EU-ERA
DISCUSSION PAPER SERIES
EU-ERA DP 17/2023

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Muzafar Shah Habibullah
Badariah Haji Din
Mohd Yusof Saari
Azim Azuan Osman
Hussin Abdullah

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EMPLOYMENT INSURANCE SYSTEM
Employment Insurance System

EU ERA
EIS-UPMCS Centre for
Future Labour Market Studies

ISSN 2785-9096

EU-ERA Discussion Paper Series

EU-ERA DP 17/2023

Shadow Economy and Public Expenditures in Malaysia: A Disaggregated Analysis

Muzafar Shah Habibullah
EIS-UPMCS Centre for Future Labour Market Studies (EU-ERA), Malaysia
Putra Business School, Malaysia.

Badariah Haji Din
College of Law, Government and International Studies, Universiti Utara Malaysia, Malaysia

Mohd Yusof Saari
EIS-UPMCS Centre for Future Labour Market Studies (EU-ERA), Malaysia
School of Business and Economics, Universiti Putra Malaysia, Malaysia

Azim Azuan Osman
Faculty of Industrial management, Universiti Malaysia Pahang, Malaysia

Hussin Abdullah
College of Business, Universiti Utara Malaysia, Malaysia

January 2023

Abstract

Motivation and aim: The novelty of the present study is that this is the first attempt to estimate the size of the shadow economy using monthly data. The main purpose of this study is to investigates the effects of the labour force participation rate on the size of the shadow economy in Malaysia for the period January 2010 to December 2019. The robustness of the impact of labour force participation rate on shadow economy is tested using five different estimators. Other determinants of shadow economy included in this study is government expenditure, financial development, unemployment and lending rates.

Methods and material: The study uses monthly data ranging from January 2020 to December 2019, and employ several estimators, namely; Ordinary Least Square with standard error (OLS-robust), Fully Modified OLS (FMOLS), Dynamic OLS (DOLS), Canonical Cointegrating Regression (CCR), and Robust Regression (Robust) approaches, for the analysis. Secondary data on macroeconomic variables were collected from Bank Negara Malaysia and Department of Statistics Malaysia.

Key findings: Generally, our results are robust to the five estimators used in the study. The labour force participation rate adversely affects the size of the shadow economy in Malaysia. The government expenditure as well the size of the financial development also has the same adverse effect on the size of the shadow economy in Malaysia. However, the rise in the unemployment rate and lending rate will raise the size of the shadow economy.

Policy implications: Financial ecosystem can play an important role in mitigating the size of the shadow economy. Programs and initiatives that address the inaccessible of firms and individuals in the shadow economy to credit and finance markets will encourage these economic units to exit the shadow economy. As to the labour force participation rate, good future prospect of the economy would increase employment and encourage people to be actively searching for jobs. The government has an important role in providing good development plans to create wealth for the nations and a healthy population, with the ultimate goal of increasing the population and the size of the labour force.

JEL Classifications
E26, J46, O17

Keywords
Shadow economy, Labour force participation rate, Robust regression, Malaysia

Shadow Economy and Labour Force Participation Rate in Malaysia

1. INTRODUCTION

There are at least two negative consequences of having a large size of the shadow economy to any nation. Firstly, the shadow economy shelter and hide criminals, and peoples who evade paying tax. Large size of the shadow economy would suggest that the amount of tax revenue loses to the government will also be large. Lack of revenue will incapacitate the ability of the government to provide quality infrastructure and other public utilities and services (Schneider & Enste, 2000; Naylor, 1996; Habibullah & Eng, 2006). And secondly, the presence of the shadow economy will impair effectiveness of government policy. Government policy are based on indicators or statistics such gross domestic product, unemployment rate, labour force participation rate, labour force, consumption, tax collection etcetera. Without taking into account the shadow economy activities, policy based on these erroneous official indicators will be ineffective (Schneider, 2000; Eilat & Zinnes, 2002). Thus, the government of any nation should take serious steps to mitigate the size of the shadow economy.

In Malaysia, the government has recognised the serious impact of the shadow economy to the government coffers. In 2019, the Minister of Finance exerts that "the size of Malaysia's shadow economy is at around RM300 billion and integrating a fifth of it into the formal sector could bring the country between RM5 billion and RM15 billion in additional revenue" (Malay Mail, 2019). In 2021, the Ministry of Finance Malaysia (2021) has estimated the size of the shadow economy in Malaysia for the period 1990-2019 averages 33.7%. Nevertheless, the trend is declining from an average of 50% between 1990-199, to 30% between 2000-2009, and to an average of 21% between 2010-2019.

The estimated sizes of the shadow economy in Malaysia varies. The magnitude of the shadow economy depends on the time period studied, the model and methods of estimation used in the analysis. Habibullah et al. (2022) has compiled several of the estimates of the size of the shadow economy in Malaysia by various authors. The work by Eng (2009) estimates the size of the Malaysian shadow economy for the period 1970-2006 averages 16.3%; Elgin and Oztunali (2012) average 45.1% for 1960-2008; Mohamed (2012) average 15.8% for 1980-

2009; Alm and Embaye (2013) average 30.4% for 1984-2006); Tan et al. (2017) average 17.0% for 1984-2012); Medina and Schneider (2018) average 31.5% for 1991-2015; Gamal et al. (2019) average 43.9% for 1972-2012; and Habibullah et al. (2022) average 38.3% for 1960-2018. More recently, Elgin et al. (2021) have provided the estimates of the size of shadow economy using Multiple Indicator Multiple Causes (MIMIC) and Computable General Equilibrium (CGE) models for Malaysia and 155 other countries. The CGE and MIMIC models estimate the size of the shadow economy for the period 1990-2018. The average size of the shadow economy for Malaysia is 30.0% and 31.5% for the periods 1990-2018 and 1993-2018, using CGE and MIMIC models, respectively.

In all of the above studies, the estimates were computed using annual data. The novelty of the present study is that this is the first attempt to estimate the size of the shadow economy using monthly data. The main purpose of this study is to investigates the effects of the labour force participation rate on the size of the shadow economy in Malaysia for the period January 2010 to December 2019. The robustness of the impact of labour force participation rate on shadow economy is tested using five different estimators. Other determinants of shadow economy included in this study is government expenditure, financial development, unemployment and lending rates.

The paper is presented as follows. Section 2 discuss the relationship between labour force participation rate and shadow economy. Section 3 describes our model. Section 4 presents our results and our conclusion is in the last section.

2. SHADOW ECONOMY AND THE LABOUR FORCE PARITICIPATION RATE

One of the most important input in producing output is the labour services. An increase in labour input will increase the amount of output, however, to a certain saturation point unless labour productivity increases. The amount of labour to be supplied in the process of production comes from a pool of people in the labour force. The number of people actively searching for job and the number of people employed make up the size of the labour force. The increase in the size of the labour force will guarantee the supply of labour to a nation to produce output. The size of the labour force relative to the number of working age of 15 to 64 years in total population is the labour force participation rate. The literature has recognised that the increase

in the labour force participation rate increases economic growth (Clark et al., 1999; Dotsey et al., 2017; Hoevelmann, 2020). Thus, the labour force participation rate is an important labour market measure because it represents the relative amount of labour resources available for the production of good and services (Hippie, 2016).

Thus, it is imperative that effort to reduce nonparticipation of the people who is able to work and actively seeking for work in the labour market to be sustained to support economic growth. The drivers that led to the shrinking labour force participation rate are several. Demographic is one of the most important factors that pulls down the labour force participation rate. This could be due to the lower participation of retirees 55 and older; and also, the lack of demand for low-skilled workers (Dantas & Wray, 2017). Klein (2019) notes that when people who are unemployed grow too discouraged and given up looking for work will also cause the labour force participation rate to shrink (Hoevelmann, 2020; Dotsey et al., 2017). Reduction in the population growth can also contribute to lower labour force participation rate (Felix & Shampine, 2022). When population growth rate slows down, so too will the growth in the size of the labour force. Hoevelmann (2020) also pointed out that an increase in educational attainment can result in lower labour force participation rate. When people are spending more time in schools and universities, they start their careers later in life. During those periods, the labour force participation rate will shrink. The theoretical model presented by Johansson (2001) postulate that whether to participate or nonparticipation in the labour market, individuals compare the benefits between the value of nonparticipation with the value of labour participation. For example, if individuals value more for leisure, education attainment or other activities considered to be more valuable, and compare with labour income and other benefits related to the working environment, then the labour force participation rate will decrease as individuals moving out of the labour force.

On the other hand, another strand of study posited that the reduction in the labour force participation rate is the result of the increasing size of the shadow economy. When people shift their labour services from the formal economy to the shadow economy, the official labour force participation rate will decrease. According to Giles (1998) a decline in the labour force participation rate may reflect a movement of workers from the official economy into the shadow economy. This observation is supported by Dell'Anno et al. (2007), Hassan and Schneider (2016) and Koufopoulou et al. (2021). They exert that the labour force participation rate is negatively related to the size of the shadow economy. Nchor and Adamee (2015)

supported this contention that the booming shadow economy is an indicative of a low labour force participation rate in the formal economy. In a study on high income OECD and other 120 countries, Schneider et al. (2010) found that the labour force participation rate adversely affects the size of shadow economy in these countries.

3. METHODOLOGY

The Estimating Model

To assess the impact of labour force participation rate on shadow economy in Malaysia, we specify the following model,

$$se_t = \alpha_0 + \alpha_1 lfpr_t + \alpha_2 govexp_t + \alpha_3 findev_t + \alpha_4 findev_t^2 + \alpha_5 ur_t + \alpha_6 lr_t + \varepsilon_t \quad (1)$$

where se_t is shadow economy, $lfpr_t$ is labour force participation rate; $govexp_t$ is government expenditure proxy using the ratio of total government expenditure to GDP; $findev_t$ is a financial development proxy using the ratio of money supply M3 to GDP, and its square is shown by $findev_t^2$. Variables ur_t and lr_t are unemployment rate and lending rate respectively. The lending rate is proxy by the average lending rate in Malaysia. The erro term, ε_t is assume to have mean zero and constant variance. The parameters $\alpha's$ are to be estimated. In this study, we transformed all variables in logarithm, so that the estimated parameters are elasticities.

The dependent variable, se_t (shadow economy) is measured using the procedure proposed by Pickhardt and Sarda (2011, 2015). Pickhardt and Sarda proposed the modified-cash-deposit-ratio to calculate the contribution of the shadow economy's gross domestic product (GDP) to the official GDP using the following relation between currency in circulation and demand deposits of a country. Their approach offers a 'reasonable' estimate of the shadow economy and it do not subject to the Breusch (2005a, 2005b, 2005c and Ahumada (Ahumada et al., 2007, 2008) critiques. The following formula is in order (Habibullah et al., 2016; Habibullah et al., 2022; Safuan et al., 2021),

$$\frac{\text{Currency}_t - \text{Currency}_0}{\text{Currency}_0 + \text{Demand Deposit}_t} = \frac{\text{GDP}_{\text{shadow},t}}{\text{GDP}_{\text{official},t}} \quad (2)$$

where Currency_t denotes currency in circulation at the end of year t; Currency_0 is currency in circulation at the end of base year, here 1970; Demand Deposit_t represents demand deposits at the end of year t; $\text{GDP}_{\text{official},t}$ and $\text{GDP}_{\text{shadow},t}$ denote the GDP of the official and shadow economy respectively. Thus, $\text{GDP}_{\text{shadow},t}/\text{GDP}_{\text{official},t}$ measures the share of shadow economy to the legal economy (official GDP).

As to our main variable of interest, the labour force participation rate, lfpr_t, is measured using the ratio of the number of persons in the labour force to the number of persons in the working age (15-64 years) population. We expect *a priori* that the impact of labour force participation rate on the size of the shadow economy in Malaysia is negative. This expected relationship imply that the size of the shadow economy can be reduce if the size of the labour force can be increased relative to the population size. By allowing the opportunity to be employed and seeking for potential jobs will keep these people from participating in the shadow economy.

In this study, since we are using monthly data, the availability of monthly macroeconomics data is limited. In view of this situation, we have selected government expenditure, financial development, unemployment rate and lending rate as the control variable. The government expenditure is proxy using the ratio of government expenditure to GDP; while financial development is proxy using the ratio of money supply M3 to GDP. Lending rate is the average lending rate in Malaysia, and the unemployment rate is the ratio of unemployed person to the labour force.

Government expenditure, govexp_t is one of the most important determinants of the shadow economy (Schneider & Enste, 2000; Schneider, 2005; Schneider et al., 2010). Government expenditure is used as one of the fiscal policy tools that can be used to regulate the economy. The proponents of the Keynesian model exert that the multiplier effect through government expenditure will enhance economic growth and therefore creating job opportunities and raise income among the population. Increase in government expenditure that led to increase in economic growth enable the government to provide public goods and services. Nevertheless, in order to spend in providing infrastructure and other public goods and services to the population, the government must collect taxes.

However, the amount of tax revenue that can be collected depends on the size of shadow economy. The larger the size of the shadow economy, the lower were the tax revenue collected. The reason why people enter the shadow economy is to evade tax. Thus, the larger the size of shadow economy the bigger will be tax evasion (Safuan et al., 2022). Nevertheless, government expenditure, as a fiscal policy tool to mitigate the size of the shadow economy can be effective if the government able to increase public trust and tax morale among the public by ascertaining responsible and accountable government spending on the tax revenue collected. These efforts will in turn discourage people from entering the shadow economy and instead shift their labour services to the formal economy (Kolluri et al., 2000; La Porta & Shleifer, 2014; Dreher & Schneider, 2010). Since in this sense that government expenditure has a negative impact on the shadow economy, an expansionary fiscal policy by increasing government expenditure would be a good policy tool (Nchor et al., 2015). We would expect a priori that the relationship between government expenditure and shadow economy in Malaysia is negative.

The works of Habibullah et al. (2016), Din et al. (2019) and Habibullah et al. (2022) have suggested that the relationship between the shadow economy and financial development in Malaysia is nonlinear. Similar nonlinear impact of the financial development on the size of the shadow economy was found for Indonesia (Safuan et al., 2021). At a lower level of financial development, the size of the shadow economy tends to expand, however, after a certain level of saturation point, as the level of financial development increases, the size of the shadow economy starts to decrease. Bose et al. (2012) argue that in higher level of financial sector development, firms have easy access to external financing, however, borrowers have to declare their income and/or assets and this can be used as collateral or to gauge their creditworthiness but in doing so they will subject to tax liability. But, since the value provided by the financial sector is considerable (Gordon & Li, 2009), there is less incentive to evade tax and the need to participate in the shadow economy is minimal. On the contrary, for countries with lower level of financial development, where there is limited access to the credit market due to shortage of loanable funds, asymmetric information and high cost of borrowings; borrowers have less incentive to declare income and/or assets. In such environment, tax evasion is substantial and shadow economy is also larger. Thus, Bose et al. (2012) contend that improvement in the development of the banking sector as well as the depth and the efficiency of the banking sector contribute to smaller shadow economy. Thus, in this study nonlinear relationship between

shadow economy and financial development is shown by the significant of parameters, $\alpha_3 > 0$ and $\alpha_4 < 0$.

On one hand, it is expected that unemployment rate could has a positive impact on the size of the shadow economy (Schneider et al., 2010; Dell'Anno, 2007). The unemployment rate is much depended on the business cycle. During expansion, unemployment rate is low while during recession the unemployment rate is higher. In the worst scenario, during recession, people could lose their job, thus their only source of income to support their oneself and their family. For survival, these affected people would turn to the shadow economy to earn their income. On the other hand, interest rate is the cost of borrowings for the lenders. Increase in the lending rate would increase their cost of production. While to the unfortunate, an increase in the lending interest would mean that they have to turn down the loan being offered (Edeme et al., 2022). If the situation persists, to sustain their business and income, these people will enter the shadow economy. We would expect *a priori* that unemployment lending rates show a positive relationship with shadow economy.

Method of Estimation

The literature recognised that most macroeconomic variables are nonstationary. Thus, running a regression such as Equation (1) that involve nonstationary variables will results in a spurious result. This will mean that the estimates cannot be use to make inferences because the t-statistics and/or F-statistics are invalid. As a matter of fact, one of the assumptions of the Ordinary Least squares (OLS) is that all variables must be stationary. In view of this problem, we need to determine the order of integration of each of the variables involves in the estimations.

To determine the integrated properties of the variable, we employ a more efficient unit root test procedure proposed by Elliot et al. (1996). According to Elliott et al. (1996) their modified Dickey-Fuller (DF) test statistic by using a generalized least squares (GLS) rationale has the best overall performance in terms of small-sample size and power, conclusively dominating the standard Dickey-Fuller test. In particular, Elliott et al. (1996: pp. 813) found that their "DF-GLS test has substantially improved power when an unknown mean or trend is present."

If the integrated variables are all I(1), then most estimators can be used to test the model – Equation (1) for cointegration. For a mixed I(0) and I(1) variables, then the popular autoregressive distributed lag (ARDL) model proposed by Pesaran et al. (2001) will be more appropriate. Assuming that all the variables are I(1), we propose estimating Equation (1) using five different estimators. The use of this multi-estimators will ensure the robustness of the results, in particularly the impact of the labour force participation rate on the size of the shadow economy is stable over the various estimators used in the analysis.

In particular, for this study will employ: (i) OLS with robust (OLS-robust) standard error due to Newey and West (1987). Using this estimator, both autocorrelation and heteroscedasticity will be eliminated; (ii) robust regression that is Robust Least Squares M-estimation (RLS-ME). RLS-ME is robust to the presence of outliers in the sample. Barnett and Lewis (1994) have stated that the presence of outliers can lead to inflated error rates and substantial distortions of parameter and statistical estimates when using either parametric or non-parametric tests. Statistically, the increase in error variance will reduce the power of the statistical tests, decrease normality, and seriously bias or influence parameter estimates (Perez et al. 2013). The most common general method of robust regression is the M-estimation method introduced by Huber (1964); (iii) Fully Modified OLS (FMOLS) proposed by Phillips and Hansen (1990) and the procedure is appropriate for small sample and can eliminate simultaneity or endogeneity bias which is suitable in this study. FMOLS is non-parametric approach in dealing with serial correlation; (iv) Dynamic OLS (DOLS) is an estimator popularised by Stock and Watson (1993). DOLS is robust to the problems of simultaneity and small-sample bias among the regressors by regressing an I(1) variable on other I(1) variables, the I(0) variables, the lags and leads of the first difference of the I(1) variables; and (v) Cointegrating Canonical Regression (CCR) is proposed by Park (1992). This is another estimator which is similar to FMOLS that also corrects for any element of serial correlation in the errors with regressors and the problem of endogeneity in the variables.

The cointegration test conducted on Equation (1) after employing the above five estimators is to determine the validity of the long-run model as per Equation (1). If cointegration cannot be rejected among the dependent and the independent variables, then the long-run model as specified in Equation (1) is valid. The estimated parameters can be used to make inferences. Since all variables are in logarithm, the estimated parameters are elasticities, thus, we can infer,

say a 1% increase in the independent variable will increase the dependent variable by the percentage of the estimated coefficient of the independent variable in question.

For OLS-robust and RLS-ME, the cointegration test is done by employing the Engle-Granger two-step procedure (Engle & Granger, 1987). In the first stage, we save the residuals after running the regression either using OLS-robust and/or RLS-ME. The residuals are then tested for the presence of a unit root using the common Dickey-Fuller (Dickey & Fuller, 1981) unit root test. The unit root test on the residual is conducted without an intercept and/or without a trend. The Engle-Granger two-step procedure test for non-cointegration as a null hypothesis. On the other hand, the cointegration test conducted on Equation (1) after running the regression using FMOLS, DOLS and CCR were tested using the Hansen (1992) parameter instability test for cointegration. The Hansen procedure using the $L_c - \text{statistic}$, test the null hypothesis of cointegration.

Sources of Data

In this study, to estimate the impact of labour force participation rate on the size of the shadow economy in Malaysia, we are using monthly data for the period January 2010 to December 2019. All data – government expenditures, gross domestic product, currency in circulation, demand deposits, money supply M3, unemployment rate and average lending rate were collected from the various issues of the Monthly Highlights and Statistics published by the Central Bank for Malaysia and the Labour Force Statistics Report published by the Department of Statistics Malaysia.

4. THE EMPIRICAL RESULTS

Table 1 elaborates on the descriptive statistics for the dependent and independent variables in our analysis. More importantly, it demonstrates that most dependent and independent variables exhibit less variation in standard deviations, skewness, and kurtosis. All variables have positive skewness (except lfpr_t and ur_t for having negative skewness), while govexp_t exhibit kurtosis with size larger than 3, and the rest of the series suggest kurtosis size less than 3. These suggest that the tail on the left side of the distribution is longer or fatter for most of the series. In other

words, the kurtosis for these variables has a leptokurtic distribution. Nonetheless, with the exception of government expenditure, the Jarque-Bera test for series normality was not rejected. Nevertheless, given that some of the variables in our analysis exhibit non-normal distribution, the most conventional way to avoid these issues is to logarithmically transform all variables (Ehrhardt-Martinez et al., 2002; Naidoo & Adamowicz, 2001; Safuan et al., 2022).

The correlation matrix for the dependent variables and all the independent variables are presented in Table 2. Generally, the explanatory variables – unemployment rate and average lending rate – show positive association with shadow economy; while negative association is shown by government expenditure, and financial development with the shadow economy. Interestingly, despite some of the regressors were significantly correlated, but none of the independent variables demonstrates potential multicollinearity among themselves. The correlation coefficients between all independent variables are no greater than 0.7. The negative relationship between the size of the shadow economy and the labour force participation rate is illustrated in Figure 1. It is clearly suggested that when labour force participation rate increase (decrease), the size of shadow economy decrease (increase) as well in Malaysia. Thus, it is not surprising that studies by Hajilee et al. (2017) and Hajilee and Niroomand (2021) have used labour force participation rate to measure the size of the shadow economy in selected merging economies.

The test results for the order of integration are shown in Table 3. The test is conducted by testing the variables in level with an intercept, and with an intercept and trend. The level series is tested for unit root with the null hypothesis of a unit root, and the alternative hypothesis of stationary. As shown in Table 3, the results clearly suggest that the null hypothesis of a unit root in the variables in level cannot be rejected. Next, we test the variables in first-difference for a unit root against stationary. Results for the difference variables, with an intercept, and with intercept and trend, indicate that the null hypothesis of a unit root in the first-difference variables can be rejected. This implies that all the series in the study are stationary after difference one time. In other words, the variables in levels are nonstationary, that is they are I(1), and they are stationary or I(0) in first-differences.

Since our results indicate that all variables are I(1) and they are all in the same order of integration, we can proceed with the cointegration tests using OLS-robust, RLS-ME, FMOLS, DOLS and CCR. The cointegration tests results and the long-run models for shadow economy

are shown in Table 4. The cointegration test as shown by the $DF_t - \text{statistics}$ clearly suggest that the residuals from running the regression Equation (1) using OLS-robust and Robust regression - RLS-ME suggest that the null hypothesis of non-cointegration can be rejected at the 1% significant level, thus, suggesting the cointegrability of shadow economy and its determinants. On the other hand, the Hansen's $L_c - \text{statistics}$ test for cointegration for the estimated regression using the FMOLS, DOLS and CCR also suggest that the dependent and independent variables are cointegrated. All three Hansen's $L_c - \text{statistics}$ indicate that the null hypothesis of cointegration cannot be rejected at the 1% level. The results for cointegration suggest that there are long-run relationships between the size of shadow economy and its determinants – labour force participation rate, government expenditure, financial development, unemployment rate and the lending rate.

Looking next at the estimated long-run models as shown in Table 4, the results from OLS-robust suggest that all variables are statistically significant at least at the 5% level. All of the variables show the expected signs. The labour force participation rate impacted the size of the shadow economy negatively, implying that an increase in the labour force participation rate will mitigate the size of the shadow economy in Malaysia. In this case, a 1% increase in the labour force participation rate will reduce the size of the shadow economy by 1.5%. On the other hand, increase in the government expenditure also has the effect of reducing the size of the shadow economy. Nevertheless, a 10% increase in the government expenditure able to shrink the size of the shadow economy by 0.5%. The unemployment rate and the lending rate have a positive impact on the size of the shadow economy in Malaysia. The results suggest that between the unemployment rate and the lending rate, the effects of lending are much greater than the unemployment rate. A 1% increase in the lending rate will reduce the size of the shadow economy by 0.6 % as compared to 0.4% when the unemployment rate is increase by 1%.

As to the impact of the financial development, the results suggest a nonlinear relationship between the size of the shadow economy and financial development, thus exhibiting an inverted U-shape curve between the two variables. The size of the shadow economy expands during the early stages of financial development, but as the financial system becomes more complex, sophisticated and technological driven, the size of the shadow economy shrinks.

Our results from using the Robust regressions (RLS-ME) procedure indicate that results are similar with OLS-robust. All variables are statistically significant at least at the 5% level. All variables have the expected signs. The labour force participation rate adversely affects the size of the shadow economy. The impact of the labour force participation rate is larger than the one estimate using the OLS-robust. The size of the Malaysian shadow economy shrinks by 1.7% with every 1% increase in the labour force participation rate. Similarly, government expenditure has the ability to reduce the size of the shadow economy in Malaysia. Nonetheless, the increase in the unemployment and lending rates has the effects of increasing the size of the shadow economy in Malaysia.

The robustness of the impact of labour force participation rate on the size of the shadow economy in Malaysia is further tested by employing the FMOLS, DOLS and CCR approaches. All explanatory variables are statistically significant at least at the 10% level and show expected signs for all the three estimators. The government expenditure variable is not significant in the FMOLS and DOLS models except in the CCR model. Interestingly, the increasing impact of the labour force participation rate is consistently showing the reducing effects on the shadow economy. For example, a 1% increase in the labour force participation rate will decrease the size of the shadow economy by 1.7%, 1.8% and 1.9%v in FMOLS, DOLS and CCR models, respectively. The effects of financial development on the size of the shadow economy in Malaysia is nonlinear, indicating that lower level of financial development support the expansion in the size of the shadow economy while larger level of financial development mitigate the size of the shadow economy. Again, consistent with earlier results, the size of the shadow economy rises with increases in the unemployment rate as well as the lending rate in Malaysia.

5. CONCLUSION

Shadow economy is a burden for the development of an economy. Large size of the shadow economy gives the indication that large amount of tax revenue cannot be collected by the government. Without good collection of taxes, a government will be unable to serve the public by providing quality infrastructure and other public utilities and services. Thus, it is not surprising that studies have been proliferating in the literature in order to estimate the size of the shadow economy.

In this study, we endeavour to estimate the size of the shadow economy at the monthly level for the period January 2010 to December 2019. Our main purpose is to determine the impact of the labour force participation rate on the size of the shadow economy in Malaysia during the same period. Other explanatory variables included in the study are namely, government expenditure, financial development, unemployment rate and lending rate. Also in this study, we tested the robustness of the effects of the labour force participation rate on the size of the size of the shadow economy by using five different estimators. These estimators are the Ordinary Least Square (OLS) with robust standard error, Robust regression M-estimation, Fully Modified OLS, Dynamic OLS and Canonical Cointegrating regression approaches.

Generally, our results are robust to the five estimators used in the study. The labour force participation rate adversely affects the size of the shadow economy in Malaysia. The government expenditure as well the size of the financial development also has the same adverse effect on the size of the shadow economy in Malaysia. However, the rise in the unemployment rate and lending rate will raise the size of the shadow economy. In Malaysia, there is an important role play by the financial ecosystem in mitigating the size of the shadow economy. Programs and initiatives that address the inaccessible of firms and individuals in the shadow economy to credit and finance markets will encourage these economic units to exit the shadow economy. On the other hand, maintaining sustainable long-run economic growth. providing programs related to job opportunity, good financial environment for investors and good governance will create more job opportunities, increase private investment, increase trust in the government and lowers the unemployment rates. All these efforts will attract people to exit the shadow economy and shift into the formal economy. As to the labour force participation rate, good future prospect of the economy would increase employment and encourage people to be actively searching for jobs. The government has an important role in providing good development plans to create wealth for the nations and a healthy population, with the ultimate goal of increasing the population and the size of the labour force.

ACKNOWLEDGEMENTS

This project was supported by the EU-ERA Research Grant [Grant Number EU-ERA-SG-01].

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Table 1: Descriptive statistics

Statistics	$shadow_t$	$lab\_participate_t$	$government\_exp_t$	$finance\_dev_t$	$unemployment_t$	$lending\_rate_t$
Unit of measurement	Ratio to GDP (%)	Ratio to working-age population (%)	Ratio to GDP (%)	Ratio to GDP (%)	Ratio to labour force (%)	%
Mean	28.47	66.94917	22.47	1566.7	3.205833	4.74325
Maximum	34.34	68.9	48.82	1731.8	3.6	5.22
Minimum	23.33	62.5	8.37	1434.4	2.7	4.44
Std. Dev.	2.39	1.65	5.64	70.52	0.21	0.18
Skewness	-0.11	-0.99	1.95	0.35	-0.54	0.38
Kurtosis	2.57	2.77	9.5	2.36	2.51	2.13
Jarque-Bera	1.15	20.07***	291.0***	4.48	7.11**	6.68**
Observations	120	120	120	120	120	120

Notes: Asterisks *** and ** denote statistically significant at 1% and 5% level, respectively.

Table 2: Correlation matrix

Probability	$shadow_t$	$government\_exp_t$	$finance\_dev_t$	$lab\_participate_t$	$unemployment_t$	$lending\_rate_t$
$shadow_t$	1					
$government\_exp_t$	-0.144	1				
$finance\_dev_t$	-0.570***	0.221**	1			
$lab\_participate_t$	-0.500***	-0.250***	-0.007	1		
$unemployment_t$	0.336***	-0.248***	-0.362***	0.213**	1	
$lending\_rate_t$	0.603***	0.035	-0.299***	-0.470***	-0.052	1

Notes: All variables are in logarithm. Asterisks *** and ** denote statistically significant at the 1% and 5% level, respectively.

Table 3: Results of unit root test

Series	Series in level:		Series in first-difference:	
	Intercept	Intercept+trend	Intercept	Intercept+trend
$shadow_t$	-0.6070 (2)	-1.0074 (2)	-11.133*** (1)	-11.416*** (1)
$lab\_participate_t$	0.5168 (2)	-1.5755 (2)	-5.0938*** (0)	-8.8680*** (0)
$government\_exp_t$	-1.1418 (11)	-1.6253 (11)	-5.6654*** (2)	-8.8953*** (2)
$finance\_dev_t$	-0.9189 (10)	-2.7521 (12)	-5.5605*** (4)	-5.5347*** (4)
$finance\_dev_t^2$	-0.9966 (8)	-1.1975 (8)	-5.5617*** (4)	-5.5370*** (4)
$unemployment_t$	-1.5160 (2)	-1.8934 (2)	-12.242*** (1)	-12.167*** (1)
$lending\_rate_t$	-1.6192 (0)	-1.8129 (0)	-10.490*** (0)	-10.455*** (0)

Notes: Asterisks *** and ** denote statistically significant at 1% and 5% level, respectively. All variables are in logarithm. The figures in the round (…) brackets are the lag length truncation using SIC. Critical values for series with intercept refer to MacKinnon (1996); while critical values for series with intercept and trend refer to Elliot, Rothenberg and Stock (1996, Table 1).

Table 4: Results of long-run model and cointegration tests

Independent variables	OLS-robust	RLS-ME	FMOLS	DOLS	CCR
constant	-248.23*	-346.19***	-328.91**	-416.82**	-325.25**
	(-1.9431)	(-3.6866)	(-2.2173)	(-2.1284)	(-2.0960)
lab_participate_t	-1.5009***	-1.4815***	-1.6641***	-1.7993***	-1.8545***
	(-6.9731)	(-8.2564)	(-5.7532)	(-5.2183)	(-6.1216)
government_exp_t	-0.0459**	-0.0434**	-0.0445	-0.0849	-0.0744*
	(-2.1160)	(-2.4764)	(-1.5857)	(-1.1707)	(-1.6813)
finance_dev_t	70.207**	96.769***	92.580**	116.23**	91.585**
	(2.0193)	(3.7923)	(2.2965)	(2.1841)	(2.1720)
finance_dev_t^2	-4.8143**	-6.6173***	-6.3502**	-7.9354**	-6.2706**
	(-2.0379)	(-3.8175)	(-2.3189)	(-2.1948)	(-2.1895)
unemployment_t	0.3613***	0.4512***	0.4186***	0.5422***	0.5080***
	(3.4374)	(7.1103)	(4.1451)	(4.3459)	(4.4128)
lending_rate_t	0.6306***	0.5760***	0.5360**	0.5937***	0.5685***
	(4.2504)	(4.8889)	(2.8849)	(3.1223)	(3.0337)
R^2	0.737	0.605	0.706	0.809	0.698
Cointegration test:					
DF_t-statistic	-7.3089***	-7.6399***			
L_c-statistic			0.7537	0.0218	0.5841

Notes: Asterisks ***, ** and * denote statistically significant at 1%, 5% and 10% level, respectively. All variables are in logarithm. The figures in the round (…) brackets are t-statistics. Cointegration tests, DF_t and L_c are t-statistics for Dickey-Fuller unit root test on the residuals, and Hansen statistics for stability test.

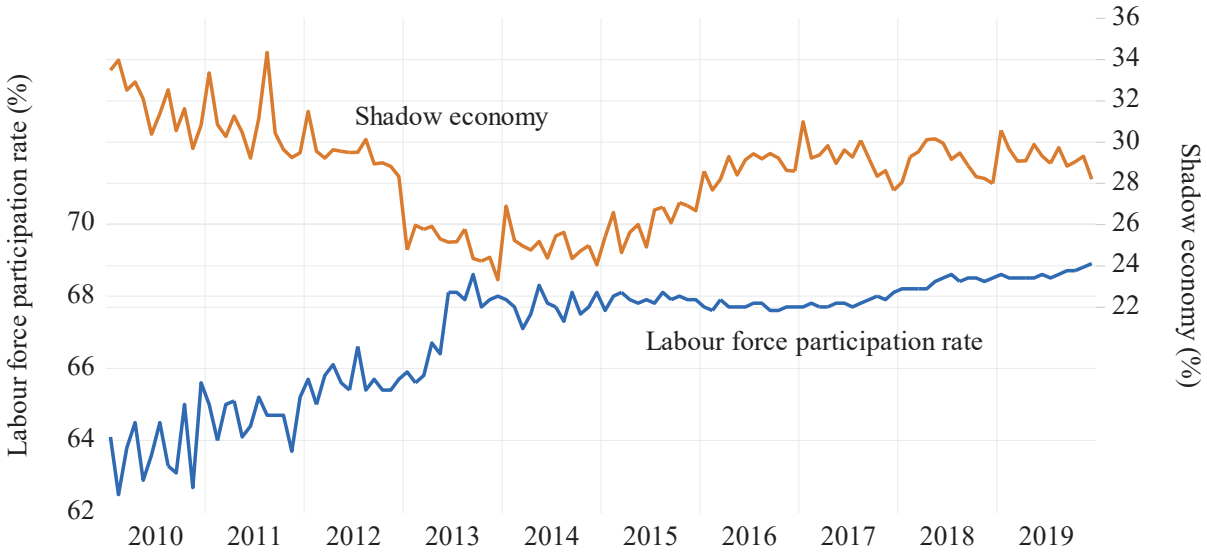

Figure 1: Trends in labour force participation rate and shadow economy, January 2010 – December 2019

About the Authors

Muzafar Shah Habibullah (corresponding author) is a Professor at Putra Business School and Senior Economist at the EIS-UPMCS Centre for Future Labour Market Studies (EU-ERA). He holds a Ph.D. in Economics from the University of Southampton, United Kingdom. His area of specialization includes Applied Macroeconomics, Monetary Economics, and Banking. Throughout his career, he has published more than 500 academic documents including journal articles, books, edited books, chapters in books, and chapters in proceedings.
E-mail: muzafar@putrabs.edu.my; muzafar@upm.edu.my

Badariah Haji Din is an Associate Professor at the School of Government, College of Law, Government and International Studies (COLGIS), Universiti Utara Malaysia (UUM), Sintok, Kedah, Malaysia. She holds a Ph.D. in Public Economics from Universiti Utara Malaysia, Malaysia. Her area of research interest includes Public Economics, Public Financial Management, Shadow Economy, Public Policy and Entrepreneurship.
E-mail: badariahdin@uum.edu.my

Mohd Yusof Saari is an Associate Professor at the School of Business and Economics at Universiti Putra Malaysia. In August 2020, he was seconded to the Office of Employment Insurance System (EIS) as Chief Economist to EIS-UPMCS Centre for Future Labour Market Studies (EU-ERA). He holds a Ph.D. in Economics from the University of Groningen and has written extensively on Development Economics with specific applications of Input-Output, Social Accounting Matrix (SAM) and Applied General Equilibrium models, including some articles published in top academic journals. Yusof is also a prominent speaker and writer in the Malaysian news and printed media.
E-mail: mysaari@gmail.com

Azim Azuan Osman is a Senior Lecturer at the Faculty of Industrial Management (FIM), Universiti Malaysia Pahang (UMP). He holds a Ph.D. in Operation Management from Universiti Utara Malaysia (UUM). His research interests include Lean Management, Survey Methodology, Scale Development and PLS-SEM Data Analysis.
E-mail: azimazuan@ump.edu.my

Hussin Abdullah is a Professor of Monetary Economics at the School of Economics, Finance and Banking (SEFB), UUM COB, Universiti Utara Malaysia teaching Macroeconomics, Monetary Economics and Econometrics. He completed his Ph.D. from Universiti Putra Malaysia, Malaysia. His research interests include the area of Applied Macroeconomics, Monetary Economics and Economic Growth.
E-mail: hussin2142@uum.edu.my

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