diakite (2016) constructed tax efforts and potential non-resource taxes using samples from 114 low- and middle-income countries from 1980 – 2014. The sample countries they collected consisted of 30 low-income countries, 41 lower-middle-income countries, and 43 upper-middle-income countries. Using the generalized two-stages least squares random-effects instrumental variables estimator (G2SLS-RE-IV), the study revealed that per capita income and trade volume have a positive and significant effect on non-resource tax revenue as a share of GDP. Meanwhile, the agricultural sector's contribution to GDP was a negative and significant impact on the actual non-resource tax collection. They argued that the majority of the sample countries exclude the agricultural sector, which is known to be a challenging sector to tax.

Yohou and Goujon (2017) estimated a new tax effort index for 120 developing countries over 1990 – 2012. To do this, they regressed actual tax revenues by per capita income, total imports per GDP, and the contribution of the industrial and agricultural sectors to GDP. Using a random-effect model, they found that per capita income, imports, and manufacturing positively and significantly affect non-source taxes as a percentage of non-source GDP. Meanwhile, the agricultural sector appeared with a negative and significant coefficient sign even at the 1% significance level. These findings are robust with the inclusion of human capital and vulnerability economy indexes into the model.

Terefe and Teera (2018) empirically examined the critical determinants of tax revenue using data from nine East African countries from 1992 to 2015. Regression analysis was carried out using FGLS and the dynamic panel data GMM model. This aim is to overcome the problems of heteroscedasticity and autocorrelation in the model. Surprisingly, the regression

results of the two models showed that the agricultural sector has a positive and significant impact on tax revenues in East African countries. This finding contradicts the notion usually found in the literature (see, e.g., Gupta, 2007; Stotsky & WoldeMariam, 1997; Teera, 2003). They argued that agriculture still seems to be the backbone of the economy in East African countries as a group of less developed countries. At the same time, inflation has a significant negative effect (p-values < 0.1 in FGLS and < 0.01 in GMM).

In contrast to the three studies discussed earlier, Amoh (2019) employed time-series data (1970 – 2015) to estimate Ghana's taxable capacity, tax effort, and tax collection. The study regressed tax revenue with inflation, population growth, per capita income, the contribution of the agricultural and service sectors in GDP, and fluctuations in foreign debt as a share of GNI to predict the value of taxable capacity and tax effort index. Since the Autoregressive Distributed Lad (ARDL) bounds test failed to confirm the long-term relationship between the dependent variable and the outcome variable, as a consequence, the study used the Vector Autoregressive (VAR) model to estimate the short-term relationship in the tax revenue regression. According to this model, population growth and per capita income growth appeared with significant positive sign coefficients at the 10% and 5% levels, respectively. Meanwhile, other factors were found to be insignificant. In addition, based on the time sample used, the analysis is carried out by dividing the tax regime in Ghana into two periods, namely the period before tax reform (1970 – 1984) and the period after tax reform (1985 – 2015). Empirically, the study revealed that the average tax effort index before and after-tax reform was 0.95 and 0.64, respectively. It indicates that tax reforms in Ghana exacerbated the government's efforts to collect taxes.

Piancastelli and Thirlwall (2020) measured tax effort in 59 developed and developing countries over 1996 – 2015 by regressing the actual tax/GDP ratio against several tax revenue bases; GDP per capita, trade, broad money, agriculture, industry, and services (all transformed into natural logarithm). Using pooled Ordinary Leas Squares (OLS) and fixed-effects model, the study found that the service sector and trade volume has the most considerable effect on tax revenue compared to other factors. Both variables were found to have a positive and significant impact on tax revenue. The study also revealed that South Africa has the highest tax effort while Switzerland has the lowest tax effort compared to other countries.

The latest study related to tax capacity and effort was carried out by Kawadia and Suryawanshi (2021) using a panel data set of 17 non-special Indian states over 16 years (from 2001–2002 to 2016–2017) by employing the stochastic frontier model. The dependent variables used in this study are the total local tax revenue and local tax revenue for non-goods and services. Meanwhile, the two usual macroeconomic factors used as independent variables are real per capita net regional domestic product (NRDP) and the ratio of the agricultural sector of gross regional domestic product (GRDP). Both factors appeared with a positive sign and are significant at the 1% level. They argued that the positive influence of the agricultural sector might be because most of the economic growth in the Indian states is contributed by the farming industry. In addition, they found that the average total tax effort index and non-goods and service tax effort is about 0.9. It indicates that the local government in Indian is quite maximal in exploiting their taxable capacity.

Data and Research Methods

Data

This study utilizes secondary data obtained from the World Development Indicators (WDI) powered by the World Bank. We examine balanced panel data, which means the number of time units is the same for each country. The time-series data covers the period 2008 – 2019. The spatial scope of the study is six Southeast Asian countries, consisting of Indonesia, Malaysia, Thailand, Philippines, Singapore, and Cambodia. This sample accounts for more than 50 per cent of the total population of eleven countries. Hence, there are 72 = 12 x 6 observations. The main background of the country and study period selection is the availability of data. Missing data for Southeast Asian countries reduced cross-sections to six countries and shortened the study period to 12.

We select several variables by referring to previous studies as described in the literature review section. A dependent variable we will use in this study is total tax revenue as a percentage of Gross Domestic Product (GDP). Meanwhile, the regressor in this study contains variables that capture macroeconomic indicators, such as per capita income, manufacturing as a percentage of the economy, the average annual inflation rate calculated based on the GDP deflator, and the trade-to-GDP ratio. Operational definitions of all variables that will be used in this study are presented in Table 1.

Table 1: Description of the Variables

Variable	Notation	Definition (units of measurement)	Source
Tax Revenue	T	Total tax revenue per GDP (% of GDP)	World Bank (2021)
Income per capita	IC	GDP per capita (current US$)	World Bank (2021)
Manufacture	$MANF$	Manufacturing, value added (% of GDP)	World Bank (2021)
Inflation rate	INF	Inflation, GDP deflator (annual %)	World Bank (2021)
Trade openness	TRD	Total export and import (% of GDP)	World Bank (2021)

Table 2 delivers a summary of statistics of tax revenue and its macroeconomic determinants. It includes the number of observations, the average value, the standard deviation, the minimum and maximum values of each variable. During the study period (2008 – 2019), our sample's average value of tax revenue is around 13.3% of GDP. This figure is lower than the average tax ratio in high-income countries (15.1% of GDP) but higher than in middle-income countries (11.8% of GDP) during the same period. The minimum value of this income is about 9.7% of GDP earned in Cambodia in 2009. The maximum value was recorded in 2019 in Cambodia with around 19.7% of GDP. For other variables, the average values are US$ 12985.04 for GDP per capita, 21.35% for the share of manufacturing value-added in GDP, 3.06% for the annual inflation rate, and 142.58% for the level of economic openness.

Table 2: Summary Statistics of the Variables

Variable	Observation	Mean	Standard Deviation	Minimum	Maximum
Tax Revenue	72	13.30447	2.026069	9.647781	19.73206
Income per capita	72	12985.04	19320.26	738.0547	66679.05
Manufacture	72	21.34966	4.091871	14.41718	30.93048
Inflation rate	72	3.056636	3.526226	-5.992202	18.14975
Trade openness	72	142.5818	102.7027	37.42134	437.3267

Table 3 provides a correlation matrix between variables in this study. According to Table 3, there is a positive correlation between taxes and all independent variables except inflation. The positive correlation between taxes and three macroeconomic indicators, namely per capita income, manufacturing value-added, and trade openness, indicates that tax inflows are higher in a more established economic structure and less in a flawed economic system. In this case, we characterize an excellent economic structure with high per capita income, the relative dominance of the manufacturing sector to GDP, and high economic openness. This illustration is correct because the highest ratio of tax revenue to GDP in the world is mainly found in developed countries such as the US and Europe, which generally have these characteristics.

Table 3: Correlation Matrix of the Variables

	Tax Revenue	Income per capita	Manufacture	Inflation rate	Trade openness
Tax Revenue	1.0000				
Income per capita	0.0488	1.0000			
Manufacture	0.3484	-0.1649	1.0000		
Inflation rate	-0.2337	-0.2757	0.1304	1.0000	
Trade openness	0.2213	0.9068	-0.1545	-0.3249	1.0000

This thesis seems to be strengthened by the negative relationship between inflation and tax revenue. Similarly, this indicates that taxes are high in a more stable economy, i.e., controlled inflation rates, and less in a volatile economy, i.e., soaring inflation rates. Other variables, such as economic openness and per capita income, seem to have a powerfully positive relationship (0.91). It indicates the presence of multicollinearity between the two variables, which can cause our estimation model to be biased. The use of panel data in this study provides an advantage for us, where heterogeneity of entities (countries) can be present. Such situations can mitigate the multicollinearity bias of the estimation model that we will use in the multivariate regression analysis in the next section. Such research becomes even more

essential as the pairwise correlations shown in Table 3 can be false, reflecting unobserved country effects.

Methodology

According to Bahl (1971), theoretically, the tax ratio can be divided into two components, namely taxable capacity (C) and tax effort (TE). Formally, it can be expressed as follows:

$$T = f(TE, C) = TE \times C \tag{1}$$

Taxable capacity and tax effort can be estimated using regression analysis, focusing on factors that might determine a country's actual tax revenue (see, e.g., Le et al., 2012; Bird et al., 2014). Hence, we use the panel data model to regress the substantial tax revenue as a share of GDP (T) against macroeconomic indicators. The following equation represents our basic estimation model:

$$T_{it} = a_1 \ln(IC_{it}) + a_2 MANF_{it} + a_3 INF_{it} + a_4 TRD_{it} + a_i + e_{it} \tag{2}$$

Where i and t are indices for country and period, respectively. a_1, a_2, a_3, and a_4 are unknown parameters to be estimated. a_i is the country fixed effect, and e_{it} is the usual disturbance assumed to be non-independently and identically distributed (i.i.d). The definitions of the variables in the model are as shown in Table 1. We convert per capita income to the natural logarithm to narrow the variation in values between variables. The income per capita is the only variable measured in money units (US$), while others are quoted by per cent (%).

According to Le et al. (2008), taxable capacity is a predictive tax-to-GDP ratio calculated using the estimated coefficients of the regression specifications, taking into account country-specific characteristics. Tax effort is an index of the balance between the actual collection per GDP and taxable capacity (Piancastelli & Thirlwall, 2020). Hence, we have:

$$\begin{aligned} C &= \widehat{T}_{it} \\ TE_{it} &= \frac{T_{it}}{\widehat{T}_{it}} \end{aligned} \tag{3}$$

A country's tax effort is high if the index is above 1, implying that the government collects more taxes than the predicted taxable capacity. Conversely, a country's tax effort is low when its index is below 1, indicating that the government is not fully maximizing its revenue potential. Hence, there is still room to increase tax revenue (Stotsky & WoldeMariam, 1997; Mertens, 2003). In addition, we use the typology proposed by Le et al. (2008) to classify the countries based on their actual tax collection. The benchmark they use is the median substantial tax revenue of all samples. A country's existing tax collection is high if its average over the sample period is higher than the median. In contrast, a country's existing tax collection is low when the standard is lower than the median. Hence, we can sort the countries into four groups, as shown in Table 4 below.

Table 4: Typology of Tax Collection and Tax Effort

Tax Collection	Tax Effort	
	Low	**High**
Low	low tax collection and low tax effort	Soft tax collection and high tax effort
High	high tax collection and low tax effort	High tax collection and high tax effort

Source: Le et al. (2008)

In addition, to deepen the analysis, we are interested in knowing whether the macroeconomic indicators that we use as regressors in equation (2) can also explain the tax effort index in Southeast Asian countries. To that end, we run the regression once again with the following estimation model:

$$TE_{it} = \beta_1 \ln(IC_{it}) + \beta_2 MANF_{it} + \beta_3 INF_{it} + \beta_4 TRD_{it} + \beta_i + v_{it} \quad (4)$$

We have expectations that align with the results of previous studies regarding the sign of the estimated coefficient of each independent variable in tax-to-GDP ratio and tax effort index regressions. Referring to the findings of prior research, per capita income is estimated to have a positive sign because it is a proxy for the level of development of a country. Higher income levels usually lead to greater demand for public goods and services and increase overall ability to pay, and therefore higher tax payments and collections are expected. Specialization in manufacturing as a percentage of the economy can positively affect taxation because industrial firms are usually easier to tax, and manufacturing can generate higher taxes than other sectors such as agriculture (Eltony, 2002). Therefore, we expect that the manufacturing sector will have a positive impact on tax revenue.

Increased inflationary pressures are often associated with an increase in the cost of living, which undermines the purchasing power of money and thus reduces the actual value of taxes collected (Ayenew, 2016). In addition, skyrocketing prices will motivate most taxpayers to institute their tax cuts through evasion (i.e., increasing the level and proportion of unreported income) and to shift activities to the informal or underground economy (Crane & Nourzad, 1986; Ghura, 1998). Thus, inflation is expected to adverse tax revenues and tax efforts. Following Agbeyegbe et al. (2004) and Castro & Camarillo (2014), trade liberalization is thought to have an ambiguous effect on taxation. The trade-to-GDP ratio can have a positive impact because as the trade volume rises, the formalization and competitiveness of the economy increases; therefore, there are more possibilities to collect taxes. On the other hand, an open economy reduces tariffs and trade barriers, negatively affecting tax collection, especially international trade tax (Baunsgaard & Keen, 2010). Formally, the hypothesis of the estimated coefficient sign of each independent variable on the dependent variable (T_{it} and TE_{it}) can be formulated as follows:

$H_0 = a_1 \; and \; \beta_1 \leq 0, and \; H_1 = a_1 \; and \; \beta_1 > 0$ (the positive effect is expected),

$H_0 = a_2 \; and \; \beta_2 \leq 0, and \; H_1 = a_2 \; and \; \beta_2 > 0$ (the positive effect is expected),

$H_0 = a_3 \; and \; \beta_3 \leq 0, and \; H_1 = a_3 \; and \; \beta_3 > 0$ (the adverse effect is expected),

$H_0 = a_4 \; and \; \beta_4 \leq 0, and \; H_1 = a_4 \; and \; \beta_4 > 0$ (the non-zero effect is expected).

Because we use panel data, there is the potential that regression models (2) and (4) produce inconsistent coefficient estimates when the accurate model is the random effects (RE) model instead of the fixed-effects (FE) model. To ensure that the FE models in (2) and (4) are correctly specified (the specific effects in the panel exist), it is necessary to perform a Hausman test. The test's null hypothesis states no correlation between the individual unobservable impact and the macroeconomic indicators. That is $E(a_i + \beta_i \mid \mathbb{R}_{it}) = 0$, for $\mathbb{R}_{it} = [\ln(IC_{it}), MANF_{it}, INF_{it} TRD_{it}]$. In that way, RE regression can consistently estimate the equation (2) and (4).

In addition, if the Hausman test results state that the FE model is privileged, we will diagnose the presence of cross-sectional dependence, heteroscedasticity, and serial correlation in the specified regression model. It needs to be done because the company of these three problems in the regression model can produce an estimator that no longer meets the Best Linear Unbiased Estimator (BLUE) criteria. In addition, these three problems are often encountered when carrying out regression using panel data (Hoechle, 2007).

Heteroscedasticity may arise if there is higher variance in the residual estimates for larger countries in terms of income. Contemporary correlations arise because the countries all come from the same geographic area. Serial correlations occur if the error of this period in the country i depends on the error of the last period in country i. Therefore, in particular, we assume that the random error terms in models (2) and (4) have the following structure:

$$e_{it} \; and \; v_{it}, \qquad i = 1,...,6; t = 1,...,12$$

$$var(e_{it}) = var(v_{it}) = \sigma_i^2 \qquad \text{(heteroskedasticity)},$$

$$E(e_{it}, e_{jt}) = E(v_{it}, v_{jt}) = s_{ij}, \qquad i \neq j \qquad \text{(contemporaneously correlated)},$$

$$e_{it} = r_i e_{it-1} + \rho_{it} \; and \; v_{it} = k_i v_{it-1} + \omega_{it} \qquad \text{(autocorrelation)}.$$

To diagnose the presence of cross-sectional dependencies, we perform the Breusch-Pagan LM test. The null hypothesis of this test states that residuals across entities (countries) are not correlated. As a heteroskedasticity check, we use the modified Wald test for GroupWise heteroskedasticity. The null hypothesis of this test is homoscedastic (or constant variance). Finally, we use the Wooldridge test to diagnose autocorrelation in panel data. The null hypothesis posits that there is no first-order autocorrelation in our FE regressions. Suppose these three issues are present in our regression models. In that case, we will employ Driscoll & Kraay (1998) standard errors to allow the disturbances (e_{it} and v_{it}) to be heteroskedastic, autocorrelated, and cross-sectionally dependent. This approach is feasible when the panel's time dimension (t) is larger than its cross-sectional dimension (i), which is the main profile of our panel data.

Finding and Discussion

Graphical Analysis

We provide several scatter plots before proceeding to the regression analysis, using simple year country averages for each variable. It helps us examine the relationship between actual tax revenues as a percentage of GDP and all macroeconomic indicators used in this

study (see Figures 1 – 4). The observed positive relationship between the tax ratio and GDP per capita in Figure 1 is in line with most of the findings in the literature. Countries with high levels of development as proxied by high income per capita, such as Singapore, Malaysia, and Thailand, have higher tax revenue ratios than countries with low GDP per capita, such as Indonesia and the Philippines. In general, countries with a relatively higher share of manufacture in GDP will have better tax performance (Figure 2). Taxes from the manufacturing sector are usually easier to collect than other sectors. This sector is primarily engaged in the formal economy with an excellent annual financial report in Southeast Asia, making it easier for tax authorities to estimate the tax collected.

It also seems that inflation has a strong negative relationship with the tax ratio (Figure 3). The actual tax revenue is lower at the time of tax payment during inflation. In addition, high inflation rates can shrink the tax base because individuals tend to replace assets that are less likely to be taxed domestically. Another observation is that the level of openness as measured as the ratio of imports plus exports to GDP has a strong positive relationship with taxation (Figure 4). Overall tax revenue collection increases with higher levels of trade openness. It makes sense in terms of efficiency, in that trade is easy to tax as it flows mainly through known points along the border. However, the relationship between tax revenue and trade liberalization is not straightforward. When trade liberalization occurs mainly through tariff cuts, tariff revenues can decrease.

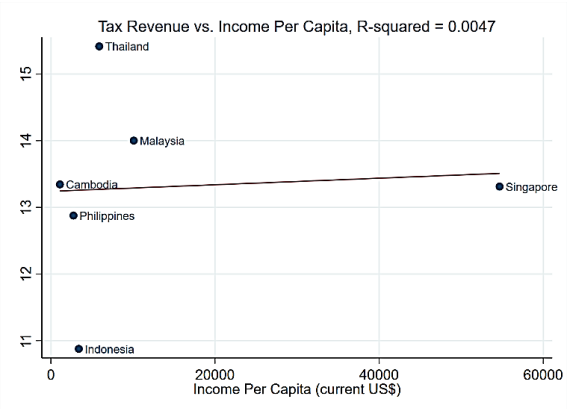

Figure 1: Tax Revenue Per GDP and Income Per Capita in Selected Southeast Asian Countries, 2008 – 2019

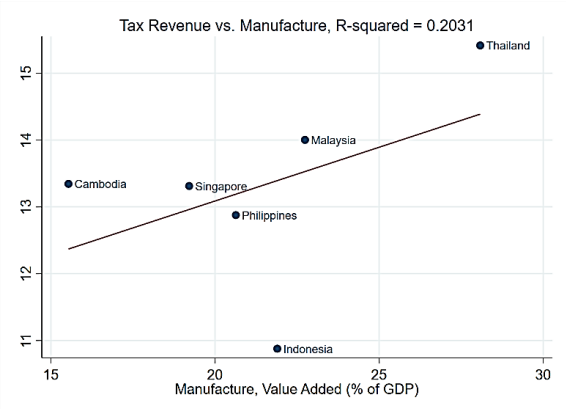

Figure 2: Tax Revenue Per GDP and Manufacture in Selected Southeast Asian Countries, 2008 – 2019

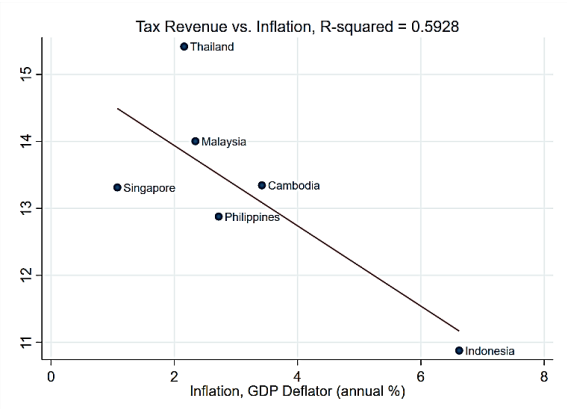

Figure 3: Tax Revenue Per GDP and Inflation In Selected Southeast Asian Countries, 2008 – 2019

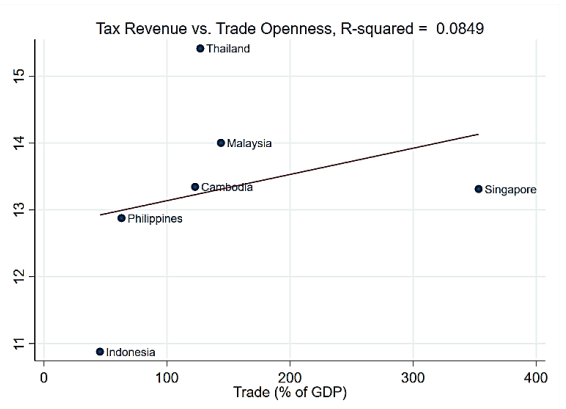

Figure 4: Tax Revenue Per GDP and Trade in Selected Southeast Asian Countries, 2008 – 2019

Estimation Results of Tax Ratio regression

Table 5 shows the estimation results from the regression equation (2). FE results (columns 1, 3, and 5) and RE results (columns 2, 4, and 6) are also provided for comparison purposes. The estimation process for equation (2) is divided into three stages. First, the tax ratio regression was carried out using the FE and RE models in which all macroeconomic indicators shown in equation (2) were included (see columns 1 and 2). Hausman test results show that the null hypothesis of no FE is rejected because the *p*-values of the Wald chi-square statistics are less than the 1% significance level. Therefore, our baseline equation (2) should be estimated by FE (within) regression as shown in column 1 because it will likely produce consistent coefficient estimates. In general, the FE model suggests that the sign coefficients of all variables correspond to the hypotheses. It's just that the inflation rate seems to be a redundant variable, as it is not significant even at the 10% level. It may be explained by the limited variation in the values of this indicator among Southeast Asian countries. This finding is the same as the results of a study from Botlhole (2010) in the countries of Sub-Saharan Africa. On the other hand, the remaining variables are very significant, with their *p*-values below 0.01.

Table 5: Tax Revenue Regression

Models	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
	FE	**RE**	**FE**	**RE**	**FE + DK SE**	**RE + DK SE**
			Exc. Inflation	**Exc. Inflation**	**Exc. Inflation**	**Exc. Inflation**
Log (Income per capita)	7.085***	0.495	7.106***	1.551***	7.106***	1.551
	(0.743)	(0.493)	(0.734)	(0.578)	(0.883)	(1.048)
Manufacture	0.697***	0.231**	0.683***	0.286***	0.683***	0.286**
	(0.109)	(0.094)	(0.098)	(0.103)	(0.097)	(0.097)
Inflation rate	-0.013	-0.041				
	(0.045)	(0.064)				
Trade openness	0.024***	0.003	0.025***	-0.000	0.025*	-0.000
	(0.007)	(0.006)	(0.007)	(0.007)	(0.012)	(0.007)
Constant	-66.114***	3.863	-66.074***	-6.138	-66.074***	-6.138
	(7.814)	(4.122)	(7.756)	(5.604)	(10.254)	(10.808)
Observation	72	72	72	72	72	72
Adjusted R^2	0.579		0.585			
Within R^2					0.632	
Overall R^2		0.159		0.099		0.099
F-statistics	26.62		35.98		36.55	
	[0.000]***		[0.000]***		[0.000]***	
Wald chi^2-statistics		9.90		14.47		170.00
		[0.042]**		[0.002]***		[0.000]***
Hausman test:						
Wald chi^2-statistics	101.65		37.91		8.40	
	[0.000]***		[0.000]***		[0.004]***	

Models	(1) FE	(2) RE	(3) FE Exc. Inflation	(4) RE Exc. Inflation	(5) FE + DK SE Exc. Inflation	(6) RE + DK SE Exc. Inflation
Breusch-Pagan LM test: chi²-statistics			35.604 [0.002]***			
Modified Wald test: chi²-statistics			32.70 [0.000]***			
Wooldridge test: *F*-statistics			4.803 [0.080]*			

Notes: Standard errors are in parentheses. Columns (5) and (6) report Driscoll-Kraay standard errors in parentheses. *P*-values are in square brackets. * = significance if *p*-value ≤ 10%. ** = significance if *p*-value ≤ 5%. *** = significance if *p*-value ≤ 1%.

We exclude the inflation variable from the tax ratio regression in the second stage because its presence makes our estimation model inefficient. Further explanation regarding model inefficiency due to extra variables can be found in Murray (2006). The estimation results that do not involve inflation are shown in columns 3 and 4 in Table 5, which are the results of the FE and RE models, respectively. Again, the *p*-value of the Hausman test rejects the null hypothesis of no FE at a 1% significant level (see column 3). It indicates that the FE model is more appropriate for estimating the tax ratio regression (when inflation is not included in the regressors) than the RE model.

As we can see in column 3 in Table 5, the sign of the coefficient and significance level of per capita income, manufacturing value added to GDP, and trade liberalization remains robust (positive sign and *p*-value < 0.01), with inflation excluded from regressors. In addition, the magnitude of the coefficient of each variable only slightly changes. The coefficient measures of GDP per capita and trade liberalization increased somewhat, from 7.0851 to 7.1061 and 0.0243 to 0.0245, respectively. Meanwhile, the estimated coefficient of the manufacturing variable is slightly smaller, from 0.6968 to 0.6831. Moreover, what is interesting is the fact that the adjusted R-squared becomes more prominent in the regression model without the inflation variable (from 0.5788 to 0.5847). It proves that the set of determinants in column 3 can explain the outcome of interest (tax ratio) better than the set of determinants in column 1. It means that in this case, the exclusion of inflation from the tax ratio regression model is the right decision.

Avoiding model inefficiencies by removing superfluous variables is wisdom. However, it is not sufficient to ensure that the estimated coefficients displayed by column 3 in Table 5 meet the BLUE criteria in the panel data regression context. For this reason, as mentioned in the previous section, several diagnostic tests are carried out. The results of the Breusch-Pagan LM test state that the *p*-value of chi-square statistics is 0.0020, and thus it rejects the null hypothesis of no contemporaneous correlation at the 1% significance level. It indicates that there is a cross-sectional dependence problem in the estimation model. The results of the modified Wald test show that the null hypothesis of the disturbance being homoscedastic

is rejected, as the *p*-value of chi-square is less than 1% (0.0000). Lastly, the Wooldridge test states a serial correlation problem in the model's error term because the probability *F*-statistics is less than 10% (0.0799). Based on the three diagnostic results, it can be concluded that the estimation model in column 3 of Table 5 does not meet the BLUE criteria.

As the third stage of the regression analysis, we re-estimate the tax ratio equation without the inflation variable. Driscoll-Kraay standard errors equip the FE model (see columns 5 and 6). Estimating the covariance matrix by the aid of this approach will produce a consistent standard error for autocorrelation, heteroscedasticity, and a very general form of cross-sectional dependence in error terms. The Hausman test is carried out again to ensure that the selected model is consistent. The test results show the researchers that FE remains a more suitable model for estimating the tax ratio equation than the RE model (see Hausman test in column 5). Based on column 1 of Table 5, the results show that the use of Driscoll-Kraay standard errors does not change the sign or the size of the estimated coefficient of each independent variable in the model. However, there is a change in the significance level in one of the variables, namely trade liberalization, which becomes significant at the 10% level. However, such changes are not essential.

According to the FE model shown in column 5, per capita income is expected to be superior in influencing the flow of tax revenues over other macroeconomic indicators. It is because per capita income directly represents the development level, the demand for public goods and services, and the ability to pay taxes in society. Statistically, the results suggest that a 1% increase in per capita GDP is associated with a rise in the tax-to-GDP ratio of 0.071 (0.01 x 7.106) percentage point. This finding reinforces the ideas put forward by several previous authors, such as Le et al. (2008) and Le et al. (2012), who conducted a cross-country analysis. In addition, the results obtained from the actual tax ratio analysis are also not much different from the findings of Castro and Camarillo (2014) in OECD countries and Gupta (2007) in developing countries. These results support the argument that economic development increases the demand for public services and the ability of taxpayers to pay taxes, which in turn increases the efficiency of tax authorities in tax collection to finance the increased demand for spending (Karagöz, 2013; Ayenew, 2016)

The share of manufacturing value-added to GDP also has a positive and significant effect on tax revenue in Southeast Asia in the study period. This variable has a coefficient of 0.6830506, which can be interpreted as an increase of one percentage point in the share of the manufacturing sector to GDP will increase tax revenues by about 0.68 percentage points, *ceteris paribus* (other things held constant). The positive effect of the manufacturing industry on tax revenue is in line with the prediction stated in the theory that firms in the manufacturing sector produce goods that are easier to tax. In addition, business owners also have a more detailed, accurate and organized record of their annual activities. These results support the argument that an increase in the manufacturing sector will contribute to tax revenue through increased corporate income tax. If the production is efficient, the industry can contribute an enormous taxable surplus. This finding is consistent with Eltony's (2002) results for Arab countries and Ahmed and Mohammed's (2010) for developing countries. They revealed that manufacturing has a more significant influence on tax revenue performance than agriculture.

Trade volume as a percentage of GDP positively affects total tax revenue, although it appears to be relatively weak. It is evidenced by the *p*-value of t-statistics, which can only reject the null hypothesis at the 10% level (*p*-value < 10%). In addition, the size of the estimated coefficient of this variable is also the smallest of the other variables, which is 0.025. In other

words, it means that a one percentage point increase in trade liberalization will only improve tax performance by about 0.025 percentage points. A plausible explanation for this is that, on the one hand, trade liberalization tends to widen the tax base due to the expansion of exports, which improves economic performance. In addition, trade-related taxes are more easily levied because goods enter or leave the country in specific locations. On the other hand, the reduction in tariffs tends to offset the increase in the frequency of international trade. Consequently, it corrects for the positive effect of trading volume on tax revenue.

These results support the ideas proposed by Baunsgaard and Keen (2005) in their cross-country study. In addition, our findings are also similar to the results observed by Epaphra and Massawe (2017) in Africa, which suggested that the positive effect of trade liberalization on tax revenues was only able to reach a significant level of 10% (p-value < 0.1). Thus, our findings reinforce what Castro and Camarillo (2014) concluded, that the statistically weak effect of trade liberalization on taxes suggests that there is potential for the opposite effect, as previously thought.

Southeast Asian Countries' Tax Effort

As explained in the methodology section, tax effort is an index calculated by dividing the tax revenue by the taxable capacity obtained from the regression model (2). According to Table 6, from 2008 to 2019, Southeast Asian countries as a whole are recorded to have excessive tax collection efforts, an indication that the actual tax collected is greater than the estimated taxable capacity. It is shown by the average value of the tax effort index, which is greater than one (1.101). It suggests that taxpayers suffer more from the taxes levied by governments which exceed their ability to pay. In addition, this also indicates that countries in Southeast Asia can maximize their full revenue potential.

However, we observe that Singapore has the lowest tax effort in the same period, with an average tax effort index of 0.547 (less than one). It shows that the tax mobilization policy in the country is less efficient. For this reason, appropriate mobilization policies are needed that can direct more efforts to utilize the country's tax capacity better. In addition, although found to have a high tax effort, Malaysia is relatively low compared to the sample average tax effort for the same period. The average value of the tax effort index for this country is 1.055, which is less than the sample mean of 1.101.

Among the six countries, the Philippines has the highest average tax effort score of 1.359. It shows that the taxable capacity in the Philippines has been exploited to its fullest. For this reason, it is necessary to improve the quality of tax administration so that tax collection can be more optimal.

Table 6: Summary Statistics of Tax Revenue, Tax Capacity, and Tax Effort by Country

Country	Period	Tax Revenue		Tax Capacity		Tax Effort	
		Mean	Median	Mean	Median	Mean	Median
Indonesia	2008 – 2019	10.876	10.795	9.290	9.224	1.170	1.177
Malaysia	2008 – 2019	14.002	14.360	13.269	13.321	1.055	1.078
Thailand	2008 – 2019	15.416	15.374	13.325	13.255	1.157	1.157
Singapore	2008 – 2019	13.312	13.255	24.386	24.742	0.547	0.543
Philippines	2008 – 2019	12.877	13.018	9.487	9.461	1.359	1.387

Country	Period	Tax Revenue		Tax Capacity		Tax Effort	
		Mean	Median	Mean	Median	Mean	Median
Cambodia	2008 – 2019	13.344	13.331	10.070	10.283	1.319	1.294
All	2008 - 2019	13.305	13.291	13.305	11.631	1.101	1.141

Based on the summary statistics provided by Table 6, we can also classify countries in Southeast Asia based on the effort they put into collecting tax and the actual tax they managed to collect . As noted in the methodology, we use the median of all sample countries (13.291) as a benchmark for actual tax collection. Countries with average tax revenues greater than 13.291 in the sample period are considered high-collection countries and vice versa. In addition, countries with a tax effort index above 1 (one) are categorized as having high tax effort and vice versa.

By referring to the matrix presented in Table 4, we can classify the six countries into three groups. The first group is countries with high tax effort but low actual tax revenue, including Indonesia and the Philippines. The second group is countries that have low tax effort but high real tax collection, namely Singapore. The last or the third group is countries with increased tax efforts and substantial tax revenues, including Malaysia, Thailand, and Cambodia. The explanation of each group is as follows.

Group 1: High Tax Efforts but Low Actual Tax Revenue

The two countries listed in this group (Indonesia and the Philippines) have some critical similarities. Both are lower-middle-income countries (according to the classification of the World Bank), highly aid-dependent, and developing countries with low tax administration capacities and volatile tax regimes (Le et al., 2008). High tax efforts but low income are usually influenced by a tax system that tends to be discriminatory. Indonesia is an example. The tax burden in Indonesia is more targeted at tax subjects with a low tax base than those with a high tax base. Personal income tax has a more elevated and progressive rate compared to corporate income tax. It may be carried out to maintain the flow of foreign investment in corporations, thereby preserving the rupiah (Indonesian local currency unit) value. However, such policies will intensify public perceptions of tax injustice, thus discouraging their tax compliance. In addition, just like in the Philippines, tax policy in Indonesia has an overly complex structure, which can create more opportunities for tax evasion, narrow the already limited tax base, and open up opportunities for corruption.

Consequently, the actual tax collected by the government is relatively low despite the high efforts made but tends to be ineffective. Therefore, a healthy, fair, and competitive tax reform is needed in Indonesia. This healthy, fair, and competitive tax reform can be achieved by increasing innovation in exploring the potential for expanding the tax ratio, developing the tax base adjusted to the ability-to-pay principle, and implementing a tax system in line with the economic structure.

Group 2: Low Tax Efforts but High Actual Tax Revenue

The only country in the sample that falls into this group is Singapore. Singapore is the only developed and upper-middle-income country in Southeast Asia (according to the World Bank classification). This country has appeared as one of the “tax havens” in Hines and Rice’s (1994) list. Low tax rates and other incentives for foreign investors qualify the country as a

"tax haven" (Dharmapala and Hines, 2009). On the other hand, the country has high-income potential and high collection rates. It reflects that Singapore has made its choice regarding the level of taxation. Singapore seems to have considered reducing the excessive tax burden with high collection rates, especially in production. The corporate income tax rate in Singapore is only 17%. However, they can lower the effective corporate tax rate with other incentives. Startups in Singapore can take advantage of incentives in the form of tax exemptions for their first three consecutive years of business. In addition, Singapore also offers tax exemptions for businesses in specific industries. It includes breaks for qualified foreign banks, offshore funds, and global trading companies. Foreign funds that meet certain conditions may also be exempt from tax on some income, including dividends, profits, and interest from traditional investments, including deposits, bonds, and stocks. Along with its strategic location, such policies have made Singapore a global centre for international investment and trade.

Group 3: High Tax Efforts and High Actual Tax Revenue

The third group consists of three countries, namely Malaysia, Thailand, and Cambodia. These countries no longer seem to have the room to further increase tax collection without paying a disproportionately economic cost. However, it is pretty surprising, with the finding of Cambodia in this group, considering its position as a lower-middle-income country. At the same time, the two others are upper-middle-income countries. Cambodia has made many improvements to its tax regime to create an efficient, transparent and consistent tax system. It is also done to create a more competitive business environment. Based on the results of a survey conducted by Transparency International Cambodia (2016), most international businesses acknowledge the Cambodian government's efforts to promote a better business environment through some improvements: 1) tax registration procedures, 2) monthly tax return procedures, 3) annual tax return procedures, 4) patent tax renewal procedures, and 5) tax audit procedures and management. In addition, the exemption of value-added tax (VAT) in the small and medium business sector is considered a critical effort in increasing the growth of small and medium enterprises (SMEs). As mentioned by Le et al. (2008), the countries included in this group view tax reform no longer as an effort to increase income but to increase the economic efficiency of existing taxes, reducing distortions caused by taxes, and promote a better business environment through further rationalizing the tax regime, rebalancing the tax mix, and simplifying administrative procedures.

Regardless of the group, it can be said that, in general, the problems faced by Southeast Asian countries in mobilizing tax revenues are twofold. First, most countries in Southeast Asia are developing economies with a limited revenue base, and most of the economic activities operate in the informal sector. Second, many fiscal incentives are offered to taxpayers, which narrows their taxable capacity, which reduces tax revenues. As a "tax haven" country, Singapore is very well known for this second taxation problem.

Estimation Results of Tax Effort regression

As mentioned in the methodology section, that we regress the tax effort index against all regressors lies in equation (2) to obtain different empirical results (see equation (4)). Table 7 shows the estimated effects of the regression. Columns 1 and 2 of the table show the regression results with the FE model, while columns 3 and 4 show the regression results with the RE model. Because the Hausman test results in column 1 state that the *p*-value of Wald chi2-statistics is below the threshold of 1%; thus, the model with fixed effects is preferred.

However, after detecting the classical assumption, we observe that there are issues of cross-sectional dependence, heteroskedasticity, and serial correlation in the FE model. Therefore, we need to employ the Driscoll-Kraay standard errors, which allow such problems in the model. Again, the Hausman test was conducted to determine the model correctly and obtain the same result. The FE model with Driscoll-Kraay standard errors (column 2) was more suitable than the RE model with Driscoll-Kraay common errors (column 4). Hence, we only take into account the estimation results presented in column 2 of Table 7.

The results from column 2 of Table 7 show that per capita income and manufacturing share of GDP have a positive and significant effect (*p*-values < 0.01) on the tax effort index. A positive impact is also found on the trade openness variable with a significance under the threshold of 5%. This result is similar to column 5 of Table 5 regarding the effect of the three regressors on the tax ratio. In addition, these findings also support the results obtained by Piancastelli and Thirlwall (2020) in developed and developing countries. They found that per capita income, trade openness, and the manufacturing sector have positive and significant effects on tax effort below the 1%, 1%, and 5% significance levels, respectively.

The increase in the three indicators above indicates that the economy in a country is experiencing expansion. To reduce the impact of the business cycle, it is likely that most countries in Southeast Asia "tighten their belts" by implementing contractionary fiscal policies. The policy is characterized by enormous revenue collection and a brake on public spending. It implies that the government's efforts to collect taxes have increased. As a result, exploration of the tax base is carried out everywhere, especially in developing sectors.

On the other hand, the inflation variable appears with a positive but not significant coefficient (*p*-value > 0.1). This result is similar to column 1 of Table 5 regarding the results of the tax ratio regression with the FE model. The insignificant effect of inflation indicates an effect that cannot be determined or has an effect opposite to what is expected. It is reasonable, considering that inflation characterizes two things in the economy. On the one hand, inflation indicates that the economy is booming because of good and service demand enhancement in the market. On the other hand, inflation also shows the erosion of purchasing power, especially for people with steady incomes.

Table 7: Tax Effort Regression

Models	**(1)**	**(2)**	**(3)**	**(4)**
	FE	**FE + DK SE**	**RE**	**RE + DK SE**
Log (Income per capita)	0.6287823***	0.6287823***	-0.1127772***	-0.1127772
	(0.0659568)	(0.0973935)	(0.0292627)	(0.0645912)
Manufacture	0.0448705***	0.0448705***	0.0027397	0.0027397
	(0.0096492)	(0.008784)	(0.0053483)	(0.0038012)
Inflation rate	-0.003975	-0.003975	-0.012918**	-0.012918***
	(0.0039599)	(0.0035787)	0.005628	(0.003225)
Trade openness	0.0014822**	0.0014822**	-0.0013963***	-0.0013963**
	(0.0006587)	(0.001049)	(0.0003501)	(0.000496)
Constant	-5.480174***	-5.480174***	2.253961***	2.253961***
	(0.6936226)	(1.046704)	(0.1880319)	(0.5583032)
Observation	72	72	72	72

Models	(1)	(2)	(3)	(4)
	FE	FE + DK SE	RE	RE + DK SE
Adjusted R^2	0.54947939			
Within R^2		0.6066		
Overall R^2			0.0534	0.7459
F-statistics	23.90	81.67		
	[0.0000]***	[0.0000]***		
Wald chi^2-statistics			196.66	6979.17
			[196.66]***	[0.0000]***
Hausman test:				
Wald chi^2-statistics:	94.43	21.32		
	[0.0000]***	[0.0000]***		
Breusch-Pagan LM test:				
chi^2-statistics	40.656			
	[0.0004]***			
Modified Wald test:				
chi^2-statistics	22.43			
	[0.0010]***			
Wooldridge test:				
F-statistics	7.341			
	[0.0423]***			

Notes: Parentheses in columns 1 and 3 report regular standard errors. Parentheses in columns 2 and 4 report Driscoll-Kraay standard errors. *P*-values are in square brackets. * = significance if *p*-value ≤ 10%. ** = significance if *p*-value ≤ 5%. *** = significance if *p*-value ≤ 1%.

The negative sign that we find from inflation seems more inclined to the second situation. An increase in the cost of living due to inflation triggers more considerable tax avoidance and a shift in economic activity to the informal sector. In addition, on the demand side, most consumers will probably switch to goods and services that are likely to be tax-free. Thus, the government's efforts to collect higher taxes are becoming narrower due to an increasingly limited revenue base.

Conclusion

A low tax-to-GDP ratio is a common feature in most Southeast Asian countries. It is worrying considering that tax revenue is the main instrument for the government to implement several development agendas. Therefore, comprehensively studying the concept of tax performance is very important to be used as a reference for public authorities to increase the productivity of state revenues. To apply it, most of the literature highlights the factors that determine tax revenue. Regression analysis is then used to estimate the value of taxable capacity to construct the tax effort index. Together with actual revenues, these two indicators are used as benchmarks for the taxation performance of a country.

In this study, we try to identify the main determinants of tax revenue concerning the recent works of literature. We chose four general indicators as determinants of the tax: the level of development as proxied by per capita income, the openness of the economy as mea-

sured by total imports and exports per GDP, the composition of the economy represented by the manufacturing sector as a share of GDP, and macroeconomic stability as proxied by the level of inflation. We use secondary data taken from the World Development Indicators for a panel of six Southeast Asian countries during the 2009 – 2019 period.

Several tests and diagnoses were carried out to specify the appropriate use of the econometric model. The Hausman test result shows that the FE model is preferred. However, we found issues of heteroscedasticity, autocorrelation, and contemporaneous correlation. We used Driscoll-Kray standard errors to allow those issues in the disturbances. As a result, we have the FE model equipped with Driscoll-Kraay standard errors as our primary estimation model. According to the model, per capita income, trade liberalization, and the manufacturing sector's contribution to GDP positively and significantly impact tax revenue. On the other hand, inflation appears with a negative sign and is assumed to be a redundant variable because the effect is not significant. To that end, we exclude inflation from the estimation model, and the results remain consistent for the other three variables.

The study classifies the six Southeast Asian countries into three groups using the median of actual tax collection from all sample countries and a tax effort index of 1. The first group is countries with low substantial tax revenue but the high tax effort (Indonesia and the Philippines). The second group is countries with high actual tax revenue but low tax effort (Singapore). The last or the third group is countries with substantial tax revenue and tax effort (Thailand, Malaysia, and Singapore). To obtain an empirical analysis of the tax effort index, we perform a second regression involving the four determinants of the tax ratio. We then use the first estimation results to predict the value of taxable capacity and tax effort. Using the same regression model from the original, we find similar results that per capita income, trade volume, and manufacturing are essential determinants of the tax effort index. Meanwhile, inflation was rediscovered as an insignificant variable in determining the tax effort index.

The results of this study lead to some policy implications related to increasing revenue productivity by focusing on these four macroeconomic factors. First, existing state revenues should be used optimally to improve the quality of public services, which are expected to encourage increased income, and thus rising tax revenues. Second, the development agendas should be prioritized for structural transformation of the economy towards industry, given the significant positive effects of manufacturing on tax revenues and efforts. Third, policies related to trade liberalization need to be improved to increase the volume of import and export transactions. Thus, it is hoped that international trade tax revenues can be increased. Fourth, the inflation rate needs to be maintained even though it is insignificant in determining income. As mentioned in many theories, a low inflation rate will reduce uncertainty and increase economic stability, which will affect the flows of revenues. In addition, some efforts must also be directed at expanding the tax efforts of revenue agencies, especially for countries with low tax efforts. It can be done, for example, through capacity building and the provision of adequate resources. Thus, tax reform must begin with reforms in the structure, processes and procedures of the administration of revenue authorities.

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