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Does the shadow economy have a significant impact on tax revenues in ASEAN?

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Abstract: The analysis incorporated four variables: the shadow economy, Gross Domestic Product (GDP), Foreign Direct Investment (FDI), and foreign exchange, which were examined through three static panel data models—Pooled Ordinary Least Squares (OLS), Random Effects (RE), and Fixed Effects (FE). The empirical results indicated that an increase in the shadow economy is positively associated with higher tax revenues in ASEAN member states, with the estimated coefficient being both positive and statistically significant at the 1% level. Similarly, GDP and foreign exchange showed a positive relationship with tax revenues, also significant at the 1% level. Additionally, FDI exhibited a positive and statistically significant relationship with tax revenues at the 5% level, suggesting that higher FDI flows are linked to increased tax revenues in the ASEAN region. The results remained consistent across all panel data models, with the RE model identified as the most appropriate, as confirmed by the Hausman test.

Keywords: *ASEAN member states, Panel data models, Shadow economy, Tax revenues.*

1. Introduction

The informal economy, commonly known as the shadow or underground economy, holds a vital yet frequently neglected position within global economic frameworks. This sector includes a diverse array of activities that operate outside the purview of formal governmental regulations, such as street vending, informal labor, and small-scale self-employment. Particularly in developing nations, the informal economy can make substantial contributions to both national and global GDP, acting as a crucial means of sustenance for countless individuals [1].

Although informal economic activities are frequently overlooked in official statistics, they play a crucial role in providing employment and generating income. It is important to recognize that comprehending and quantifying the informal economy is necessary for formulating effective policies aimed at enhancing labor market conditions, delivering social protection, and fostering sustainable economic growth. Despite the difficulties associated with its unregulated characteristics, the informal economy often serves as a stabilizing force during economic recessions, demonstrating flexibility and resilience [2, 3]. A study has underscored the increasing significance of the informal economy, especially in light of swift urbanization, globalization, and advancements in technology. By improving the techniques used to assess this sector, governments and international bodies can promote inclusive economic growth, alleviate poverty, and strengthen social protection for individuals engaged in work outside of formal labor markets [4].

The informal economy holds a crucial yet frequently overlooked position in influencing tax revenues within ASEAN (Association of Southeast Asian Nations) member states. This sector encompasses various activities that function outside formal regulatory frameworks, including street vending, small-scale farming, and casual employment, and is believed to represent a substantial portion of economic activity across numerous ASEAN countries. While it provides essential livelihoods for

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millions, the informal economy also presents significant challenges for governments regarding tax collection, economic strategy, and social welfare. In these nations, the informal economy can make a notable contribution to national income; however, its unregulated characteristics often lead to tax evasion. Consequently, this creates a tax gap, resulting in lost potential revenues that could otherwise support public services, infrastructure development, and social initiatives. In certain countries, the informal economy may constitute over 30% of GDP, underscoring its considerable influence on tax revenues [5, 6].

Regional governments are becoming progressively cognizant of the necessity to tackle this issue. Initiatives aimed at formalizing specific segments of the informal economy are currently in progress, encompassing strategies such as promoting financial inclusion, implementing digital payment systems, and offering tax incentives to small enterprises. Nevertheless, achieving a balance between the imperative of formalization and the inherent characteristics of the informal economy—particularly its adaptability and the precarious nature of its workforce—presents a complex challenge. Ultimately, the impact of the informal economy on tax revenues within ASEAN underscores the critical need for inclusive economic policies that facilitate the integration of informal workers into formal frameworks, thereby fostering more equitable and sustainable economic development throughout the region [7, 8].

2. Literature Review

The shadow economy, commonly referred to as the informal or underground economy, encompasses economic activities that operate outside the purview of government regulation and are not included in the official Gross Domestic Product (GDP) calculations [9]. This presents considerable difficulties for governments across the globe, especially by compromising the collection of tax revenues. Consequently, it is essential to comprehend the intricacies of the shadow economy and its effects on tax income in order to formulate effective fiscal policies and promote economic sustainability.

For many years, the shadow economy has captured the attention of researchers and policymakers alike, primarily because of its intricate relationship with the formal economy. This sustained interest has led to the creation of numerous analytical approaches aimed at understanding its magnitude, underlying causes, and implications. Research has consistently shown that the extent of the shadow economy differs markedly from one region to another, shaped by elements such as the quality of governance, tax rates, and labor market regulations. Nevertheless, this variability has posed challenges for policymakers striving to evaluate its true scale effectively [10].

To tackle this issue, scholars have implemented various techniques to gauge the magnitude of the shadow economy. Notably, the MIMIC (Multiple Indicators, Multiple Causes) model and the currency demand method have been extensively applied in this context. In particular, Dell'Anno [11] utilized the MIMIC model to assess the scale of the shadow economy in Portugal. The findings revealed that the shadow economy was considerable, yet its size varied over time in response to changing economic circumstances. Dell'Anno and Davidescu [12] furthered this line of inquiry by integrating the currency demand approach into their research. Their findings underscored the challenges associated with quantifying the shadow economy, primarily due to its elusive characteristics, and revealed that the application of different estimation techniques can lead to disparate outcomes, thereby complicating the formulation of effective policies. Additionally, Schneider and Williams [13] enriched the discourse by presenting indirect measurement techniques, such as analyzing tax discrepancies and electricity consumption patterns. Their research also highlighted the complexities involved in assessing the magnitude of the shadow economy, which encompasses both legal activities that remain unreported and illegal undertakings, as well as those that exist outside the purview of governmental regulations. Moreover, the study indicated that the scale of the shadow economy tends to be more pronounced in developing nations, attributed to inadequate enforcement mechanisms and institutional weaknesses.

The complexities of the shadow economy are further exacerbated by regional analyses. Albu [10] specifically examined Romania and noted that transition economies are particularly vulnerable due to structural adjustments and insufficient regulatory frameworks. Similarly, Murat [14] expanded this

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investigation to Kazakhstan, establishing a connection between the shadow economy and the presence of underdeveloped financial systems alongside weak governance structures. In a broader context, Baklouti and Boujelbene [15] explored the implications of the shadow economy on economic development, contrasting its effects in both developed and developing nations. Although the shadow economy may offer temporary employment and spur economic activity, it ultimately jeopardizes long-term sustainable growth by eroding public finances. Various case studies further illuminate the distinct drivers of the shadow economy; for example, Dell'Anno and Davidescu [12] utilized the MIMIC model in Tanzania and found that inflation, unemployment, and government expenditure were significant contributors to its expansion. In Zaman and Goschin [16] identified socio-economic and institutional factors that rendered the shadow economy a considerable component of GDP, highlighting the impact of structural inefficiencies. Despite improvements in measurement techniques, accurately assessing the shadow economy continues to pose challenges, emphasizing the necessity for enhanced data collection, robust institutions, and customized policies to alleviate its economic and fiscal repercussions.

The factors contributing to the shadow economy are diverse and interrelated. Fuest and Schneider [17] highlighted tax evasion and avoidance as significant contributors, driven by elevated tax burdens, inadequate enforcement, and pervasive corruption. Nchor [18] corroborated this by noting that corruption and weak enforcement intensified shadow economies in the Czech Republic, Poland, and Hungary. Similar trends were observed in the Middle East, where Imam and Jacobs [19] indicated that corruption diminished tax revenues and fostered informality. Dreher and Schneider [20] further established a global link between corruption and shadow economies, underscoring the necessity of enhancing institutional quality. In Asia, Ulyssea [21] pointed out that ineffective enforcement and convoluted tax systems discouraged compliance and encouraged informality. Mughal and Schneider [22] echoed these concerns in Pakistan, where the informal sector not only hampers direct tax collection but also skews fiscal planning due to unreliable data. In Sub-Saharan Africa, research by Idris, et al. [23] alongside Kodila-Tedika and Mutascu [24] revealed that the shadow economy significantly constrains tax bases, thereby impeding fiscal sustainability. In Latin America and OECD nations, Boitano and Abanto [25] noted that high levels of informality diminish tax revenues and hinder economic growth. Additionally, Ghazo, et al. [26] illustrated that informal activities disrupt resource allocation and weaken fiscal capacity in the Middle East. Gnangnon [27] emphasized that the shadow economy poses substantial obstacles to effective tax reform in developing nations, with structural deficiencies such as limited administrative capabilities and entrenched corruption perpetuating informality and undermining fiscal performance.

Economic crises and deficiencies in governance exacerbate these challenges. Vlachaki [28] observed that during periods of crisis, Greece's shadow economy experienced significant growth, leading to a marked decline in VAT revenues. Similarly, Abou Ltaif, et al. [29] demonstrated that in Lebanon, financial turmoil and ineffective governance heightened the fiscal repercussions of the shadow economy, further destabilizing the economic landscape. Moreover, the shadow economy contributes to the persistence of socioeconomic inequalities. The decline in tax revenues hampers investments in essential public services such as infrastructure, education, and healthcare, which disproportionately impacts marginalized communities [4, 30]. The presence of informality creates a cyclical effect that diminishes state capacity and perpetuates inequality [31]. In light of these challenges, a comprehensive strategy is necessary to tackle the shadow economy. For instance, Joshi, et al. [7] recommended the implementation of simplified tax systems and the enhancement of tax administration capabilities. Similarly, Awasthi and Engelschalk [32] highlighted the importance of combining enforcement efforts with initiatives that promote compliance, such as minimizing bureaucratic obstacles and utilizing technology. Digital payment systems, for example, can help decrease cash transactions, thereby making tax evasion more challenging [33].

Tax morale is of paramount importance in the context of taxation. Torgler and Schneider [34] posited that enhancing public trust in governmental institutions and ensuring the just allocation of tax revenues can lead to a notable decrease in tax evasion. This perspective is supported by the findings of

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Hammond, et al. [35] who emphasized the necessity of implementing fair and transparent tax policies. Additionally, customized approaches, including tax amnesty programs as noted by Awwad and Al-Kababji [36] and various local initiatives highlighted by Lukito and Adi [37] can further encourage the formalization of tax compliance. The shadow economy represents a considerable obstacle to tax systems and economic growth on a global scale. Although its effects vary by region, recurring issues such as inadequate enforcement, corruption, and convoluted tax structures highlight the necessity for holistic approaches. By integrating robust enforcement with initiatives that promote formal economic participation, governments can alleviate the repercussions of the shadow economy, strengthen fiscal stability, and foster sustainable economic progress. Ongoing investigation into novel strategies and enhanced measurement methodologies is crucial for tackling this enduring global issue.

3. Methodology

The objective of this research can be achieved through the application of a static panel data model, which encompasses Pooled Ordinary Least Squares (OLS), Random Effects (RE), and Fixed Effects (FE) models. The analysis incorporates four independent variables: the shadow economy (SDE), the growth rate of real Gross Domestic Product (GDP), Foreign Direct Investment (FDI), and foreign exchange (FX). These variables are included in the models to assess their impact on the dependent variable, tax revenues (TAX). The specification of the model is detailed as follows.

$$TAX_{it} = \theta_0 + \theta_1 SDE_{it} + \theta_2 GDP_{it} + \theta_3 FDI_{it} + \theta_4 FX_{it} + \varepsilon_{it} \quad (1)$$

In this context, θ_0 functions as the intercept, while θ_1, θ_2, θ_3 and θ_4 denote the coefficients linked to the SDE, real GDP, FDI, and FX, respectively, which must be estimated using three static panel data models. The notation ε_it represents the residual or error term, and t indicates the temporal dimension of the dataset. The study employs panel data that integrates information from six ASEAN member countries, specifically Cambodia, Indonesia, Malaysia, the Philippines, Singapore, and Thailand, alongside annual time series data from 2010 to 2020, culminating in a total of 66 observations. All data utilized in this research are obtained from the World Bank. The analysis of the gathered data begins with descriptive statistics, followed by the correlation matrix, model estimation, and hypothesis testing.

3.1. Empirical Results

The summary statistics provided deliver a detailed examination of essential economic indicators derived from a dataset comprising 66 observations. The variables in question—TAX, SDE, GDP, FDI, and FX—are crucial for evaluating economic vitality, foreign investment, and currency dynamics. Analyzing these statistics reveals significant insights into their implications for economic analysis.

The TAX variable indicates tax revenue, with an average of 48,770. A standard deviation of 29,791 points to considerable fluctuations in tax revenues throughout the dataset. The lowest recorded value is 1,125, which signifies instances of notably low tax revenues, while the highest value of 109,134 demonstrates the existence of substantial tax revenue outliers. This broad spectrum of values underscores the disparities in tax systems or the effectiveness of tax collection among the entities observed, with some experiencing markedly higher or lower revenues than the average. The SDE variable presents an average of 29.42, accompanied by a standard deviation of 12.64, suggesting a moderate dispersion of data points around the mean. The minimum value stands at 10.77, and the maximum at 47.95, indicating that the values for this variable exhibit less variability compared to TAX or GDP. The relatively confined range and lower standard deviation imply that measures of socio-economic development across the observations are more uniform, with fewer extreme deviations from the mean.

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Table 1.
Summary statistics.

Variable	Observation	Mean	Standard deviation	Minimum	Maximum
TAX	66	48770	29791	1125	109134
SDE	66	29.42	12.64	10.77	47.95
GDP	66	220648	130446	7265	374215
FDI	66	19657	25601	-4947	105293
FX	66	2701	4556	1.25	14582

The variable representing GDP has an average value of 220,648, indicating a substantial economic scale among the entities analyzed. Nevertheless, the standard deviation of 130,446 reveals a considerable level of variability in GDP figures, with certain observations deviating markedly from the mean. The minimum GDP recorded is 7,265, which starkly contrasts with the maximum GDP of 374,215, illustrating a significant disparity in the economic sizes of the entities within the dataset. This broad range in GDP values emphasizes the coexistence of both smaller and larger economies, highlighting the diverse economic conditions present across the regions or countries examined. The FDI variable, which has an average value of 19,657, exhibits notable variability, as evidenced by a standard deviation of 25,601. The minimum value of -4,947 indicates that some entities experienced negative FDI, suggesting a net outflow of foreign capital. Conversely, the maximum value of 105,293 reflects instances of substantial foreign investments. This extensive range in FDI values, along with the presence of negative figures, underscores the varying levels of foreign investment and capital movement, with certain regions benefiting from significant inflows while others may be experiencing capital flight.

The exchange rate has an average value of 2,701; however, the standard deviation of 4,556 indicates a high degree of volatility within the dataset, suggesting that FX values are widely dispersed around the mean. The minimum value of 1.25 points to instances of very low exchange rates or foreign exchange reserves in some observations, while the maximum value of 14,582 reveals extreme values at the upper end. The substantial difference between the minimum and maximum values highlights significant fluctuations in currency or exchange rate conditions, potentially reflecting varying degrees of economic stability or differing monetary policies among the entities analyzed.

The summary statistics indicate a dataset characterized by considerable diversity and variability, with each of the five variables exhibiting unique traits. Both TAX and GDP display substantial dispersion, especially at their respective extremes, suggesting that the entities represented encompass a range of economies with differing degrees of wealth and economic engagement. In contrast, SDE appears to be relatively stable, indicating a level of consistency in socio-economic development indicators. FDI is marked by significant volatility, reflecting the dynamic nature of capital inflows and outflows, while FX shows pronounced fluctuations, likely influenced by varying degrees of exchange rate stability or currency reserves within the sample. Collectively, these summary statistics illustrate a dataset rich in diversity, particularly regarding economic scale, foreign investment, and currency stability. This variability is essential for subsequent analysis or policymaking, as it underscores the heterogeneous characteristics of the observations and the distinct challenges or opportunities each may encounter in the realms of economic development, taxation, and international finance.

Table 2.
Correlation matrix.

Variable	SDE	GDP	FDI	FX
SDE	1			
GDP	-0.016	1		
FDI	-0.729	0.305	1	
FX	-0.361	-0.742	-0.109	1

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The provided correlation matrix illustrates the interrelationships among four significant economic variables: SDE, GDP, FDI, and FX. The correlation coefficients derived from this matrix shed light on the linear associations between these variables, enabling an evaluation of potential issues such as multicollinearity, which occurs when two or more independent variables in a regression model exhibit high correlation with one another. A thorough interpretation of the correlation matrix is presented, along with an examination of multicollinearity concerns. The correlation coefficient between SDE and GDP is -0.016, which is effectively negligible, indicating an absence of a significant linear relationship between these two variables. This implies that fluctuations in GDP do not substantially influence the level of SDE, nor does SDE impact GDP within this dataset. In contrast, the correlation between SDE and FDI is -0.729, reflecting a moderately strong negative relationship. Additionally, the correlation between SDE and FX stands at -0.361, indicating a moderate negative relationship. The correlation between GDP and FDI is 0.305, suggesting a moderate positive relationship, while the correlation between GDP and FX is -0.742, denoting a strong negative relationship. Lastly, the correlation between FDI and FX is -0.109, which points to a very weak negative relationship, suggesting that foreign direct investment and foreign exchange values do not exhibit a strong linear association in this dataset.

Table 3.
Panel data

Variable	Pooled OLS	RE	FE
SDE	956.33***	956.33***	1026.97***
	(3.92)	(3.92)	(4.07)
GDP	0.285***	0.285***	0.299***
	(14.57)	(14.57)	(14.48)
FDI	0.238**	0.238**	0.264**
	(2.23)	(2.23)	(2.39)
FX	10.47***	10.48***	10.96***
	(15.73)	(15.73)	(15.56)
Constant	-75131***	-75131***	-82374***
	(-5.98)	(-5.98)	(-6.24)
	F(4, 61) = 81.10	Wald Chi2(4) = 324.40	F(4, 51) = 78.79
	Prob > F = 0.000	Prob > Chi2 = 0.000	Prob > F = 0.000
Observations	66	66	66
Groups	6	6	6
R-squared	0.8417	0.8605	0.8415
Hausman test		Chi2(3) = 5.24	
		Prob > chi2 = 0.155	

Note: The asterisk ***, **, * indicate statically significant at the 1%, 5%, 10% level, respectively.
t-statistics are in parentheses.

The results you provided show the output from three different panel data models: Pooled OLS, RE, and FE models. The interpretation will be conducted as referring to each of the models: The coefficient for SDE is significant at the 1% level, and the estimated value is similar across Pooled OLS and RE models (956.33), but slightly higher in the FE model (1026.97). This suggests that a unit increase in SDE leads to a significant increase in TAX, with a slightly stronger effect when using FE. The result is robust across different model specifications. The coefficient for GDP is also statistically significant at the 1% level in all models, indicating that GDP has a positive impact on TAX. The coefficients are very similar across the Pooled OLS and RE models (0.285), with a slightly stronger effect in the FE model (0.299).

The FDI coefficient is statistically significant at the 5% level, showing a positive impact on TAX. The effect is consistent across the Pooled OLS and RE models (0.238) but slightly stronger in the FE model (0.264). This suggests that FDI has a positive but relatively modest influence on TAX. The FX variable shows the strongest effect among all the variables with coefficients ranging from 10.47 to 10.96, and is highly statistically significant at the 1% level. This suggests that changes in foreign

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exchange rates have a large and statistically significant effect on TAX. The effect is almost the same across Pooled OLS and RE, but slightly stronger in the FE model. The constant term represents the intercept of the model, and is significant at the 1% level in all three models. The constant is negative in all cases. The constant is very similar in Pooled OLS and RE, but more negative in the FE model.

The F-statistic measures the overall significance of the model. A high F-value (81.10) and a very low p-value (0.000) indicate that the independent variables, taken together, significantly explain the variation in TAX in the Pooled OLS model. The Wald chi-squared statistic is used to assess the goodness-of-fit for the RE model. The result (324.40) with a p-value of 0.000 shows that the independent variables in the RE model significantly explain TAX. For the FE model, the F-statistic is also significant, indicating that the model is statistically significant with a p-value of 0.000.

R-squared values indicate how well the model explains the variation in TAX. In this case, all models have high R-squared values, with the RE model explaining slightly more variance (0.8605) than the Pooled OLS (0.8417) and FE model (0.8415). In addition, the Hausman test helps determine whether the FE model or the RE model is more appropriate. The chi-squared statistic of 5.24 with a p-value of 0.155 suggests that there is no significant difference between the RE and FE models. This non-significant result (p-value > 0.05) means that both models are equally appropriate for the data. However, when this happens, RE is typically preferred for its efficiency (since it uses both within and between-group variations).

SDE, GDP, FDI, and FX all show significant relationships with TAX. The FX variable has the largest impact, followed by SDE, GDP, and FDI. All models are statistically significant, with high R-squared values indicating a good fit. The Hausman test suggests no strong preference between FE and RE models, but RE might be the preferred model due to its efficiency, assuming no severe correlation between the individual effects and the explanatory variables.

4. Conclusion

The aim of this research was to assess the impact of the shadow economy on tax revenue across six ASEAN member states, specifically Cambodia, Indonesia, Malaysia, the Philippines, Singapore, and Thailand. This evaluation was conducted utilizing panel data models, including pooled OLS, RE, and FE models. In addition to the primary variable of interest, the shadow economy or informal economy, three control variables were incorporated: Gross Domestic Product, Foreign Direct Investment, and foreign exchange. The empirical results indicated a significant positive relationship between the shadow economy and tax revenues, as well as among the control variables. This positive correlation between the shadow economy and tax revenues may be elucidated as follows.

The informal economy is frequently perceived primarily in terms of its challenges; however, it can also contribute positively to tax revenues, particularly when governments implement creative policies and strategies aimed at incorporating informal activities into the larger economic framework. The informal economy plays a crucial role in fostering economic growth by providing employment opportunities and generating income. Numerous individuals and small enterprises operating within this sector enhance overall economic activity by producing goods and services that cater to local community needs. Although these transactions may not be subject to taxation at the outset, the rising demand for such goods and services can eventually result in increased tax revenues as these businesses expand and gain visibility. As informal enterprises develop, they may transition into the formal economy, allowing them to be integrated into the tax system and thereby broadening the tax base.

Informal workers frequently allocate their earnings towards various goods and services that incur sales taxes, despite the fact that they may not contribute to income tax directly. For instance, these workers typically buy necessities such as food and clothing, which are subject to consumption taxes, including value-added tax (VAT) or sales tax. Consequently, this behavior generates a form of indirect revenue for governments, even in the absence of direct income tax contributions from these individuals.

The informal economy plays a significant role in fostering innovation and entrepreneurship. Numerous informal enterprises are established by individuals who identify market gaps or unexploited

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opportunities. These small-scale businesses frequently result in the creation of novel products, services, or business models, which may later transition into the formal sector, thereby enhancing overall economic growth. As these enterprises formalize, they become liable for corporate taxes, which in turn increases tax revenues.

The informal economy plays a significant role in diversifying the overall economic landscape by offering opportunities to individuals who might be marginalized from the formal employment sector due to obstacles such as insufficient education, limited access to financial resources, or regulatory challenges. As informal enterprises expand and make contributions to local economies, they enhance the prospects for future tax revenues, particularly as these businesses evolve into more structured entities that are better equipped to meet tax compliance requirements. In various nations, authorities have effectively enacted measures that motivate informal enterprises to willingly register and fulfill their tax obligations. Initiatives such as streamlined tax systems, educational programs on financial management, and the provision of digital payment solutions have facilitated the transition of small businesses from the informal sector to the formal economy, consequently broadening the tax base.

Transparency:

The author confirms that the manuscript is an honest, accurate, and transparent account of the study; that no vital features of the study have been omitted; and that any discrepancies from the study as planned have been explained. This study followed all ethical practices during writing.

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