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Nonlinear Impact of Financial Development on Shadow Economy in Indonesia

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Nonlinear Impact of Financial Development on Shadow Economy in Indonesia

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Abstract

Motivation and aim: Shadow economy is not uncommon in Indonesia. As a matter of fact, shadow economy contributes significantly to the economy of Indonesia, providing economic opportunities to the people of Indonesia in terms of employment, food and shelter. A study by Asian Development Bank (ADB, 2011) reports the shadow economy to the gross value added of Yogyakarta and Banten was 37% and 27%, respectively. The firms in Yogyakarta and Banten that participate in the shadow economy are significant. Rothenberg, Gaduh, Burger et al. (2016) indicate that 93% of firms in Indonesia were in the shadow economy, however, this firms are mostly small in size; and firms remain in the shadow economy for not able to access the financial markets. One of the reasons given due to the complicated procedures associated in getting loans (ADB, 2011). This paper explores the link between the shadow economy and financial sector development in Indonesia; with the inclusion of control variables such as national income, foreign direct investment (FDI) and misery index.

Methods and material: We calculated the size of the shadow economy in Indonesia for the period 1980 to 2015 by using the modified-cash-deposits-ratio (MCDR) approach. In this study we used several estimators such as Ordinary Least Squares (OLS), Autoregressive Distributed Lag (ARDL), Fully Modified OLS (FMOLS), Dynamic OLS (DOLS) and Canonical Cointegrating Regression (CCR) to estimate the long-run model for the Indonesian shadow economy; we investigated the contention that financial development can mitigate shadow economy – higher level of financial development led to lower level of shadow economy.

Key findings: Results suggest that financial development indicator measured by the ratio of domestic credit to private sector to GDP show non-linear relationship with the size of shadow economy in Indonesia. Economic development or income proxy by real GDP per capita and misery index suggest a positive impact on the size of shadow economy; while increasing foreign direct investment show adverse effect on shadow economy in Indonesia.

Policy implications: Our study reveals that the relationship between shadow economy and financial development in Indonesia is nonlinear and exhibit an inverted U-shape curve; suggesting that shadow economy increases at lower level of financial development but as financial development increases further, shadow economy ultimately decreases. An important policy implication is that the Indonesian government as well as the Central Bank of Indonesia should embark on programs that can discourage people or firm from participating in the shadow economy. Programs on financial inclusion and further reforms of the financial sector should be the focus. For example, by providing avenue for easy access to the credit markets and further reforms of the capital market sector. On the fiscal side, the government of Indonesia should provide programs to reduce poverty and to narrow the income gap in the country. Fiscal policies and incentives that can attract more foreign direct investment into the country should also be given strong considerations.

JEL classification: E26, H26, O17

Key words: Shadow economy, Modified-cash-deposit-ratio, Financial development, Nonlinear, Indonesia

Nonlinear Impact of Financial Development on Shadow Economy in Indonesia

1. INTRODUCTION

Shadow economy is not uncommon in Indonesia. As a matter of fact, shadow economy contributes significantly to the economy of Indonesia, providing economic opportunities to the people of Indonesia in terms of employment, food and shelter. The study by Asian Development Bank (ADB, 2011) reports the activities of shadow economy in the provinces of Yogyakarta and Banten. The contribution of the shadow economy to the gross value added of Yogyakarta and Banten was 37% and 27%, respectively. The firms in Yogyakarta and Banten that participate in the shadow economy are significant. In the agriculture sector they contributed 89% of the gross value added, follow by manufacturing 69%, wholesale and retail trade 53%, and other services 53%. In Banten, the informal firms in the agriculture sector contributed about 87% of gross value added, with wholesale and retail trade 63%, hotels and restaurants 55%, and other services 72%. In another study, Rothenberg, Gaduh, Burger et al. (2016) indicate that 93% of firms in Indonesia were in the shadow economy, however, this firms are mostly small in size. Rothenberg et al. (2016) conclude that (i) firms in the shadow economy are micro small and medium enterprises which significantly contribute to the Indonesian economy; (ii) the firms pay low wages and exhibit low productivity; (iii) entrepreneurs have low educational attainment; and (iv) firms are limited to local markets and rarely expand their business. Rothenberg et al. (2016: p.105) further report that the reason firms may shifted out of the shadow economy because firms will be able "to access formal financial resources, which allows them to borrow large amounts and invest in physical capital or business expansion". Also, formal firms are allowed to legally export their products, and compete for government contracts. On the contrary, firms remain in the shadow economy for not able to access the financial markets. One of the reasons given due to the complicated procedures associated in getting loans (ADB, 2011).

Nevertheless, several studies have attempted to estimates the size of shadow economy in Indonesia. Elgin and Oztunali (2012) estimate the magnitude of the shadow economy involving 161 countries by employing the two-sector dynamic general equilibrium model over the period 1955-2008; and find that the Indonesian shadow economy has decreased steadily from 34% in

1970 to 18% in 2008. Alm and Embaye (2013) estimate the size of the shadow economy for 111 countries using the generalized method of moments for the period 1984-2006 and similarly for Indonesia, the size of shadow economy has decreased from 57% in 1984 to 36% in 2006. Tan, Habibullah, Kaliappan and Radam (2017) estimate the size of shadow economy for a panel of 80 countries using the pooled mean group (PMG) estimator and the estimates for Indonesia's shadow economy averages 28% for the period 1984 to 2012. On the other hand, Medina and Schneider (2018) by using a combination of the multiple indicators multiple causes (MIMIC) procedure and the currency demand models; they have estimated the size of the shadow economy for 158 countries including Indonesia for the periods 1991 to 2015. For the 25 years period, Indonesia's shadow economy averages 19.8% of the official GDP, and it is on a declining trend.

On the other hand, Wibowo and Sharma (2005), Panjaitan (2007), Nizar and Purnomo (2011), Samuda (2016), Azwar and Mulyawan (2017) and Ramadhan (2019) estimate the size of shadow economy for the Indonesian economy using the currency demand model. Both estimates by Wibowo and Sharma, and Panjaitan suggest shadow economy in Indonesia is on an increasing trend. Wibowo and Sharma (2005) report shadow economy has increased from 9.6% in 1976 to 46.4% in 1999; while Panjaitan (2007) indicate shadow economy rose from 68% in 1973 to 97% in 2004. The average size of shadow economy for Indonesia is 22.2% for the 24 years period reported by Wibowo and Sharma (2005); while Panjaitan (2007) reports an average size of 86% for the 32 years period. However, smaller size of shadow economy for Indonesia was reported by Nizar and Purnomo (2011), Samuda (2016), Azwar and Mulyaman (2017) and Ramadhan (2019). Nizar and Purnomo (2011) report an average of 5.6% for the 10 years period; Samuda (2016) 8.0% for the 13 years period; Azwar and Mulyawan (2017) 22.1% for the 5 years period; and Ramadhan (2019) 7.6% for the 18 years period.

The above premises suggest that different methods were used to estimate the size of the shadow economy in Indonesia. Nevertheless, according to Berger, Pickhardt, Pitsoulis, Prinz and Sarda (2014) that there is no one method that is ideal to estimate the size of the shadow economy exists. Thus, the purpose of this paper is two-fold. First, to re-estimate the size of shadow economy for Indonesia using the modified-cash-deposit-ratio procedure proposed by Pickhardt and Sarda (2011, 2015). This approach offers a 'reasonable' estimate of the shadow economy (Pickhardt & Sarda, 2011, 2015) and according to Breusch (2005a, 2005b, 2005c) does not suffer from serious econometrical and mathematical flaws. And secondly, to investigate the nonlinear relationship between shadow economy and financial development in Indonesia. In view of this, the paper is organized as follow. In the next section we discuss the literature that relates financial development and shadow economy; and in section 3 is the method used in the analysis. Section 4 presents the results, while the last section contains our conclusion.

2. REVIEW OF RELATED LITERATURE

Studies have indicated that there are various reasons why people remain and participate in the shadow economy. Tax burden either direct or indirect taxation, social security contribution, regulation, tax morale, unemployment rate, and harsh economic conditions encourage people to enter the shadow economy (Schneider, 2005; Dell'Anno & Solomon, 2008; Bajada & Schneider, 2005). Other factors pushing people into the shadow economy includes government spending or consumption (Vo & Ly, 2014; Wang, Lin, & Yu, 2006; Buehn & Schneider, 2012); weak government and bad governance (Friedman, Johnson, Kaufman, & Zoido-Lobaton, 2000; Manolas, Rontos, Sfakianakis, & Vavouras, 2013); lack of trust for the government (D'Hernoncourt & Meon, 2012); crime rate (Wang et al., 2006); and inflation (Bittencourt, Gupta, & Stander, 2014).

On the other hand, studies have also indicated that the lack of access to the financial or credit markets could encourage people to participate in the shadow economy. The proponents of this strand of studies postulate that with the absence of asymmetric information, individual or firm will have easy access to the credit market and will benefited by increasing their output through the use of the borrowed financing. Bose, Capasso and Wurm (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.

The contention made by Bose et al. (2012) is supported by Blackburn, Bose and Capasso (2012) that explained the connection between shadow economy activity and the credit market development using a simple model of tax evasion and financial intermediation. According to Blackburn et al. (2012) potential borrowers are required to declare their income or wealth in order to acquire a loan to finance their investment. The amount of wealth will determine the amount of collateral for securing a loan and also the type of terms and conditions of the loan contract made available to them. The less wealth been declared, the less collateral to secure the required loan, and the worse will be the terms and condition of the loan contract. As a consequence, the credit arrangement is worsened in a country with low level of financial development. Thus, the benefit of wealth disclosure increases with the level of financial development with the implication that individual or firm participate in the shadow economy decline as the economy moves from a low to high level of financial development.

On one hand, Capasso and Jappelli (2013) put forward that for a firm to earn high-return technology investment, firms have to acquire external funding. However, this kind of investment is expensive and costly. Nevertheless, firm can reduce the cost of funding by disclosing part or all of their assets and pledging them as collateral. The disclosure decision, however, also involves higher tax payments and reduces tax evasion. Their model predicts that financial development (a reduction in the cost of credit) induces firm to disclose more assets and to invest in a high-tech project, and an improvement in the judicial efficiency reduces the cost of credit and the size of the shadow economy. Bittencourt et al. (2014), on the other hand, argue that countries with higher level of financial development will have a lower cost of monitoring provided that borrowers are willing to declare their income to the bank. However, borrowers that choose to undeclared their income to the bank will be subjected to higher costs of access to and conditions of obtaining loans. These higher costs and with lower level of financial development, will provides an incentive for borrowers to participate in the shadow economy.

Does financial development reduce the size of shadow economy? What does the evidence say? It seems that the available empirical evidences support this contention. Bayar and Ozturk (2016) investigate the effects of financial development and institutional quality on shadow economy in nine European Union transition economies for the period 2003-2014. Using the Basher and Westerlund (2009) cointegration test, they found that both financial development and institutional quality reduced shadow economy in the long-run. Berdiev and Saunoris (2016) examine the dynamic relationship between financial development and the shadow economy for 161 countries over the period 1960-2009 by employing the panel vector autoregression model. Their results also indicate that financial development reduces shadow economy. Similar finding was also reach by Bayar and Aytemiz (2017) for Turkey. Using Maki (2012) cointegration test, Bayar and Aytemiz (2017) found that financial development has adverse effects on shadow economy in Turkey for the period 1960-2009. On the other hand, Henri (2018) investigates the impact of financial development on shadow economy in a panel of 41 Sub-Saharan African countries for the period 1991-2015. Using both static and dynamic panel data analysis, his study suggests that financial development has negative and significant effect on the shadow economy in the Sub-Saharan African countries. For Malaysia, the work by Habibullah, Din, Yusof-Saari and Baharom (2016), Din (2016) and Din, Habibullah and Baharom (2019) and Habibullah, Baharom, Din and Furuoka (2017) also found financial development can play an important role in mitigating the size of the shadow economy.

3. MODELLING INDONESIA'S SHADOW ECONOMY

In this study we specify Indonesia's long-run model for shadow economy by following the work of Schneider (2005), Dell'Anno and Solomon (2008), Bajada and Schneider (2005), Vo and Ly (2014), Buehn and Schneider (2012), and Bittencourt et al. (2014) as follow,

$$\mathrm{se_t} = \theta_0 + \theta_1\mathrm{rgdppc_t} + \theta_2\mathrm{findev_t} + \theta_3\mathrm{findev_t^2} + \theta_4\mathrm{fdigdp_t} + \theta_5\mathrm{misery_t} + \varepsilon_t \qquad (1)$$

where $\mathrm{se_t}$ is the size of shadow economy (% to GDP) as discussed below; $\mathrm{rgdppc_t}$ is real GDP per capita to measure economic development or income or wealth of a nation; $\mathrm{findev_t}$ is financial sector development indicator; while $\mathrm{findev_t^2}$ is financial sector development squared to establish whether the relationship between shadow economy and financial sector development is non-linear; $\mathrm{fdigdp_t}$ is the ratio of foreign direct investment net inflow to GDP; and $\mathrm{misery_t}$ is the misery index calculated as inflation rate plus unemployment rate. All variables are in logarithm.

If our data support the contention made by Blackburn et al. (2012) and Bose et al. (2012) in which the relationship between shadow economy and financial development exhibit an inverted U-shape curve, we would expect a *priori* that $\theta_2 > 0$ and $\theta_3 < 0$. This will imply that at lower stage of financial development shadow economy is increasing until at some turning point after which at higher level of financial development shadow economy starts to decrease. For the other variables, it is expected that the parameters, $\theta_1, \theta_5 > 0$ and $\theta_4 < 0$. The error term, ε_t is expected to well behave with mean zero and constant variance. In this study we employ two measures of financial development – the ratio of money supply M2 to GDP (m2gdp), and the ratio of domestic credit to private sector to GDP (dcgdp). Similar proxy for financial development impact on shadow economy were used by Berdiev and Sauronis (2016), Habibullah et al. (2017) and Henri (2018).

For the control variables, the impact of real GDP per capita as a proxy for income on the shadow economy is ambiguous. Pickhardt and Sarda (2015) point out that the expected sign of real GDP is difficult to predict as it might depend on both the structure and development stage of the shadow economy under consideration. However, for the developed countries a negative sign for real GDP is more likely (see Schneider, 2008; Gaspareiene, Remeikiene & Heikklia, 2016). On the other hand, the studies by Bajada (2003), Giles (1997), Ferreira-Tiryaki (2008) and Granda-Carvajal (2010) on the business cycle of the shadow economy demonstrate that shadow economy and real GDP, consumption and investment are procyclical. This implies positive correlation between shadow economy and output, and that shadow economy and real GDP move parallel over time. Nevertheless, we would expect that the impact of income or real GDP per capita on shadow economy in Indonesia is positive. In Indonesia, income inequality remains low (OECD, 2015) and as such an increase in economic growth, widens the income disparity between the rich and the poor; and since the poor depends their livelihood on the activities in the shadow economy, the size of shadow economy will increase further.

As for the foreign direct investment, studies have reported that FDI inflows stimulates economic growth through spillover effects such as technology transfers, capital accumulation, higher income per capita, higher productivity growth, higher exports and human capital development (Opoku, Ibrahim, & Sare, 2019; Almasaied, Baharumshah, & Rashid, 2008). FDI is also important for tax revenue for government of any nations. FDI are attracted to countries that have better institutional quality and good governance with strong protection of property rights (Lee, Alba, & Park, 2018; Huynh, Nguyen, Nguyen, & Nguyen, 2019). Thus, the presence of FDI provides economic opportunity for employment and better institutional quality, will ultimately reduce shadow economy. Studies by Nikopour, Habibullah, Schneider and Law (2009), Davidescu (2015) and Huynh et al. (2019) indicate that FDI has a negative effect on the size of shadow economy.

Misery index measures the "hardship" of the population of a country. The combine effects of both inflation and unemployment rates will push people into the shadow economy seeking for employment in order to substantiate their income as well as looking for cheaper goods and services. Inflation reduces the purchasing power of their wages, while unemployment denies any income that could have been earned if the economic situation is better. Thus, high inflation rate and unemployment rate will increase the size of the shadow economy as more people participate in the underground activities to support their livelihood. Studies that show positive relationship between unemployment and shadow economy includes Dell'Anno and Solomon (2008), Sahnoun and Abdennadher (2019), and Bajada (2009). On the other hand, inflation affect shadow economy positively are found by Mazhar and Meon (2017) and Baklaouti and Boujelbene (2019). Study by Bittencourt et al. (2014) conclude that "lower (higher) levels of financial development and higher (lower) inflation causes a bigger (smaller) shadow economy.

4. METHOD OF ESTIMATIONS

Estimating the long-run model as per Equation (1) is a challenge as we are dealing with time series variables which are normally non-stationary. Running Equation (1) using ordinary least square (OLS) will result in spurious regression unless we can establish that there is cointegration among the variables (i.e., long-run relationship among the variables). The most common method to test for cointegration is the Engle-Granger two-step procedure. However, to employ this cointegration procedure we must establish that all variables in their level are in the same order of integration, that is, they are all I(1); meaning that the series will becomes stationary (i.e. I(0)) after first-differencing. To test whether the series is I(0) or I(1) in their level, we need to employ the unit root test. The most common unit root test is the augmented Dickey-Fuller (Dickey & Fuller, 1981) unit root test. However, in this study we will employ a more efficient unit root test proposed by Elliot, Rothenberg and Stock (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: 813) found that their "DF-GLS test has substantially improved power when an unknown mean or trend is present."

To test for cointegration and to estimate the long-run model, in this study, we employ several estimators. First, the use of the Ordinary Least Square (OLS) with robust standard error due to Newey-West (Newey & West, 1987) heteroskedasticity and autocorrelation consistent (HAC) estimates of the standard error on Equation (1). An important property of robust standard errors is that the form of the heteroskedasticity and/or autocorrelation does not need to be specified. The residual of the estimated regression is then saved. In the second step, we test the residual for unit root. This is the conventional Engle and Granger (1987) two-step procedure for testing the null hypothesis of non-cointegration or the present of unit root in the residuals. We test the residual whether they are I(0) or I(1) using the standard augmented Dickey-Fuller unit root test. If the residual is stationary or I(0), we can conclude that there is cointegration implying that there is long-run relationship between shadow economy and its determinants.

Second, the use of the Dynamic OLS (DOLS), Fully-modified OLS (FMOLS) and canonical cointegrating regression (CCR) which are more efficient and robust especially in small samples and to the problem of heteroscedasticity, autocorrelation and non-normality of the errors. Stock and Watson (1993) propose the DOLS; Park (1992) presents the CCR; while Phillips and Hansen (1990) recommend the FMOLS. The possible simultaneity bias and small sample bias among the regressors can be corrected through DOLS procedure by regressing one of the I(1) variables on other I(1) variables, the I(0) variables, and lags and leads of the first difference of the I(1) variables. Taking the variables with first difference and the associated lags and leads will eliminate simultaneity bias and small sample bias inherent among regressors. In contrast, FMOLS procedure was developed to eliminate bias in small sample as well as to correct endogeneity and serial correlation effects. The CCR is almost identical to FMOLS, however engage with stationary transformation of the time series data to obtain least squares estimates to eliminate the long-run dependence between the cointegrating equation and stochastic regressors innovations. Park (1992) reveals that the endogeneity problem from the long-run correlation of the cointegrating equation errors and stochastic regressors innovations, as well as asymptotic bias caused by the contemporaneous correlation between the regression and stochastic regressor errors can be removed and corrected by the transformations of the CCR. To test for cointegration when using the FMOLS, DOLS and CCR estimators, we employ the

Hansen (1992) instability test. According to Hansen (1992), the L_c statistics is a LM test statistic and can be used to test for the null hypothesis of cointegration against the alternative of no cointegration.

Third, we employ the Autoregressive distributed lag (ARDL) proposed by Pesaran, Shin and Smith (2001). ARDL procedure is robust to a mixed of I(0) and I(1) variables, small sample properties and endogeneity with good enough lags structure in the model. According to Pesaran et al. (2001), the validity of the long-run model as per Equation (1) can be tested using cointegration Bound F-test. If Equation (1) exhibit cointegration, then the long-run model is non-spurious. To test for cointegration, Pesaran et al. (2001) proposed estimating the bound F-test statistics by running the following conditional error-correction model (ECM) model as follows;

$$\Delta se_t = \alpha_0 + \alpha_1 se_{t-1} + \alpha_2 rgdppc_{t-1} + \alpha_3 findev_{t-1} + \alpha_4 findev^2_{t-1} + \alpha_5 fdigdp_{t-1} + \alpha_6 misery_{t-1} + \sum_{i=1}^{p} \gamma_{1i} \Delta se_{t-i} + \sum_{i=0}^{q} \gamma_{2i} \Delta rgdppc_{t-i} + \sum_{i=0}^{r} \gamma_{3i} \Delta findev_{t-i} + \sum_{i=0}^{s} \gamma_{4i} \Delta findev^2_{t-1} + \sum_{i=0}^{v} \gamma_{5i} \Delta fdigdp_{t-i} + \sum_{i=0}^{w} \gamma_{6i} \Delta misery_{t-i} + \epsilon_t \quad (2)$$

The bound-F test were tested on whether $\alpha_1 = \alpha_2 = \alpha_3 = \alpha_4 = \alpha_5 = \alpha_6 = 0$ (null hypothesis) versus $\alpha_1 \neq \alpha_2 \neq \alpha_3 \neq \alpha_4 \neq \alpha_5 \neq \alpha_6 \neq 0$ (alternative hypothesis). The long-run cointegrating relationship is identified when the computed F-statistic is compared with the bound critical value tabulated by Narayan (2005) for small sample size. The null hypothesis of no cointegration is rejected when the computed F-statistic exceeds the upper bounds of critical value that the variables are cointegrated. On the other hand, the variables are not cointegrated if the null hypothesis of no cointegration is not rejected where the estimated F-statistic falls below the lower bounds of critical value. If the calculated F-statistic falls between the upper and lower bounds of critical values, the decision is inconclusive. Rejection of the null hypothesis meaning that there is cointegration and the long-run model as per Equation (1) is valid. Equation (2) must pass the non-serial correlation test with optimum lag length chosen using the Schwartz criteria proposed by Pesaran et al. (2001).

According to Pesaran et al. (2001), the long-run model as per Equation (1) can be derived from model (2). Note that in the long run, $\Delta = 0$ and $se_{t-1} = se_t$ and so on, after rearranging terms, thus we have,

$$se_t = -\frac{\alpha_0}{\alpha_1} - \frac{\alpha_2}{\alpha_1} rgdppc_t - \frac{\alpha_3}{\alpha_1} findev_t - \frac{\alpha_4}{\alpha_1} findev_t^2 - \frac{\alpha_5}{\alpha_1} fdigdp_t - \frac{\alpha_6}{\alpha_1} misery_t - \frac{1}{\alpha_1} \epsilon_t \quad (3)$$

And we have,

$$se_t = \theta_0 + \theta_1 rgdppc_t + \theta_2 findev_t + \theta_3 findev_t^2 + \theta_4 fdigdp_t + \theta_5 misery_t + \varepsilon_t \quad (1')$$

where $\theta_0 = -\frac{\alpha_0}{\alpha_1}$, $\theta_1 = -\frac{\alpha_2}{\alpha_1}$, $\theta_2 = -\frac{\alpha_3}{\alpha_1}$, $\theta_3 = -\frac{\alpha_4}{\alpha_1}$, $\theta_4 = -\frac{\alpha_5}{\alpha_1}$, $\theta_5 = -\frac{\alpha_6}{\alpha_1}$, and $\varepsilon_t = -\frac{1}{\alpha_1}\epsilon_t$.

Once we have estimated the long-run model, we can also estimate the short-run model, i.e. the error-correction model as follows,

$$\Delta se_t = \varphi_0 + \pi ECT_{t-1} + \sum_{i=1}^{p} \varphi_{1i} \Delta se_{t-i} + \sum_{i=0}^{q} \varphi_{2i} \Delta rgdppc_{t-i} + \sum_{i=0}^{r} \varphi_{3i} \Delta findev_{t-i} + \sum_{i=0}^{s} \varphi_{4i} \Delta findev_{t-i}^2 + \sum_{i=0}^{v} \varphi_{5i} \Delta fdigdp_{t-i} + \sum_{i=0}^{w} \varphi_{6i} \Delta misery_{t-i} + \mu_t \quad (4)$$

where $ECT_{t-1} = \varepsilon_{t-1} = se_{t-1} - [\theta_0 + \theta_1 rgdppc_{t-1} + \theta_2 findev_{t-1} + \theta_3 findev_{t-1}^2 + \theta_4 fdigdp_{t-1} + \theta_5 misery_{t-1}]$. Equation (4) must pass the non-serial correlation test. The significance and the negative values of the estimated coefficient, π would indicate cointegration. The estimated parameter π, would lies between 0 and -2 (see Fromentin & Leon, 2019; Samargandi, Fidrmuca, & Ghosh, 2015; Loayza & Rancière, 2006).

According to Pesaran et al. (2001), as in MICROFIT, the long-run model (Equation 1) was derived from the following ARDL model in levels,

$$se_t = \beta_0 + \sum_{i=1}^{p} \beta_{1i} se_{t-i} + \sum_{i=0}^{q} \beta_{2i} rgdppc_{t-i} + \sum_{i=0}^{r} \beta_{3i} findev_{t-i} + \sum_{i=0}^{s} \beta_{4i} findev_{t-i}^2 + \sum_{i=0}^{v} \beta_{5i} fdigdp_{t-i} + \sum_{i=0}^{w} \beta_{6i} misery_{t-i} + \eta_t \quad (5)$$

where the long-run model can be derived as,

$$se_t = \frac{\beta_0}{1-\sum\beta_{1i}} + \frac{\sum\beta_{2i}}{1-\sum\beta_{1i}} rgdppc_t + \frac{\sum\beta_{3i}}{1-\sum\beta_{1i}} findev_t + \frac{\sum\beta_{4i}}{1-\sum\beta_{1i}} findev_t^2 + \frac{\sum\beta_{5i}}{1-\sum\beta_{1i}} fdigdp_t + \frac{\sum\beta_{6i}}{1-\sum\beta_{1i}} misery_t + \frac{1}{1-\sum\beta_{1i}} \eta_t,$$ and we have,

$$se_t = \theta_0 + \theta_1 rgdppc_t + \theta_2 findev_t + \theta_3 findev_t^2 + \theta_4 fdigdp_t + \theta_5 misery_t + \varepsilon_t \quad (2")$$

where $\theta_0 = \frac{\beta_0}{1-\sum\beta_{1i}}$, $\theta_1 = \frac{\sum\beta_{2i}}{1-\sum\beta_{1i}}$, $\theta_2 = \frac{\sum\beta_{3i}}{1-\sum\beta_{1i}}$, $\theta_3 = \frac{\sum\beta_{4i}}{1-\sum\beta_{1i}}$, $\theta_4 = \frac{\sum\beta_{5i}}{1-\sum\beta_{1i}}$, $\theta_5 = \frac{\sum\beta_{6i}}{1-\sum\beta_{1i}}$, and $\epsilon_t = \frac{1}{1-\sum\beta_{1i}}\eta_t$. Equation (5) must pass the non-serial correlation test with optimum lag length.

Sources of Data

In this study, we employ annual time-series data for the period 1980 to 2015. Data on gross domestic product (GDP), real GDP (2010=100) per capita, foreign direct investment net inflow, broad money supply (M2), domestic credit to private sector, inflation and unemployment rates (for misery index) were compiled from the World Development Indicators published online and accessible at the World Bank database (see http://data.worldbank.org/indicator). Foreign direct investment net inflow, broad money supply (M2), and domestic credit to private sector were expressed as ratios to GDP; while misery index equals to inflation rate plus unemployment rate. Misery index will measure the "hardship" of the population of a country.

For the measurement of the size of shadow economy in Indonesia, we following Pickhardt and Sarda (2011, 2015) by using the following modified-cash-deposit-ratio (MCDR),

$$\frac{CC_t - CC_0}{CC_0 + DD_t} = \frac{Y_{Ut}}{Y_{Lt}} \quad (6)$$

where CC_t denotes currency in circulation at the end of year t; CC_0 is currency in circulation at the end of base year, here 1980; DD_t represents demand deposits at the end of year t; Y_{Lt} and Y_{Ut} denote the size of the legal and shadow economy respectively. Thus, Y_{Ut}/Y_{Lt} measures the share of shadow economy to the legal economy (official GDP). This approach has been applied for Malaysia as well by Habibullah and his colleagues (see for example, Habibullah et al., 2016; Din, 2016; Habibullah et al., 2017; Din et al., 2019). Data on currency in circulation and demand deposits were collected from various issues of the Key Indicators for Asia and the Pacific published by Asian Development Bank.

Thus, having estimate the size of the shadow economy for Indonesia for the period 1981-2015, we endeavor in this study to investigate the determining factors affecting shadow economy. Our focus is to test the conjecture made by Bose et al. (2012) and Blackburn et al. (2012) on the role of the financial sector development as a conduit to reduce shadow economy. Other determining factors included in the study as the control variables are national income or wealth of the nation, foreign direct investment and misery index.

5. THE EMPIRICAL RESULTS

The results of the unit root test for the order of integration of the series using the DF-GLS procedure is presented in Table 1. The unit root test results clearly indicate that all variables are I(1), that is the series achieved stationarity after differencing once. These results suggest that all variables are non-stationary in levels and their first-differences are stationary, that is, they are I(0). Thus, a consequence of regressing such integrated variables will produce spurious regression results. Spurious regression results will imply that inferences cannot be made and hypothesis testing will be invalid. Thus, estimating Equation (1) using OLS will result in spurious regression unless the variables are cointegrated. A cointegrating regression implies a long-run model for the shadow economy as specified in Equation (1). It also implies that there are long-run relationships between shadow economy and its determinants. Since all variables are I(1), that is they are of the same order of integration we can then proceed for the test of cointegration among the variables by using the Engle-Granger two-steps procedure for the OLS, bound F-test for ARDL, and using the Hansen test for the FMOLS, DOLS and CCR. For OLS we indicate the E-G test t-statistics, and the L_c statistics is for FMOLS, DOLS and CCR. On the other hand, for ARDL we presented both the F-bounds statistics and the ect_{t-1} t-statistics.

Tables 2 and 3 present the results of the cointegration tests as well as the estimated long-run models for Indonesian shadow economy for all five estimators, for M2 (m2gdp) and domestic credit (dcgdp) as financial development indicators, respectively. In Table 2, cointegration is detected for OLS, ARDL, DOLS and CCR. In all four cases the null hypothesis of non-cointegration is rejected for OLS and ARDL, while the null hypothesis of cointegration cannot be rejected for DOLS and CCR. The E-G test statistic, Bound F-test statistic, and ect_{t-1} t-statistic are significant at the 1% level, while the L_c statistic is insignificant for DOLS and CCR. Thus, the estimated long-run models for the Indonesian shadow economy by using OLS, ARDL, DOLS and CCR are non-spurious.

Results in Table 2 indicates that all variables in the long-run models are significant at least at the 5% significant level except for fdigdp and misery index in the DOLS estimation. Furthermore, all estimated coefficient shows the expected sign. As for our variable of interest, the estimated coefficients for the financial development indicator - ratio of M2 to GDP, show that $\hat{\theta}_2 > 0$ and $\hat{\theta}_3 < 0$, thus portraying an inverted U-shape curve. This is in line with the contention made by Bose et al. (2012) and Blackburn et al. (2012) that at lower level of financial development, shadow economy increases up to a certain point, however, beyond that saturation point, as financial development become more sophisticated, the size of the shadow economy starts to decrease. The saturation point beyond which the shadow economy starts to decline is 4.35 for OLS, 4.31 for ARDL, 4.48 for DOLS and 4.36 for CCR. Our results indicate that the long-run relationship between shadow economy and financial development in Indonesia is non-linear.

On the other hand, the income variable proxy using real GDP per capita suggests that the impact on shadow economy is positive. This implies that higher economic growth does not mitigate the size of the shadow economy in Indonesia but instead tend to push people or firm to participate in the shadow economy. This is because with higher economic growth and if the income or wealth is not distributed equally to the population, and couple with the increase in unemployment and inflation rate, people and firm are force into the shadow economy. The positive relationship between the misery index and the shadow economy clearly suggest this is the case in Indonesia where the poverty rate is more than 9% and income disparity is widening. On the other hand, the impact of fdigdp on the size of shadow economy is negative. An increase in the FDI inflows in the country, reduces the size of the shadow economy. Thus, there is an important role that foreign direct investment can play an important role in reducing the size of the shadow economy in Indonesia.

Table 3 shows the results of cointegration tests using the ratio of domestic credit to private sector to GDP (dcgdp) as proxy for financial development in Indonesia. Among the five estimators, cointegration are found for OLS, ARDL and DOLS; where the null hypothesis of non-cointegration was rejected for OLS and ARDL and the null hypothesis of cointegration cannot be rejected for DOLS. All variables show expected sign in all models except for fdigdp in ARDL which show positive effects on shadow economy. For DOLS, all variables are significant while misery index in OLS and ARDL and rgdppc, dcgdp and dcgdp^2 in ARDL are not significant. Nonetheless, results in Table 3 suggest that financial development indicator measured by the ratio of domestic credit to private sector to GDP show non-linear relationship with the size of shadow economy in Indonesia, with $\hat{\theta}_2 > 0$ and $\hat{\theta}_3 < 0$ in all OLS, ARDL (although not significant) and DOLS. For the case of dcgdp, the turning point is 4.25 for OLS and 4.22 for DOLS.

Further Analysis with Quantile Regressions

One strong simplification of the OLS estimates is that the explanatory variables determine the effects on the mean of the conditional distribution of the dependent variable. To allow the effects of the regressors on the entire conditional distribution of the dependent variable, we employ the quantile regression (Koenker & Basset, 1978). Quantile regression allows the estimated parameters (slopes) to differ at different points of the conditional distribution of the dependent variable. Since quantile regression is nonparametric procedure, it does not impose any functional form on the shadow economy relationship. Furthermore, quantile regression is not sensitive to the presence of outliers. Therefore, a number of different quantile regressions give us a more complete description of the underlying conditional distribution.

The quantile regression is defined as follows

$$\text{se}_t = x_t'\beta_\tau + \mu_{\tau t} \qquad 0<\tau<1 \qquad (7)$$

$$\text{Quantile}_\tau(\text{se}_t|x_t) = x_t'\beta_\tau \qquad (8)$$

wherex_t' equals a vector of explanatory variables as defined above, β_τ equals the vector of parameters associated with the τ-th percentile, and $\mu_{\tau t}$ equals an unknown error term. The $\text{Quantile}_\tau(\text{se}_t|x_t) = x_t'\beta_\tau$ equals the τ-th conditional quantile of se given x with $\tau \in (0,1)$. By estimating β_τ, using different values of τ, quantile regression permits different parameters across different quantiles of shadow economy. In other words, repeating the estimation for different values of τ between 0 and 1, we trace the distribution of se conditional on x and generate a much more complete picture of how explanatory variables affect the dependent variable. The τ-th quantile regression estimates β_τ, by solving the following minimization problem and the median regression occurs when $\tau = 0.5$ and the coefficients of the absolute values both equal one.

$$\hat{\beta}(\tau) = \arg\min_\beta \Big[\sum_{\{se_t \geq x_t'\beta\}} \tau |se_t - x_t'\beta| + \sum_{\{se_t < x_t'\beta\}} (1-\tau)|se_t - x_t'\beta| \Big]. \quad (9)$$

Table 4 displays the variables used in the analysis. The descriptive statistics illustrate that the mean values of the variables are close to the median values. Nevertheless, the skewness measure is negative for the majority of the variables which shows that the time series are skewed to the left. The kurtosis statistic is more than 3 for se (shadow economy), m2gdp, fdigdp and misery, demonstrating that these series have flatter tails compared to the normal distribution. The Jarque-Bera test clearly suggests that the null hypothesis of normality is rejected for these series except rgdppc, $m2gdp^2$ dcgdp, and $domcredit^2$. Furthermore, the p-values of the Anderson and Darling (1954) goodness of fit test rejected the null hypothesis of normality for all series except rgdppc and dcgdp. It seems that the majority of the data distribution is not normal, thus quantile regression can provide more efficient estimates for detecting the relationship between shadow economy and its determinants for Indonesia.

Table 5 presents the results from running the quantile regressions for both financial development indicators - Panel A for ratio of M2 to GDP (m2gdp), while Panel B for ratio of domestic credit to private sector to GDP (dcgdp). We estimate quantile regression for 20^{th}, 30^{th}, … 70^{th} and 80^{th}quantiles. In the table we report the pseudoR^2 a quantile measure of goodness of fit. The pseudo R^2 decreases from the lower to the higher quantiles in both panels, which indicates that the model explains the size of the shadow economy in the lower quantiles better than the size of the shadow economy in the higher quantiles.

The Wald tests for symmetry and the slope equality are presented in Table 5. According to Koenker and Basset (1982), the slope equality test is also a robust heteroscedasticity test. The Wald tests of slope equality equal 12.84 and 8.84 for M2 and domestic credit with p-values equal to 0.801 and 0.963, respectively. We may conclude that the coefficients do not differ statistically across the values of the quantiles and the conditional quantiles are similar. On the other hand, the Wald test of quantile symmetry gives 17.43 and 17.52 with p-values equal to 0.967 and 0.965, respectively. This indicates that coefficients across quantiles do not deviate from symmetry.

As presented in Table 5, Panels A and B, overall, the estimated quantile regressions perform well. Most of the variables are statistically significant at the 1% level of significance (except for misery index) with expected signs that vary with quantiles. The role the financial development can play as a mitigating factor for the size of shadow economy in Indonesia is strongly supported by the results of the quantile regression. In both panels, the estimated coefficients for the financial development indicators demonstrate a quadratic curve, and inverted U-shape curve with $\hat{\theta}_2 > 0$ and $\hat{\theta}_3 < 0$. Thus, the nonlinear relationship between shadow economy and financial development is supported by the quantile regression, at all distribution of the size of the shadow economy (at all quantiles). The turning point at which the shadow economy starts declining as the financial development expand further ranges from 4.34 to 4.40 in Panel A; and from 4.20 to 4.29 in Panel B. Comparing the estimated turning point from OLS, the results suggest that the turning points obtained from quantile regression are generally greater than those obtained from OLS for panel A, but on the other hand, the turning point from OLS is lesser than the results obtained from the quantile regression for Panel B. Nevertheless, our results support the contention made by Bose et al. (2012) and Blackburn et al. (2012) that pursuing financial development sophistication will reduce the size of the shadow economy. The Indonesian financial data support this contention.

On the other hand, the other mitigating factor in reducing the size of the shadow economy for the Indonesian government to consider is the role of the foreign direct investment. In both panels, fdigdp is statistically significant at the 1% level, mostly at all quantiles, but with declining impact. The estimated coefficients were higher at the lower quartiles and as we move to the higher quantile the coefficients become smaller. For example, at lower 30thquantile a 10% increase in fdigdp, the size of shadow economy reduces by 1.4%, but at higher 70thquantile, a 10% increase in fdigdp, reduces the size of shadow economy by 1.1%. Similar findings on the reducing effects of fdigdp on the size of the shadow economy is shown by the results in Panel B. Our results suggest that the impact of foreign direct investment in reducing the size of the shadow economy is stronger at the lower quantile compared to when the size of the shadow economy move at the higher quantile.

Lastly, our results in Table 5 indicate that both the income and misery index have positive impact on the size of the shadow economy in Indonesia at all quantiles for income, while at higher quantiles for misery index. In Indonesia, our results suggest that economic growth does not guarantee economic opportunity for all the population, thus imply that some people are force to participate in the shadow economy. However, the impact of income on the size of the shadow economy is larger at the lower quantiles compare to the higher quantiles. For example, at 20^{th} quantile a 10% increase in income will increase the size of the shadow economy by 8.9%, but at the 80^{th}quantile it increases shadow economy only by 5.2%. Similar trend is also shown in Panel B. On the other hand, the positive impact of the misery index on the size of the shadow economy is only felt at the higher quantiles. Thus, at the lower quantiles, the people of Indonesia can endure the “hardship” but not at the higher quantiles.

6. CONCLUSION

In this study, the size of the shadow economy for Indonesia was estimated for the period 1980 to 2015. We then relate the size of the shadow economy with its determinants – income, financial development, foreign direct investment and “hardship” measured by the misery index. For the analysis, we employ several estimators – OLS, ARDL, FMOLS, DOLS, CCR and the quantile regression analysis. Generally, our estimated long-run models suggest that increasing income and misery index increases the size of the shadow economy in Indonesia. With the present poverty rate of more than 9% and a widening income disparity among the population, economic growth does not do much help to reduce the size of the shadow economy. The mounting pressure from the hardship of living in poor condition, people are push into the shadow economy.

Our results further suggest that the inflow of foreign direct investment into the country able to mitigate the size of the shadow economy in Indonesia. The establishment of big foreign firm benefits the population and the Indonesian economy. Big multinational corporations are attracted to invest in countries having good infrastructure, better institutional quality and good governance that protects property rights; while the people is benefited with employment opportunities, and tax revenue for the government. Thus, foreign direct investment can act as a conduit to reduce the size of the shadow economy in Indonesia.

Importantly, our study reveals that the relationship between shadow economy and financial development in Indonesia is nonlinear and exhibit an inverted U-shape curve; suggesting that shadow economy increases at lower level of financial development but as financial development increases further, shadow economy ultimately decreases. Our findings support the earlier work of Bose et al. (2012), Blackburn et al. (2012) and also Bittencourt et al. (2014). An important policy implication is that the Indonesian government as well as the Central Bank of Indonesia should embark on programs that can discourage people or firm from participating in the shadow economy. Programs on financial inclusion and further reforms of the financial sector should be the focus. For example, by providing avenue for easy access to the credit markets and further reforms of the capital market sector. On the fiscal side, the government of Indonesia should provide programs to reduce poverty and to narrow the income gap in the country. Fiscal policies and incentives that can attract more foreign direct investment into the country should also be given strong considerations.

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Table 1: Results of DF-GLS unit root tests

Series	Level: Intercept	Level: Intercept+trend	First-difference: Intercept	First-difference: Intercept+trend
se_t	-0.9613 (0)	-2.2333 (0)	-2.5284**(0)	-4.3826**(0)
$rgdppc_t$	0.6298 (1)	-2.1155 (1)	-4.4811**(0)	-4.5054**(0)
$m2gdp_t$	-0.9433 (1)	-1.1216 (1)	-2.8912**(0)	-3.4939**(0)
$m2gdp_t^2$	-0.9777 (1)	-1.1369 (1)	-2.9763**(0)	-3.5234**(0)
$dcgdp_t$	-1.0859 (0)	-1.8443 (1)	-3.9250**(0)	-4.2117**(0)
$dcgdp_t^2$	-1.3836 (1)	-1.8711 (1)	-4.1267**(0)	-4.3014**(0)
$fdigdp_t$	-1.7483 (0)	-2.0127 (0)	-4.7302**(0)	-4.7250**(0)
$misery_t$	-1.6441 (2)	-1.8070 (2)	-7.1272**(1)	-7.9569**(1)

Notes: Asterisk ** denotes statistically significant at 5% level. The figures in round (…) brackets are Schwarz information criterion automatic lag length truncation.

Table 2: Results of shadow economy long-run models with ratio of M2 to GDP (m2gdp) as proxy for financial development

Estimators	Intercept	$rgdppc_t$	$m2gdp_t$	$m2gdp_t^2$	$fdigdp_t$	$misery_t$
OLS (robust estimates)	-42.647*** (-6.6040)	0.7381*** (5.1715)	18.703*** (5.5513)	-2.1497*** (-5.46847)	-0.1409*** (-4.9787)	0.2228*** (4.2188)
	E-G test: -5.28***		SER=0.151	$\bar{R}^2$=0.932	Optimal point=4.35	
ARDL(1,0,0,0,0,0)	-24.337*** (-3.1783)	0.7417*** (5.3325)	10.222*** (2.8191)	-1.1852*** (-2.7963)	-0.1143** (-2.6088)	0.3022*** (2.9849)
	Bounds F-test: 9.79*** ect_{t-1}= -0.5658*** (-4.6620)		SER=0.094	$\bar{R}^2$=0.959	$LM\chi^2$=[0.145] Optimal point=4.31	
FMOLS {Prewhitening lag=1}	-43.892*** (-9.1698)	0.7516*** (6.9351)	19.181*** (8.1105)	-2.2017*** (-7.8280)	-0.1383*** (-4.0366)	0.2347*** (3.1372)
	L_c = [0.045]**		SER=0.139	$\bar{R}^2$=0.913	Optimal point=4.36	
DOLS {lead=1, lag=1}	-31.364*** (-7.7616)	0.3981*** (3.5311)	14.784*** (7.4929)	-1.6500*** (-6.9429)	0.1079 (2.1711)	-0.0256 (-0.2000)
	L_c = [>0.20]		SER=0.087	$\bar{R}^2$=0.952	Optimal point=4.48	
CCR {Prewhitening lag=1}	-42.360*** (-10.421)	0.7439*** (5.9920)	18.410*** (9.2251)	-2.1086*** (-8.6662)	-0.1183** (-2.4141)	0.2625** (2.1661)
	L_c = [>0.20]		SER=0.141	$\bar{R}^2$=0.910	Optimal point=4.36	

Notes: Asterisks *** and ** denote statistically significant at 1% and 5% level, respectively. The figures in round (…) and square [...] brackets are the t-statistics and p-values, respectively. SER denotes standard error of regression. E-G test denote the DF t-statistic on the cointegrating regression's residuals. L_c- statistic measures Hansen parameter instability test for cointegration. The E-G tests with null hypothesis of no cointegration while the Hansen test the null hypothesis of cointegration. The optimal point is calculated as $-\hat{\theta}_2/2\hat{\theta}_3$.

Table 3: Results of shadow economy long-run models with ratio of domestic credit to private sector to GDP (dcgdp) as proxy for financial development

Estimators	Intercept	$rgdppc_t$	$dcgdp_t$	$dcgdp_t^2$	$fdigdp_t$	$misery_t$
OLS (robust estimates)	-29.467*** (-9.6585)	0.9069*** (6.6323)	12.378*** (7.1291)	-1.4567*** (-6.9489)	-0.1822*** (-5.1161)	0.1904 (1.6126)
	E-G test: -2.74***		SER=0.140	$\bar{R}^2$=0.942	Optimal point=4.25	
ARDL(1,0,0,0,0,0)	-30.968*** (-4.7737)	-0.7592 (-1.6701)	5.0207 (1.3469)	-0.6505 (-1.4755)	1.1158** (2.4665)	9.3711*** (13.072)
	Bounds F-test: 13.03*** ect_{t-1}= - 0.5813*** (-5.8180)		SER=0.089	$\bar{R}^2$=0.963	$LM\chi^2$=[0.068] Optimal point=3.86	
FMOLS {Prewhitening lag=1}	-33.441*** (-13.341)	0.7295*** (9.1707)	14.906*** (11.076)	-1.7546*** (-10.921)	-0.1823*** (-6.3257)	0.2322*** (4.2972)
	L_c = [<0.010]***		SER=0.156	$\bar{R}^2$=0.890	Optimal point=4.25	
DOLS {lead=1, lag=0}	-37.233*** (-7.0586)	0.7011*** (6.0156)	11.998*** (6.6634)	-1.4207*** (-6.7415)	-0.1171** (-2.1717)	0.3173** (2.4841)
	L_c = [>0.20]		SER=0.095	$\bar{R}^2$=0.958	Optimal point=4.22	
CCR {Prewhitening lag=1}	-31.967*** (-17.029)	0.7255*** (9.3212)	14.027*** (14.096)	-1.6476*** (-13.975)	-0.1819*** (-6.6001)	0.3292*** (3.2625)
	L_c = [0.031]**		SER=0.163	$\bar{R}^2$=0.879	Optimal point=4.26	

Notes: Asterisks *** and ** denote statistically significant at 1% and 5% level, respectively. The figures in round (…) and square [...] brackets are the t-statistics and p-values, respectively. SER denotes standard error of regression. E-G test denote the DF t-statistic on the cointegrating regression's residuals. L_c- statistic measures Hansen parameter instability test for cointegration. The E-G tests with null hypothesis of no cointegration while the Hansen test the null hypothesis of cointegration.

Table 4: Descriptive statistics

Variables	Mean	Median	Stddev	Skewness	Kurtosis	Jarque-Bera [p-values]	Anderson-Darling [p-values]
se_t	4.60	4.84	0.59	-1.77	6.11	[0.000]***	[0.000]***
$rgdppc_t$	8.35	8.39	0.35	-0.16	2.04	[0.472]	[0.357]
$m2gdp_t$	4.32	4.39	0.33	-0.97	3.19	[0.061]*	[0.001]***
$m2gdp_t^2$	18.76	19.23	2.78	-0.83	2.96	[0.136]	[0.007]***
$dcgdp_t$	4.09	4.00	0.43	-0.03	2.20	[0.622]	[0.139]
$dcgdp_t^2$	16.88	15.99	3.51	0.15	2.05	[0.485]	[0.065]*
$fdigdp_t$	0.72	0.92	0.89	-1.07	3.75	[0.024]**	[0.016]**
$misery_t$	3.32	3.23	0.39	1.74	7.91	[0.000]***	[0.001]***

Notes: Asterisks ***,** and * denote statistically significant at 1%, 5% and 10% level, respectively. Figures in square […] brackets are p-values.

Table 5: Results of quantile regressions

Independent variables	Quantiles: $Q(0.20)$	$Q(0.30)$	$Q(0.40)$	$Q(0.50)$	$Q(0.60)$	$Q(0.70)$	$Q(0.80)$
Panel A: Using m2gdp as proxy for financial development							
Constant	-45.274***	-37.176***	-39.751***	-35.098***	-34.834***	-36.983***	-38.831***
	(-5.4499)	(-4.6066)	(-4.7217)	(-4.9579)	(-4.7295)	(-6.6066)	(-4.8056)
$rgdppc_t$	0.8947***	0.8636***	0.7806***	0.6810***	0.6547***	0.6370***	0.5242***
	(4.4395)	(5.4744)	(4.8257)	(5.3575)	(4.8217)	(5.5446)	(3.0687)
$m2gdp_t$	19.012***	15.698***	17.228***	15.530***	15.4930***	16.6034***	17.570***
	(4.4121)	(3.8395)	(4.0695)	(4.3225)	(4.1341)	(5.7821)	(4.2521)
$m2gdp_t^2$	-2.1582***	-1.8007***	-1.9808***	-1.7851***	-1.7774***	-1.9114***	-2.0082***
	(-4.1813)	(-3.7395)	(-3.9799)	(-4.2779)	(-4.0908)	(-5.7445)	(-4.1937)
$fdigdp_t$	-0.1166**	-0.1407***	-0.1343***	-0.1159***	-0.1084***	-0.1109***	-0.1145**
	(-2.2555)	(-3.1763)	(-2.8076)	(-3.7973)	(-3.3637)	(-4.0845)	(-2.4377)
$misery_t$	0.2211	0.1849	0.1996	0.1636**	0.1552**	0.1658***	0.3156**
	(1.9658)	(1.9148)	(1.9538)	(2.7100)	(2.4813)	(3.5929)	(2.2107)
Pseudo R^2	0.815	0.761	0.752	0.744	0.723	0.687	0.653
SER	0.253	0.162	0.156	0.177	0.179	0.184	0.214
Wald asymmetric test				12.84 [0.801]			
Wald slope equality test				17.43 [0.967]			
Optimal point	4.40	4.36	4.35	4.35	4.36	4.34	4.38
Panel B: Using domestic credit to private sector (dcgdp) as proxy for financial development							
Constant	-31.918***	-31.371***	-30.845***	-31.542***	-29.713***	-30.436***	-26.691**
	(-6.0418)	(-8.4619)	(-8.8354)	(-10.155)	(-4.9767)	(-5.5385)	(-2.6806)
$rgdppc_t$	0.9800***	0.8939***	0.8157***	0.7965***	0.7297***	0.7636***	0.7970***
	(8.1793)	(6.9468)	(5.4283)	(4.8943)	(3.8740)	(4.2940)	(4.1456)
$dcgdp_t$	13.447***	13.376***	13.351***	13.389***	12.961***	13.185***	11.247**
	(4.8246)	(6.4285)	(6.8545)	(7.0425)	(3.9550)	(4.3519)	(2.2200)
$dcgdp_t^2$	-1.6044***	-1.5795***	-1.5638***	-1.5614***	-1.5156***	-1.5454***	-1.3118**
	(-4.4065)	(-5.9989)	(-6.5181)	(-6.6761)	(-3.8985)	(-4.2979)	(-2.2274)
$fdigdp_t$	-0.2192***	-0.2251***	-0.2272***	-0.1979***	-0.2090***	-0.2003***	-0.1785***
	(-4.3693)	(-4.6175)	(-4.5397)	(-3.7184)	(-4.2358)	(-4.6869)	(-3.4409)
$misery_t$	0.1496	0.1782	0.1793	0.3852	0.3141	0.3256**	0.3198**
	(1.0387)	(1.1065)	(0.6790)	(1.5653)	(1.7516)	(2.0888)	(2.3657)
Pseudo R^2	0.788	0.758	0.736	0.711	0.685	0.657	0.621
SER	0.217	0.170	0.156	0.171	0.173	0.176	0.204
Wald asymmetric test				8.84 [0.963]			
Wald slope equality test				17.52 [0.965]			
Optimal point	4.20	4.23	4.27	4.29	4.28	4.27	4.29

Notes: Asterisks *** and ** denote statistically significant at 1% and 5% level, respectively. The figures in round (…) and square [...] brackets are the t-statistics and p-values, respectively. SER denotes standard error of regression.

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