



## MODERATION OF TRADE OPENNESS ON THE EFFECT OF SERVICE SECTOR AND INFLATION ON INDIRECT TAX REVENUE

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### Abstract

This study aims to analyze the effect of service sector, inflation, and trade openness on indirect tax revenue in a number of countries in Latin America and the Caribbean. The results of this study are expected to provide additional insight into the knowledge of the factors that influence indirect tax revenue as well as the moderating effect of trade openness on the influence of the service sector and inflation in influencing indirect tax revenue in the region. This study uses secondary data on 15 countries with a period of 2009-2019. The analysis model used is multiple linear regression for panel data with panel-corrected standard errors. The results show that there is a significant effect of all independent and moderation variables on indirect tax revenue. Individually, the service sector has a negative effect on indirect tax revenue. However, after being moderated, the effect is weakened. Inflation also negatively affects indirect tax revenue, but this effect cannot be moderated by trade openness. Meanwhile, trade openness partially has a positive effect on indirect tax revenue. It is recommended that the government make policies that encourage trade openness because it has a positive impact on the economy, especially in the field of taxation.

Keywords: Indirect Tax, Inflation, Latin America and the Caribbean, Service, Trade Openness

### INTRODUCTION

State revenue in the field of taxation has a vital role as a source of state revenue in order to meet the cost needs of government activities and programs aimed at carrying out development in the country (Bird, 2008). In various countries, especially developing countries, increasing this revenue is still a big challenge. This needs to be done to maintain the economic and political stability of these countries. To formulate policies that support the increase of expenditure revenues, knowledge of the factors that affect these revenues is essential.

Indirect tax is a type of tax borne by consumers for what they consume (Gunadi et al., 2010). Consumption here is the expenditure of a portion of the consumer's income to spend something. This type of tax has the juridical consequence that there is a difference between the tax bearer and the taxpayer. Some forms of indirect taxes include various types of sales taxes, value-added taxes, and taxes levied on goods and services.

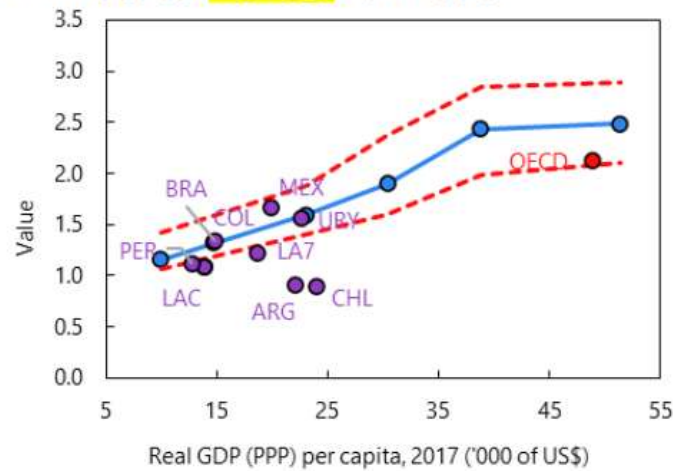
Indirect taxes are important because they serve as a significant source of revenue for governments, especially in developing countries (Martinez-Vazquez et al., 2011). This type of tax is also considered to have better efficiency than direct taxes in revenue collection, as it is easier to administer and has lower compliance costs. In addition, indirect taxes also have other potential uses to increase the price of certain goods and services for specific purposes such as public health or environmental purposes.

The tax structure of countries in the Latin American and Caribbean region tends to be biased towards indirect taxes (Acosta-Ormaechea et al., 2022). This suggests substantially different collection conditions compared to Organisation for Economic Co-operation and Development (OECD) countries. It can be seen in Figure 1 that the ratio of direct to indirect taxes of countries in the Latin American and Caribbean region is generally lower than that of OECD countries. In addition, there is a large difference in income levels between the two groups of countries.



Figure 1. Direct-Indirect Tax Ratio

## 2. Direct-to-Indirect Tax Ratio

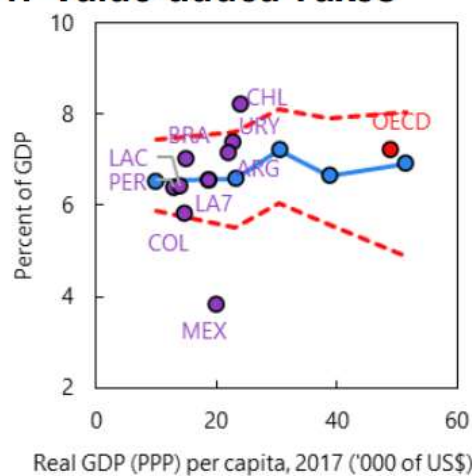


Source: Acosta-Ormaechea et al., (2022)

This bias in tax collection can be further explained by the over-reliance on value-added tax and corporate income tax (Acosta-Ormaechea et al., 2022). On the other hand, personal income tax revenue has a ratio that is too low. It can be seen from Figure 2 that the ratio of value-added tax revenue, which is one type of indirect tax, in countries in the Latin American and Caribbean region is not much different from the ratio achieved by OECD countries.

Figure 2: Value Added Tax Revenue Ratio

## 1. Value-added Taxes

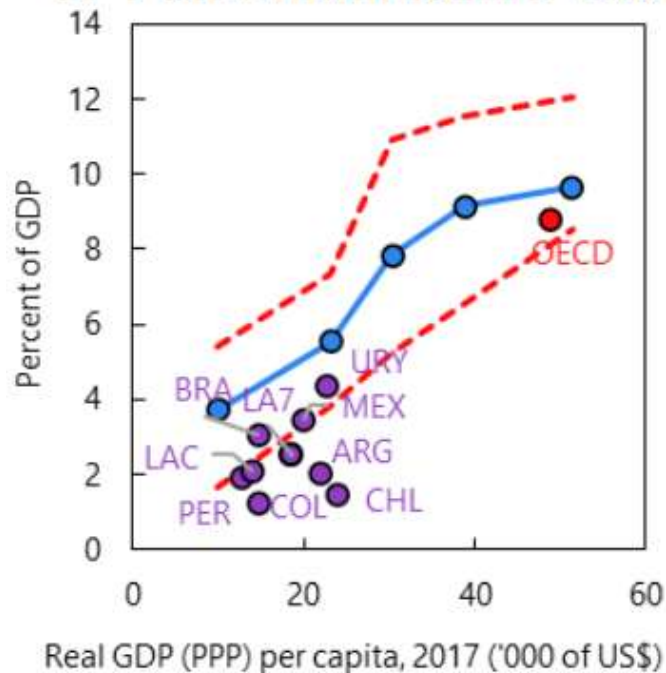


Source: Acosta-Ormaechea et al., (2022)

Meanwhile, the revenue ratio in personal income tax shows a value that is far below OECD countries as can be seen in Figure 3.



Figure 3: Individual Income Tax Revenue Ratio  
**3. Personal Income Taxes**



Source: Acosta-Ormaechea et al., (2022)

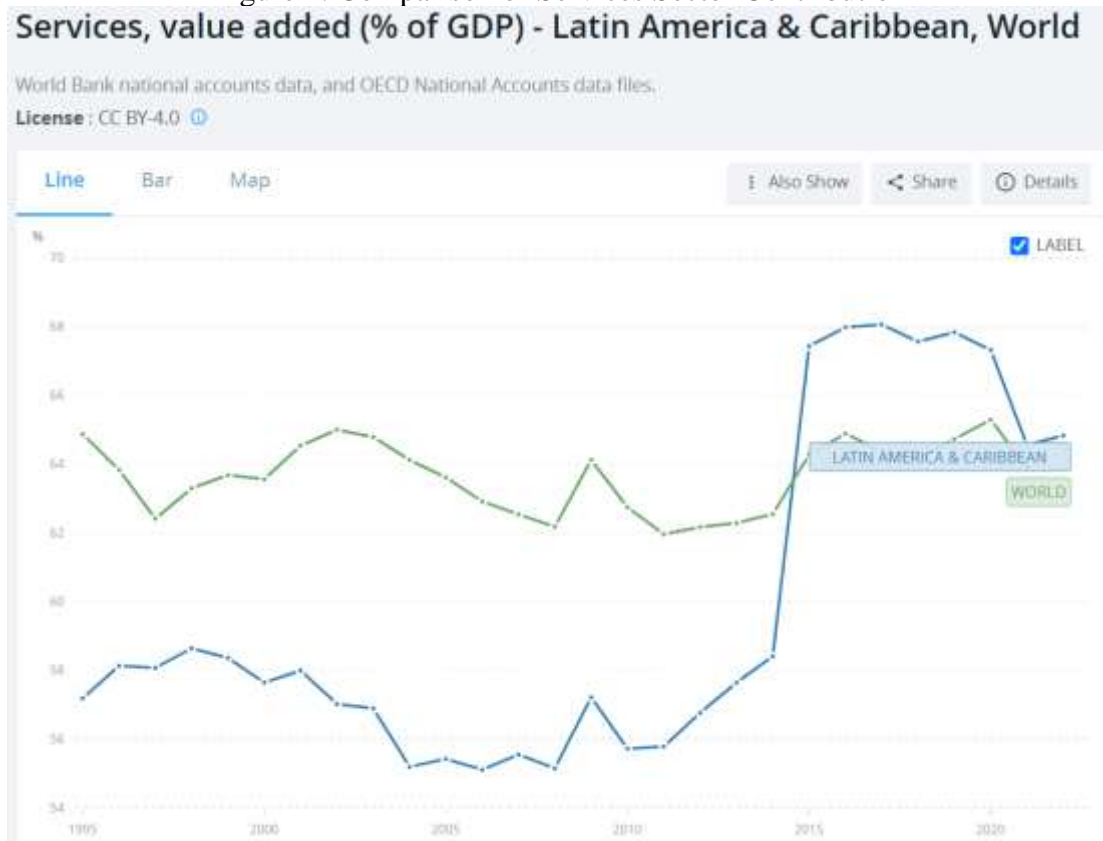
Considering the important contribution of indirect taxes in tax revenue in countries in the Latin American and Caribbean region as explained earlier, it is interesting to further review the factors that affect their revenue ratio.

Taxes imposed on the consumption of goods and services are categorized as indirect taxes as explained earlier. Developments that occur in the goods or service sector industry contribute to the increase in tax revenue (Hines & Summers, 2009). This is due to various growth challenges in other sectors as well as the efficiency of other revenue sources that continue to decline. This condition encourages the state government to rely on taxes levied on consumption in order to meet budgetary needs. In addition, the industry in the service sector also has promising potential to grow as an important source of tax revenue. Permadi & Wijaya (2022) in their research revealed that the service sector is a sector with high productivity, which can be seen from its relatively largest contribution compared to other sectors in Gross Domestic Revenue (GDP). More specifically, a study provides results that the imposition of taxes on the consumption of goods and services makes a significant contribution to increasing tax revenue, especially indirect taxes (Dey, 2021).

In the Latin America and Caribbean region, the contribution of the services sector to GDP has been increasing in recent times (The World Bank, 2023c). As can be observed in Figure 4, initially the level of contribution of the service sector in the region was below the world average, but since 2015 there has been significant growth. Since then, the contribution rate of the services sector in the region has remained above the world average. This condition can be an indication of the great potential of the services sector for countries in the region.



Figure 4: Comparison of Services Sector Contribution



Source: *World Bank*

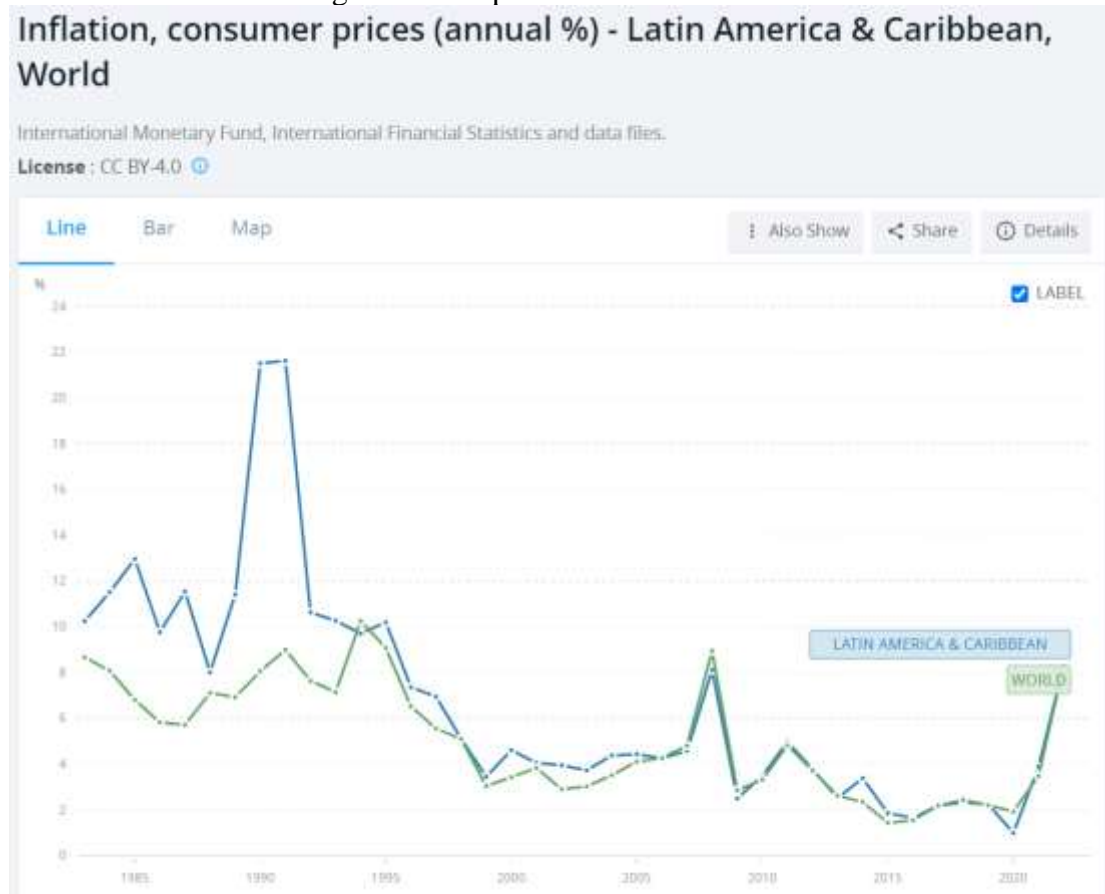
Various studies have been conducted to study the influence of the service sector on tax revenue in a country. As Piancastelli (2000) did in his research which found the result that the proportion of the service sector in GDP in a country has a positive influence on the ratio of tax revenue in that country. The same thing was found by Lemma (2019) who in his thesis research found similar results. This influence is also the result of research conducted by Permadi & Wijaya (2022). The results of this study reveal that the contribution of the service sector significantly affects the level of revenue of one type of indirect tax, namely Value Added Tax (VAT) positively. However, there are also studies whose results show a negative effect of the contribution of the service sector to GDP on the level of tax revenue collected (Tujo, 2021). In contrast to the previously mentioned studies, there are also studies that found the result that the proportion of the service sector in GDP does not have a significant effect on tax revenue as found by Chaudhry & Munir (2010).

Inflation can be defined as the process of a continuous rise in prices (Laidler & Parkin, 1977). On the other hand, inflation can also be seen as a process of continuous decline in the value of money. Inflation is an important phenomenon in economics that affects the entire economy. According to (Nowotny, 1980), inflation and taxation have a complex relationship where changes in one can have a significant effect on the other. Inflation can affect taxation in various ways. For one, inflation can increase the taxation of capital gains and profits. Inflation can also change the impact of taxation on the distribution of personal income, where the value of ad valorem tax levies such as sales tax and value-added tax is unaffected by inflation, while the burden of specific taxes such as excise tax on tobacco products is reduced in real terms by inflation. The impact of inflation on taxation can be complex and influenced by a variety of factors, such as the income elasticity of various taxes and potential delays in response from tax agencies.



Inflation rates in the Latin America and Caribbean region are usually slightly above the world inflation rate as can be seen in Figure 5 (The World Bank, 2023b). The situation was different during the late 1980s and early 1990s when the inflation rate in the region was very high. This was due to hyperinflation in some of its member countries (Capistrán & Ramos-Francia, 2009).

Figure 5: Comparison of Inflation Rates



Source: World Bank

Inflation that occurs along with economic growth has a significant effect on both overall tax revenue, income tax, and value added tax (Muttaqin & Halim, 2020). Other research conducted on countries that are members of the Emerging and Growth-Leading Economies (EAGLE), found that the inflation rate has a positive and significant effect on the level of tax revenue in these countries (Arif & Rawat, 2018).

In contrast to the results of previous studies, research conducted by Muibi & Sinbo (2013) found that the inflation rate has a negative and significant effect on tax revenue in Nigeria. Similar results were also found in research conducted on Sub-Saharan African countries which also found a negative and significant effect (Ghura, 1998). Similarly, the results of a study conducted by Rodríguez (2018) were conducted on 138 countries in the period 1976 to 2015. This study shows that the percentage level of inflation is inversely proportional to the level of tax revenue in these countries.

Results showing that the inflation rate has no effect on the level of tax revenue are also found in a number of research results. Research conducted on several districts in Central Java found that the inflation rate did not have a significant effect on the level of tax revenue (Mispiyanti & Kristanti, 2018). Similar to these results, the results of research conducted by Puspitha & Supadmi (2018) show that the inflation rate does not significantly affect the level of value-added tax revenue in Bali Province. Tax revenue in Pakistan in the period 1973 to 2009



was also not significantly affected by the inflation rate in the country (Chaudhry & Munir, 2010). Rodríguez (2018) in his research found that the inflation rate has no significant effect on tax revenue on goods and services included in the indirect tax category. This study also found that the inflation rate does not significantly affect the Indicator of Tax Progressiveness.

In the process of tax reform, the steps taken often begin with the reduction of tariff barriers in international trade that can boost the state's revenue from international trade taxes (Ebrill et al., 1999). However, at some point, increased trade liberalization will actually reduce these revenues. The government certainly hopes that the reduction in international trade tax revenue can be compensated by domestic tax revenue, especially from taxes on consumption. As stated by Keen & Lighthart (2002) in their research results that the policy to reduce international trade tariffs coupled with an increase in domestic consumption taxes can increase overall tax revenue because the domestic trade tax base is larger than the import tax base.

Although still relatively higher on average, the level of tax revenue on international trade in countries in the Latin American and Caribbean region shows a downward trend similar to the overall trend of countries in the world (The World Bank, 2023a). This comparison can be observed in Figure 6

Figure 5: Comparison of International Trade Tax Revenue Levels



Source: *The World Bank*

There are several studies that have been conducted to study the effect of a country's level of international trade openness on tax revenue in that country. Research conducted by Arif & Rawat (2018) on countries that are members of EAGLE found that the level of trade openness of a country positively and significantly affects the level of tax revenue in these countries. Similar results were also obtained in a study that studied macroeconomic determinants of tax revenue in Nigeria (Muibi & Sinbo, 2013). The results of this study found that the level of trade



openness has a positive and significant effect on Nigeria's tax revenue. In line with the two previous research results, research on the determinants of tax revenue in Pakistan also obtained results in the form of a positive influence exerted by the level of trade openness on the level of tax revenue in Pakistan (Chaudhry & Munir, 2010). Research that took a sample of 39 Sub-Saharan African countries also found that the level of trade openness affects the level of tax revenue positively and significantly (Ghura, 1998). Still with similar results, research conducted by Listikarini & Wijaya (2023) also found that the level of trade openness has a positive and significant effect on the level of tax revenue. This study also found that the level of trade openness can act as a variable that moderates the independent variables in influencing the level of tax revenue.

The previous paragraphs have shown that many studies have found that the level of trade openness has a positive and significant effect on the level of tax revenue. However, there are also studies that find different results. Research conducted to determine the dynamic effects of growth, financial development and trade openness on tax revenue in Malaysia found that trade openness in the long run does not significantly affect the level of tax revenue (Loganathan et al., 2020).

Given the lack of research that specifically discusses indirect taxes, this study was conducted to test the effect of service sector contribution and inflation on indirect tax revenue. This study uses a moderating variable in the form of the level of trade openness. The analysis will be conducted on the effect of each variable on the level of indirect tax revenue. Then the moderation of the level of trade openness on each variable will also be analyzed for the type of moderation and its causes.

With the various considerations previously described, in this study the authors used a sample of countries located in the Latin America and Caribbean region. With consideration of data availability, the research was conducted on 15 countries, namely Belize, Bolivia, Brazil, Chile, Colombia, Costa Rica, Ecuador, El Salvador, Guatemala, Honduras, Mexico, Panama, Paraguay, Peru and Uruguay. In order to avoid periods of major economic turmoil that could potentially compromise the accuracy of the results, this study uses time periods outside of these periods. The Great Recession of 2008 was declared to have ended in 2009 (Federal Reserve History, 2013). Meanwhile, the Covid-19 Pandemic was declared to have started on March 11, 2020 by the World Health Organization (WHO) (WHO, 2020). Therefore, this study uses the time period from 2009 to 2019.

## **LITERATURE REVIEW**

Tax revenue is state revenue obtained from the imposition of taxes on transactions of goods and services, income or profits of a person or business entity, as well as various other types of taxes (OECD, 2023). The level of tax revenue is usually measured as a percentage of revenue over GDP. This is done to see the proportion of production in a country's economy that is shared by the government through taxation. It also indicates the level of government control over economic resources in the country.

Through the explanation in the previous paragraph, it is clear that the size of a country's economy has a major role in the tax revenue that can be collected by its government. The growth of economic size is explained by Mankiw (2016) with the Solow Growth Model. The independent variables used in this study, namely the level of contribution of the service sector to the economy and the inflation rate, are closely related to the size of a country's economy.

The Solow Growth Model provides an overview of how capital, labor and technological progress affect the output of goods or services in the economy as a whole (Mankiw, 2016). Simply put, this model explains how factors of production in the form of physical capital and



labor drive economic growth. Todaro & Smith (2014) separately, each factor will only have an influence on a diminishing scale, but together, they will have a constant impact.

Inflation is a phenomenon that occurs as a result of people's desire to live beyond their economic means (Atmadja, 1999). This causes the demand made by the community to exceed the availability of supply. This explanation is the premise of the inflation model developed by Keynes (Keynesian Model). This lack of supply is a result of firms' production that cannot be increased immediately. Therefore, the Keynesian Model is considered more suitable to explain inflation in a short period of time. Based on this concept, it can be understood that inflation is an indicator that the productivity of the economy will increase.

International trade can improve economic welfare in a country through economic specialization (Hasoloan, 2013). Through specialization, countries can focus more on producing goods in which the country has a comparative advantage. Increasing people's income through economic specialization needs to be supported by trade between countries to optimize its benefits. Thus, trade openness can encourage specialization to become more profitable for both the country and the people in the country.

The service sector is a labor-intensive economic sector. Growth in this sector is expected to be able to sustain overall economic growth and then increase tax revenue in a country. In this study, the hypothesis chosen is that the service sector has a positive and significant influence on tax revenue in a country. This selection is supported by the results of several studies including those conducted by Lemma (2019), Permadi & Wijaya (2022) and Piancastelli (2000).

Inflation can be defined as a continuous rise in prices. The occurrence of inflation can be seen as an indicator of economic growth. For the inflation variable, the hypothesis chosen is that the amount of inflation has a positive significant effect on tax revenue. This hypothesis is supported by the results of research conducted by Arif & Rawat (2018).

Higher trade openness is expected to improve people's welfare through specialization and trade. The hypothesis for this variable is that the level of trade openness has a positive and significant effect on tax revenue, this is supported by various previous studies such as those conducted by Arif & Rawat (2018), Muibi & Sinbo (2013), (Chaudhry & Munir (2010), Ghura (1998), and Listikarini & Wijaya (2023).

The moderating variable of a good level of corruption control is expected to indicate fraud efforts such as those related to rent-seeking. That way the hypothesis used against it is that the level of corruption control has a significant positive effect on the level of tax revenue. This hypothesis is supported by the results of previous studies such as those conducted by Neog & Gaur (2020), and Djayasinga & Prasetyo (2019).

It has been explained earlier that the hypotheses for the effect of the service sector, inflation, and trade openness are all positive effects on tax revenue. Therefore, the hypothesis for the moderating effect is that trade openness will strengthen the effect of either the service sector or inflation on tax revenue in a country.

## **METHODS**

The sources of the data processed in this study are various publications from the World Bank and the Economic Commission for Latin America and the Caribbean (ECLAC). The World Bank publications used in this study are World Governance Indicators (The World Bank, 2023d) and World Development Indicators (WDI) (The World Bank, 2023e). Meanwhile, the data obtained from ECLAC is taken from the CEPALSTAT publication (ECLAC, 2023). The variables used, both dependent and independent variables, can be explained in Table 1 below.



Table 1. Operational Definition of Variables

<b>Dependent Variable</b>	<b>Unit</b>	<b>Data Scale</b>	<b>Data Transformation</b>
Indirect Tax Revenue	Percent (%)	Ratio	-
<b>Independent Variable</b>	<b>Unit</b>	<b>Data Scale</b>	<b>Data Transformation</b>
Proportion of Services Sector in GDP	Percent (%)	Ratio	-
Inflation	Percent (%)	Ratio	-
<b>Moderating Variable</b>	<b>Unit</b>	<b>Data Scale</b>	<b>Data Transformation</b>
Trade Openness	Percent (%)	Ratio	-

The method used in the research is the regression method which is included in one type of quantitative research method. The regression model used is the panel data regression model, to be more specific. There are three types of panel data regression models that need to be selected, namely pooled/common models, fixed-effect models, and random effect models (Baltagi, 2005). The selection of the most appropriate model is done using some form of testing on the suitability of the model. The model selection process is carried out with reference to the indicators outlined in Table 2.

Table 2. Model selection testing

<b>Panel Model Test</b>	<b>Null Hypothesis</b>	<b>Alternative Hypothesis</b>
LM BP Test	Pooled / Common is a more suitable model type than the Fixed model type.	The Fixed model is a more suitable model type than the Pooled/Common model type.
Chow Test	Pooled/Common is a more suitable model type than the Random model type.	The Random model is a more suitable model type than the Pooled/Common model type.
Hausman Test	The Random model is a more suitable model type than the Fixed model type.	Fixed models are more suitable than random models.

After choosing the most suitable model, the process of testing the Gauss-Markov assumption or what is often referred to as the classical assumption fulfilment test is carried out. This process is carried out as an effort to determine whether the regression model used has the capability to find the influence that occurs between the independent variables on the dependent variable and then predict the value of the dependent variable from the pad value of each independent variable studied (Gujarati, 2005). The hypotheses in this test can be seen in Table 3.

Table 3. Testing the Gauss-Markov Assumption

<b>Panel Model Test</b>	<b>Null Hypothesis</b>	<b>Alternative Hypothesis</b>
Normality Test	Normal Data Distribution	Non-Normal Data Distribution
Heteroscedasticity Test	Data Has Homoscedastic Variance	Data Has a Heteroscedastic Variant
Autocorrelation Test	There is no autocorrelation in the model	Autocorrelation Occurs in the Model

If the most suitable model has been selected and testing of the fulfilment of the Gauss-Markov assumptions has been carried out, the next stage is the implementation of the Goodness



of Fit Test, also known as model goodness testing (Walpole et al., 2007). Model goodness test is a series of several testing stages which include F value test, t value test and coefficient of determination (R<sup>2</sup>) test. The F test is carried out with the aim of knowing how significant the simultaneous influence of all the independent variables studied is. While the t test is carried out with the intention of studying the significance of each variable in influencing the dependent variable individually. Another case with the test of the coefficient of determination whose purpose is to obtain a value that describes the amount of contribution of the influence of all independent variables on the value of the dependent variable. This coefficient of determination has a range of values between 0 and 1, the greater the value, the greater the contribution of the influence given.

The hypotheses used as a basis for conducting this research include:

H1: The proportion of service sector in GDP has a positive effect on indirect tax revenue.

H2: Inflation has a positive effect on indirect tax revenue.

H3: Trade openness has a positive effect on indirect tax revenue.

H4: Trade openness strengthens the effect of the proportion of service sector in GDP on indirect tax revenue.

H5: Trade openness strengthens the effect of income per capita on indirect tax revenue.

As a complement, the author also uses a number of control variables in this study. These variables include economic growth, unemployment rate, area, proportion of agricultural sector in GDP, corruption control, government efficiency, currency exchange rate, proportion of industrial sector in GDP, quality of law enforcement, income per capita, quality of regulation, and urban population. Therefore, the basic model in this study is:

$$ITRev = f(Open, Inf, InfOpen, Serv, ServOpen, Growth, Unemp, LnLand, Agri, Corr, Eff, Exch, Ind, Law, Pci, Reg, Urb)$$

The data used in this study has a type of time series data using a period of 11 years with a span of time between 2009 and 2019 combined with 15 cross section data consisting of countries that have a geographical location in the Latin American and Caribbean Region. This data will be analysed with the STATA version 17.0 application. Based on that, the estimation model that will be applied becomes:

$$ITRev_{it} = \alpha + \beta_1 Open_{it} + \beta_2 Inf_{it} + \beta_3 InfOpen_{it} + \beta_4 Serv_{it} + \beta_5 ServOpen_{it} + \beta_6 Growth_{it} + \beta_7 Unemp_{it} + \beta_8 Lnland_{it} + \beta_9 Agri_{it} + \beta_{10} Corr_{it} + \beta_{11} Eff_{it} + \beta_{12} Exch_{it} + \beta_{13} Ind_{it} + \beta_{14} Law_{it} + \beta_{15} Pci_{it} + \beta_{16} Reg_{it} + \beta_{17} Urb_{it} + \epsilon_{it}$$

## RESULTS AND DISCUSSION

Before further discussion, descriptive analysis was conducted first with the aim of understanding the characteristics of the variables studied. The analysis was carried out with the STATA 17 application and the results are shown in Table 4 below.

Table 4. Descriptive Analysis

Descriptive	ITRev	Serv	Inf	Open
Mean	8,85	57,53	3,63	68,42
Standard Deviation	3,15	6,67	2,3	29,03
Minimum	3,97	40,21	-1,1	22,11
Maksimum	18,83	72,97	9,88	162,49

Source: STATA 17, processed by the author (2023)

From the results of descriptive analysis, some information is obtained such as indirect tax revenue (ITrev) to GDP, the average value is 8.85% and the standard deviation is 3.15%. The lowest value of the level of indirect tax revenue occurred in 2019 in the country of Panama



with the percentage of revenue to GDP worth 3.97%. In contrast, the highest level of indirect tax revenue was in Belize which in 2019 reached a revenue level of 18.83%. Meanwhile, the independent variable of the proportion of the service sector (Serv) has an average value that is at the level of 57.53% with a standard deviation value of 6.67%. The smallest value of the proportion of the service sector is 40.21% which occurred in Bolivia in 2012 and the maximum value reached 72.97% which occurred in 2016 in Guatemala. Meanwhile, another independent variable, Inflation (Inf), has an average value of 3.53% with a standard deviation value of 2.3%. The lowest inflation rate reached a negative value of -1.1% which occurred in the Belize economy in 2009, while the highest inflation rate reached a level of 9.88% which occurred in 2011 in Bolivia. Meanwhile, the moderating variable of trade openness has an average value of 68.42% with a standard deviation value of 29.03%. The lowest value of the trade openness variable was in Brazil in 2009 with a percentage of -22.11% and the highest percentage reached 162.49% which occurred in Panama in 2011.

**Multicollinearity Test**

A good regression model requires that there is no high multicollinearity between the independent variables. Testing for multicollinearity is done with the Variant Inflation Factor (VIF). A sign of high multicollinearity is the VIF value of more than 10. The results of the VIF test in this study can be seen in table 5.

Table 5. Results of Multicollinearity Testing

<b>Variabel</b>	<b>VIF</b>
Open	12.98
Serv	15.88
ServOpen	7.98
Inf	12.25
InfOpen	13.70

Source: STATA 17, processed by the author (2023)

From the test results, it can be seen that all independent variables have VIF values greater than 10 except the proportion of the service sector moderated by trade openness (ServOpen). This result means that the independent variables used do not pass the multicollinearity test. However, the multicollinearity problem in this study can be ignored due to the use of panel data which is the result of combining cross section data and time series data (Gujarati, 2005). This is referred to as one of the rules of thumb.

**Panel Model Selection**

To select the most appropriate model to perform the regression function, a model selection process is required. The process is carried out in the form of a series of tests as previously described in the research methodology section. The results of this test series can be seen in Table 6.

Table 6. Model Selection Test

<b>Test</b>	<b>Prob Value</b>	<b>Conclusion</b>
Chow Test	0.00	Fixed Effect is more appropriate to use than Common Effect
LM BP	0.00	Random Effect is more appropriate to use than Common Effect.
Hausman	0.00	Fixed Effect is more appropriate to use than Random Effect

Source: STATA 17, processed by the author (2023)



Referring to the results of this series of tests, it is found that the Fixed Effect is a more appropriate model to use than the Common Effect model and the Random Effect model. However, before the model can be used, a test must first be carried out to fulfil the provisions of the Gauss-Markov assumption which is often referred to as the classical assumption test. These tests can be described as follows.

**Testing the Gauss-Markov Assumption**

As described in the methodology section, the tests carried out here include normality testing, heteroscedasticity testing and autocorrelation testing. The results of these tests are presented in Table 7.

Table 7. Classical Assumption Testing

Test	Prob Value	Conclusion
Normality	0.000	Not Passed
Heteroscedasticity	0.000	Not Passed
Autocorrelation	0.000	Not Passed

Source: STATA 17, processed by the author (2023)

From these tests, it can be seen that this research data does not meet the criteria to pass all three types of tests. However, the results of the normality test can be ignored. This refers to the central limit theorem (CLT), where large amounts of data (more than 30) will naturally follow a normal distribution.

For the results of the heteroscedasticity test and the results of the autocorrelation test, which were also declared unsuccessful, the panel data regression model with panel-corrected standard error (PCSE) was used. This regression function is applied to the STATA application using the 'xtpcse' command.

**Hypothesis Testing**

As explained earlier, this research uses the 'xtpcse' regression model. The results of the hypothesis testing stage are shown in Table 8.

Table 8. Hypothesis Testing Results

Variable	Coefficient	Standard Error	z-Statistic	Prob. z
Open	0.0638	0.1038	6.15	0.000***
Serv	-0.3695	0.0363	-10.17	0.000***
ServOpen	-0.0003	0.000087	-2.93	0.0015***
Inf	-0.2331	0.0995	-2.34	0.0095***
InfOpen	-0.0121	0.1466	-0.08	0.467
R-squared	0.9137	Prob > chi2	0.0000	

Source: STATA 17, processed by the author (2023)

With these regression results, the goodness of model test as presented in the research methodology section can be carried out. It can be seen that the resulting R-squared value is 0.9137. This result means that all independent variables together are able to explain changes in the value of the dependent variable by 91.37%. The remaining 8.63% is influenced by other variables not tested in this study. While the significance test results provide the result that the independent variables simultaneously have a significant effect on the level of indirect tax revenue as the dependent variable. This result means that the model used is appropriate.

After being tested simultaneously, the effect of the independent variables partially was also tested. This test is carried out by paying attention to the probability z value of each independent variable. It can be seen in Table 8 that all independent variables and moderating



variables have a significant effect on the dependent variable. The exception is the inflation variable that has been moderated by trade openness which partially has no significant effect on the dependent variable.

The final regression equation in this study is as follows:

$$\begin{aligned} TR_{it} = & 32.205 + 0.0638 * Open_{it} - 2331 * Inf_{it} - 0.0121 * InfOpen_{it} \\ & - 0.3695 * Serv_{it} - 0.0003 * ServOpen_{it} - 0.1662 * Growth_{it} \\ & - 0.0339 * Unemp_{it} - 0.1943 * Lnland_{it} + 0.1788 * Agri_{it} \\ & + 2.7438 * Corr_{it} + 0.2112 * Eff_{it} - 0.0004 * Exch_{it} \\ & - 0.2858 * Ind_{it} - 2.1965 * Law_{it} + 0.00008 * Pci_{it} \\ & - 0.1922 * Urb_{it} + 0.0539 * Urb_{it} \end{aligned}$$

The regression results show that partially, the proportion of the service sector in GDP has a significant influence on the level of indirect tax revenue. This effect has a negative coefficient, which means that the greater the proportion of the service sector in GDP, the smaller the level of indirect tax revenue. This result is not in line with the hypothesis of this study, but it is similar to the results of Tujo's research (2021). The study explains that this can occur due to the nature of the service sector itself. Sometimes this sector is dominated by services that do not add value. In addition, there is a possibility of the dominance of informal businesses in this sector which contribute less to tax revenue.

Moderation by the trade openness variable makes the coefficient of the effect of the proportion of the service sector smaller but the type of effect remains negative. It can be interpreted that trade openness as a moderating variable weakens the effect of the proportion of the service sector on the decline in indirect tax revenue. This can happen because trade openness affects each sector differently. While the agricultural and industrial sectors are positively impacted by trade openness, the opposite impact is felt in the services sector (Tahir et al., 2019).

The equation results show that inflation has a negative and significant effect on the level of indirect tax revenue. This condition is also not in line with the hypothesis of this study. Inflation can cause a decrease in purchasing power and the level of public consumption (Dewi et al., 2018). This condition can cause the revenue of value added tax or tax on goods and services which is a type of indirect tax to decrease. This result is also in line with a number of previous studies such as those conducted by Muibi & Sinbo (2013), Ghura (1998), and Rodríguez (2018).

After moderation by trade openness variable, inflation has no effect on indirect tax revenue. This condition means that trade openness does not moderate the effect of inflation rate on indirect tax revenue. Referring to the results of a study, trade openness in the long run will reduce the inflation rate itself (Mukhtar, 2012).

Meanwhile, the moderating variable of trade openness partially has a positive and significant effect on the level of indirect tax revenue. This condition is in accordance with the hypothesis used in this study. In line with the results of this study, the results of research conducted by Arif & Rawat (2018) found that wider trade led to increased tax revenue in developing economies. It is a well-established fact that developing countries depend on trade taxes to collect revenue. Similar research results can also be found in research conducted by Chaudhry & Munir (2010), Muibi & Sinbo (2013), Muibi & Sinbo (2013), and Listikarini & Wijaya (2023).

## CONCLUSION

This study was conducted to analyse the effect of the proportion of services sector in GDP and inflation on the level of indirect tax revenue. This study uses trade openness as a moderating variable. The sample locations studied were a number of countries in the Latin America and Caribbean region. The time period used is 2009 to 2019. The method applied is



panel data regression with panel-corrected standard error. Simultaneously, all variables used have a significant effect on the level of indirect tax revenue.

Analyses were also conducted on the partial effects of these variables. Trade openness as a moderating variable has a positive partial effect on indirect tax revenue. Meanwhile, the proportion of service sector has a negative impact on indirect tax revenue. After moderation, this variable still has a negative effect but with a lower coefficient. This means that trade openness weakens the effect of the proportion of the service sector on the level of indirect tax revenue. Another independent variable, inflation, also negatively affects the level of indirect tax revenue. However, unlike the proportion of the service sector, trade openness does not moderate the effect of inflation on the level of indirect tax revenue.

With this result, it is suggested that the government as a policy maker should encourage an increase in international trade openness. Although it does not moderate the effect of inflation on indirect tax revenue, trade openness is able to reduce the negative effect of the proportion of the service sector. In addition, trade openness also partially increases indirect tax revenue.

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