The Magnitudes of Shadow Economy in Malaysia, 1960-2018

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Abstract

Motivation and aim: The shadow economy existed in all countries in the world; the size is relatively larger in less developed countries. Studies conducted around the world show that a large portion of economic activities remain hidden and uncovered from the official statistics. It is a common phenomenon in any economy, and there is no exception to the Malaysia economy. The aim of this paper is to re-estimate the size of shadow economy in Malaysia for the past over five decades; and further to examine whether the level of economic development, the stages of financial development, the tax burden, the inflation rate, and the unemployment rate are all major drivers of the size of Malaysia's shadow economy.

Methods and material: Ordinary least squares with robust standard error were used to estimate the shadow economy model for Malaysia. Cointegration was conducted on the models to test the validity of its long-run model. Nine models of shadow economy were estimated based on nine different sources of sizes of shadow economy in Malaysia calculated by Kasipillai et al. (2000), Tan et al. (2019), Eng (2009), Elgin and Oztunali (2012), Gamal et al. (2019), Mohamed (2012), Alm and Embaye (2013), Medina and Schneider (2018) and our own estimation.

Key findings: All nine measures of the shadow economy and their determinants – economic development, financial development, tax burden, inflation, and unemployment rates – are cointegrated. In other words, the sizes of the shadow economy and its determinants have a long-run relationship. Our conclusion from this study that the level of economic development, the stages of financial development, the tax burden, the inflation rate, and the unemployment rate are all major drivers of the size of Malaysia's shadow economy. Increased economic development can diminish the size of the shadow economy, while increased financial development can also reduce the size of the shadow economy in Malaysia. Increases in the tax burden, inflation, and unemployment rates, on the other hand, will enhance the size of Malaysia's shadow economy.

Policy implications: An important policy issue is that the Malaysian government and the Central Bank of Malaysia should implement measures to prevent individuals and businesses from participating in the shadow economy. Financial inclusion programmes and future financial sector changes, such as establishing avenues for simple access to credit markets and further capital market reforms, should be prioritized. Monetary policy can help to reduce the rate of inflation. On the fiscal front, the Malaysian government should implement measures to alleviate suffering, poverty, and to close the country's income gap. Fiscal strategies and incentives such as reduced income tax rates and providing opportunities to increase employment levels that can enhance the economy should also be strongly considered.

The Magnitudes of Shadow Economy in Malaysia, 1960-2018

1. INTRODUCTION

Several Stylized Facts

The shadow economy, often known as the underground, informal, or black economy, exists in every country on the planet. As a result, every country appears to have two economies: an official economy and a shadow economy that coexist. The main distinction between the two economies is that the former refers to economic activities recorded by national accounting systems (NAS), and the latter refers to economic activities undertaken outside the scrutiny of government agencies.

According to studies conducted around the world, a considerable amount of economic activity stays hidden from authorities, and many workers are paid under the table. According to the OECD (2009, as reported in Schneider, 2012), about two-thirds of the world's total employments, involving around 1.8 billion people, are involved in shadow economy activities, with the remainder formally employed. According to Schneider (2012), the European Union's shadow economy labour force has expanded one-fold, from 15 million workers in the late 1970s to 30 million people in 1997-1998. Similarly, over a two-decade period, the number of people engaging in shadow economic activities in all European OECD countries increased about one-fold, from 26 million to 48 million. Schneider (2012) also estimated that between 1997 and 1999, the two most populous countries in the world, China and India, had 160 million and 217 million people working in the informal sector, respectively. Furthermore, the global value of the shadow economy is estimated to be around $10 trillion. In 2013, this sector in Europe had a total value of €2.15 trillion, which equated to 18.5 percent of the size of the official GDP (Schneider & Kearney, 2013).

Figure 1 depicts the rate of expansion of the global shadow economy by region from 2000 to 2007. It demonstrates that, with the exception of Latin America and the Caribbean (LAC), the shadow economy has been developing in all

regions since 2005, with the rate of expansion varying substantially among regions. The most striking feature of this picture is the significantly higher rate of growth of shadow economic activities in developing markets compared to developed countries. High-income OECD countries grew at a 2.5 percent annual rate, compared to 4.5 percent in EAP, 5.9 percent in Europe and Central Asia (ECA), 2.7 percent in Latin America (LAC), 3.7 percent in the Middle East and North Africa (MENA), 5.4 percent in South Asia (SAS), and 5.4 percent in Sub-Saharan Africa (SSA).

Tan et al. (2017) found that emerging regions (varying from 19.9 percent to 37.3 percent) have a considerably greater shadow economy (see Table 1). ECA and MENA, in particular, have a sizable share of the shadow economy, accounting for 37.3 percent and 31.3 percent, respectively. The estimations are closely followed by EAP (27.4%), SAS (23.7%), SSA (22.5%), and LAC (22.5%). On the other hand, developed areas have a far lower estimate (varying from 13.7 percent to 19.0 percent), and the shadow economy projections for EURO (13.7 percent) are still low in compared to both high income OECD and high-income non-OECD nations (19.0 percent). There is a significant difference in standard deviations between regions. Global estimates of the shadow economy as a proportion of GDP average at 23.1 percent (standard deviation of 13.5 percent).

Figure 2 depicts the evolution of the size of the shadow economy by region over time. The upper panel of the picture depicts the evolution of the shadow economy in developing nations, while the lower panel depicts the evolution of estimates in developed regions. Except for EAP, ECA, and LAC, estimates of the shadow economy have ranged between 15 and 40 percent for the majority of developing regions. Nonetheless, EAP and LAC appear to be trending downward during the whole study period. On the contrary, we see that the shadow economy in ECA soared to a peak in 1998, with more than half of economic activities taking place underground, and then stabilized for the next two years before dropping. Developed regions, on the other hand (bottom panel), have seen significant change over the sample period. Initially, we see an increase trend from 1978 to 1997, followed by a severe decrease from 1998 to 2007, and a rise beginning in 2008.

Figure 3, on the other hand, shows how big the variance in the size of the shadow economy as a percentage of GDP is. Most developing countries, including Thailand, Kyrgyzstan, Egypt, Moldova, Jordan, Bangladesh, and the Republic of Korea, are in the top ten. These countries have a relatively substantial percentage of the shadow economy, ranging from 41 to 70 percent of GDP, indicating that the shadow economy is larger than the official economy. It is worth noting that advanced countries are at the bottom of the Figure, with an average of roughly 5-15 percent (of GDP). Bahrain, Luxembourg, Italy, Switzerland, Norway, Oman, Spain, Denmark, Germany, Bhutan, Pakistan, France, Slovak Republic, United States, Hungary, The Bahamas, Iceland, Belgium, Fiji, Singapore, and Guatemala are among these countries. Overall, we find that most countries are in the middle, with average shadow economies ranging from 16 to 20 percent (of GDP). Solomon Islands, Belize, Portugal, Colombia, Madagascar, Grenada, Netherlands, Syrian Arab Republic, Japan, Dominican Republic, Côte d'Ivoire, Malaysia, Uganda, Tonga, Canada, Ireland, Sierra Leone, Morocco, Australia, Lithuania, Ghana, Zambia, and Jamaica are among these countries.

Similarly, a more recent study by Medina and Schneider (2018) revealed that the extent of the shadow economy has decreased significantly over time. Figures 4 and 5 clearly show that the size of the shadow economy is falling across both geographical regions and economic levels. Nonetheless, Medina and Schneider (2018)'s estimations of the extent of the shadow economy do not affect the fact that higher-income nations have the lowest shadow economy and low-income countries have the highest shadow economy.

2. DEFINITION OF THE SHADOW ECONOMY

When investigating the phenomenon of the shadow economy, the definition of the term is critical because the shadow economy is heterogeneous in nature. The shadow economy is a market that consists of all business that avoids or violates applicable taxes and/or government laws. There is currently no agreement on how to define the shadow economy (Bajada, 1999; Caridi & Passerini, 2001; Dell'Anno et al., 2007; Feige, 1990; Fleming et al., 2000; Hernandez, 2009; Tanzi, 1983). The literature has used a variety of names to

refer to the shadow economy (refer to Table 2). Because the most commonly used phrases are shadow economy, hidden economy, and underground economy, these terms are used interchangeably in this study.

A broader definition of the shadow economy includes any currently unregistered economic operations that have contributed "to the officially calculated (or observed) gross national product" (Buehn & Schneider, 2012b; Schneider & Enste, 2000; Schneider, 2005). Smith (1994, p.4) defines the shadow economy as "market-based production of products and services, legal or illicit, that elude detection in official GDP calculations." According to Feige (1979), the term "irregular economy" refers to economic activity that remains unreported or unmeasured by society's current measurement systems.

Most definitions of the shadow economy are based on estimation methodologies and measurements (Ahumada et al., 2007, 2009; Schneider & Enste, 2000). In fact, different authors utilize a variety of alternate definitions (Feige, 1990). As a result, all of these definitions are far from conventional, and they frequently appear to overlap (Caridi & Passerini, 2001). Table 3 may be useful in displaying a broad description of monetary and barter transactions, as well as legal and illegal status activities (Mirus & Roger, 1997). According to Table 3, the shadow economy includes unreported income from legal production of products and services involving monetary or non-monetary transactions.

Recent research (e.g., Buehn & Schneider, 2012a, 2012b; Schneider et al., 2010; Schneider, 2005, 2009) have embraced the narrow definition of the shadow economy, in that "all market-based legal production of goods and services that are intentionally concealed from public authorities for the following reasons: I to avoid payment of income, value added, or other taxes; (ii) to avoid payment of social security contributions; and (iii) to avoid having to meet certain legal labour market public authorities market standards, such as minimum wages, maximum working hours, and safety standards." Thus, in their studies, Buehn and Schneider (2012a) and Schneider (2005, 2009) do not address criminal economic activity such as burglary, robbery, or drug dealing. They also do not take into account informal household activities such as all household services and production that are not offered in the market.

3. REASONS FOR INVOLVEMENT IN THE SHADOW ECONOMY

Why do people participate in the underground or shadow economy? In general, shadow economy activities emerge when the cost of formality exceeds the cost of informality. In this sense, economic agents' decision to remain underground after balancing the costs and rewards is said to be reasonable. Loayza (1996), who uses De Soto (1989)'s analytical framework and some of his reported evidence on the informal sector in Peru, noted that an excessive regulatory system that imposes high entry costs through license fees and registration requirements, as well as high costs of maintaining legal through taxes, red tape, and labour and environmental regulations, has made the formal economy unsustainable.

The Price of Formality

When entrepreneurs create a company plan, the first hurdle to overcome is the procedures that must be completed before lawfully beginning operations. Obtaining all essential permits and licenses, as well as completing all mandatory inscriptions, verifications, and notifications with authorities, is frequently enough to pique one's interest in legally launching a firm. According to the World Bank's Doing Business Indicators database 2008, Southeast Asian economies differ significantly in how they control new business entrance. Some are simple and inexpensive, yet in others, the procedures are so time-consuming that they create a breeding ground for bribes and corruption among those seeking to expedite the process. Those who do not comply go underground or engage in shadow economic activity.

Figure 6 shows that, only to start a firm, the waiting period in Southeast Asian poor countries is often more than one month, compared to 5 days in Singapore. In Indonesia, the waiting period is about 5 months, and the cost of launching a firm can be up to 80% of the gross national income (GNI) per capita. To receive a business registration number, entrepreneurs must deposit at least 30.4 percent of their GNP per capita as minimum capital in a bank.

After registering a business, the firm must get the relevant licencing and permits. Figure 7 depicts the indicators in regard to getting licences for a construction entrepreneur in Southeast Asia to develop a warehouse. To achieve the licencing requirement in Malaysia, for example, an entrepreneur must complete 25 procedures, which take at least 285 business days and cost almost 10% of the country's per capita GDP in fees. To achieve the same in Singapore, an entrepreneur must go through 11 distinct procedures, pay around 22.9 percent of income per capita in fees, and wait at least 102 business days to obtain the appropriate permits.

Aside from the initial investment, remaining formal can be prohibitively expensive. According to Loayza (1996), the expenses of being formal can be separated into three basic categories: taxes, regulations, and bureaucratic requirements. Firm taxes are a significant source of government revenue, particularly in developing countries. Excessive government taxes, on the other hand, provide incentives for businesses to avoid registration, forcing them into the shadow economy and making it difficult for revenue administrators to tax them. According to the World Bank's Doing Business Indicators database, the overall number of taxes paid by enterprises in the Philippines within a year is 47 times, and the total amount of taxes payable by businesses, excluding labour taxes, is around 52.8 percent of gross profit (see Table 4.).

Regulations impose both a direct cost in the form of fees or bribes to officials and an indirect cost in the time required by the entrepreneur meeting numerous procedures and submitting documentation. According to a World Bank group enterprise survey performed in the Philippines in 2003, 44.7 percent of enterprises plan to pay informal payments to public authorities to get things done, and 27.6 percent of firms expect to present gifts in meetings with tax officials. Environmental protection, allocation of imported supplies, consumer protection and quality control, financial capital ability, and worker welfare are the most typical forms of laws. Workers' welfare requirements are the most stringent and costly of all sorts of restrictions. According to Tokman (1992), the additional costs associated with labour restrictions are the most important component of the cost in the formal sector for small enterprises. According to Nipon (1991), ignoring labour protection laws saves between 13 and 22 percent of worker wages in Thailand. The expense of being formal is also

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borne by bureaucratic obligations (red tape and paper work). According to Alonzo (1991), "no matter how tiny the business, an owner requires an accountant and a lawyer to comply with all of the requirements" in the Philippines.

The Price of Informality

It is apparent that informal enterprise goes to great lengths to avoid being prosecuted by the state. Informal businesses must remain small in order to avoid being the target of government inspections. According to De Soto (1989), informal firms use a variety of strategies to avoid detection and penalties, such as dispersing their employees among a number of smaller and less visible workplaces, not advertising their goods or services, refusing to enter certain markets that are effectively barred to them, and corrupting the authorities.

The opportunity costs of working in the informal sector are also included in the costs of informality. This includes restricted access to government and financial services. The difficulty in obtaining access to legal means in order to organize and distribute risk, share responsibilities, and conduct long-term economic activities is a significant constraint to informal activity, as it forces production to remain relatively small, limits the ranges of goods provided, and allows for the use of few technological advances.

4. MEASUREMENT OF THE SHADOW ECONOMY

The shadow economy is measured using a variety of approaches. According to the literature (Bajada & Schneider, 2005; Dell'Anno & Halicioglu, 2010; Schneider & Enste, 2000), existing methods can be classified into three types: direct, indirect, and model approaches. Table 5 summarizes the various methodologies for assessing the shadow economy, as well as its key advantages and limitations. The currency demand approach (CDA) and the latent variable approach, also known as the multiple indicators and multiple causes (MIMIC) model, are two of the most well-established and widely used methodologies. In the next sections, we will go over these two methodologies

in depth, with a focus on the CDA. This is because the CDA is a widely used tool that has been used to estimate the shadow economy in numerous nations throughout the world (Schneider & Buehn, 2013).

In a nutshell, the CDA estimates the size of the shadow economy based on market cash demand, assuming that all shadow economic transactions are conducted in cash. A higher tax burden suggests a bigger incentive to engage in cash-intensive underground economic activity, which raises the demand for cash. Furthermore, the CDA gives an indirect measure of the shadow economy by calculating how much cash is utilized for shadow transactions under the premise that the cash used in the unofficial and official economies has the same velocity (Tanzi, 2002). The MIMIC model, on the other hand, allows for various causes and effects at the same time in order to calculate the size of the shadow economy.

The average estimates of the extent of the shadow economy using the CDA and MIMIC methodologies are shown in Tables 6 and 7, respectively. Studies that use the CDA tend to estimate the size of the shadow economy on an individual country basis, but the MIMIC technique is more appropriate for large panels of nations. According to the CDA, most research concentrated on advanced economies, indicating a somewhat lower representation of the shadow economy regardless of the study period. In contrast, estimates of the shadow economy are rather large in rising and developing countries such as Guyana, Peru, Romania, Turkey, and Pakistan. According to a recent assessment conducted by Alm and Embaye (2013) on 111 nations based on income levels from 1984 to 2006, low and lower medium-income countries had the greatest shadow economies, accounting for 38.2 percent and 37.2 percent of GDP, respectively. Upper middle-income and high-income non-OECD countries recorded 33.4 percent and 24.3 percent of GDP, respectively, whereas OECD countries had the smallest shadow economies at 16.9 percent. Nevertheless, the global average for the size of shadow economies was 31.7 percent.

According to MIMIC estimations, the shadow economy is more prominent in emerging and developing countries than in most established ones. It should be mentioned that the extent of the shadow economy in most advanced countries

is less than 20% (refer to Table 7). For example, New Zealand and Japan have the least percentage of the shadow economy, which is estimated to be 6.8-11.3 percent (of GDP) between 1968 and 1994 and 8.0-11.0 percent between 1980 and 2008. These estimations were verified by a shadow economy ranking (Ruge, 2010), which showed that New Zealand ranks first out of 35 countries, with Romania ranking last. The Netherlands and the United Kingdom have the smallest shadow economies in the European Union, with Poland having the biggest percentage (Tafenau et al., 2010).

Shadow economic transactions account for a sizable portion of the official economy in emerging and developing countries. For example, the average size of the shadow economy in Latin American countries between 1990 and 1993 was approximately 38.8 percent (Loayza, 1996), with Bolivia having the largest shadow economy that equaled about 65.6 percent of its official GDP, followed by Panama (62.1 percent) and Peru (57.9 percent), and Chile and Argentina having the lowest at 18.2 percent and 21.8 percent, respectively. In 2008, Armenia ranked first among Caucasus and Central Asia (CCA) countries with 35.0 percent (of GDP); Kyrgyzstan and Georgia have the smallest shadow economies, with around 26.3 percent and 30.1 percent, respectively. In 1994/1995 (Chaudhuri et al., 2006), Thailand and the Philippines had the largest shadow economies, accounting for 48.3 percent and 38.4 percent of GDP, respectively, while China, Japan, and Singapore were at the other end of the spectrum, accounting for 10.2 percent, 10.6 percent, and 11.2 percent, respectively. The average size of the Asian shadow economy is estimated to be 24.5 percent.

Furthermore, using a reasonably large panel sample of 162 nations from 1999 to 2007, the average share of the shadow economy is around 33% (Buehn & Schneider, 2012b; Schneider et al., 2010). When these countries are estimated by sub-region, Latin America and the Caribbean (LAC), Sub-Saharan Africa (SSA), and Europe and Central Asia (ECA) have the highest estimates at 41.1 percent, 40.2 percent, and 38.8 percent, respectively, while high-income OECD countries have the lowest at 17.1 percent.

5. ESTIMATES OF THE SIZES OF MALAYSIA'S SHADOW ECONOMY

Activities in the shadow economy are hidden, and participants evade being discovered in many ways. Given the lack of resources to monitor their activities, authorities face a difficult problem in identifying and estimating the extent of the shadow economy (Singh et al., 2012). In the case of Malaysia, various studies attempted to determine the magnitude of the shadow economy. Kanbur et al. (1993) made the first attempt to determine the size of Malaysia's shadow economy. They estimate that the extent of Malaysia's shadow economy ranged from 0.23 percent to 1.20 percent of GDP from 1980 to 1985 (cited in Mohamed, 2012; Kasipillai et al., 2000). According to Mahfar (1994) and Abdul (2001), Malaysia's shadow economy is 30 percent and 29 percent, respectively, while Aziz (2004) estimates a range of 19.7 percent to 13.2 percent between 1987 and 1997 (see Mohamed, 2012). According to an expert opinion polled by Kasipillai (1998) in 1995, the construction sector contributes the most hidden income; however, Mohammad (2004) reports that the services sector had the highest percentage of informal sector relative to formal sector in 2002, with an estimated ratio of 4.2 percent. However, according to Kamaruddin and Ali (2006), 24 percent of enterprises in the information technology industry operate underground, followed by manufacturing (3.5 percent) and the service industry (3 percent).

Table 8 presents time series estimates of the extent of Malaysia's shadow economy by various sources. These figures were produced from either a single nation estimate or a panel setting framework. For example, Kasipillai et al. (2000) estimate the size of Malaysia's shadow economy from 1971 to 1994 using the typical currency demand approach, ranging from 8.1 percent of gross national product in 1971 to 3.73 percent in 1994, with a 24-year average of 7.1 percent. Eng (2009) estimates the magnitude of the shadow economy in four Southeast Asian nations — Indonesia, Malaysia, the Philippines, and Thailand – from 1970 to 2006. During the 37-year period, Malaysia's average size of the shadow economy was 16.3 percent of GDP. Elgin and Oztunali (2012) use the two-sector dynamic general equilibrium model to assess the extent of the shadow economy in 161 nations from 1955 to 2008; Malaysia's shadow economy averaged 47 percent throughout that time period. Mohamed

(2012) calculates the average size of Malaysia's shadow economy to be 10.92 percent for 1980-1984, 12.19 percent for 1985-1989, 17.17 percent for 1990-1994, 23.19 percent for 1995-1999, 18.31 percent for 2000-2004, and 12.83 percent for 2005-2009 using the non-tax compliant technique. Alm and Embaye (2013) assess the size of the shadow economy for 111 nations using the generalized method of moments for the period 1984-2006, and Malaysia's shadow economy is estimated to be 30.4 percent for the time period.

Tan et al. (2017), on the other hand, use the pooled mean group (PMG) estimator on a panel of 80 nations to arrive at an estimate for Malaysia's shadow economy that averages 17 percent from 1984 to 2012. Medina and Schneider (2018), on the other hand, assessed the extent of the shadow economy for 158 countries, including Malaysia, from 1991 to 2015, using a mix of the multiple indicators multiple causes (MIMIC) approach and currency demand models. Malaysia's shadow economy has averaged 31.5 percent of official GDP during the last 25 years. Gamal et al. (2019) estimate the extent of Malaysia's shadow economy to be 43.9 percent of GDP using the currency demand model technique for the period 1972 to 2012.

Although it is acknowledged that no single method for estimating the size of the shadow economy exists (Berger et al. 2014), the purpose of this study is to extend the earlier work of Din et al. (2019) and re-estimate the size of the shadow economy for Malaysia using the modified-cash-deposit-ratio procedure proposed by Pickhardt and Sarda (2011, 2015). Pickhardt and Sarda (2011, 2015) assert that their approach provides a "decent" estimate of the shadow economy and is unaffected by the Breusch and Ahumada critiques. According to Breusch (2005a, 2005b, 2005c), the MIMIC model approach, which is extensively employed to assess the extent of the shadow economy, has major econometrical and mathematical errors. Ahumada et al. (2007, 2008), on the other hand, point out that estimations of the size of the shadow economy using the currency demand technique are right only if the long-run elasticity of income is unity, which is not the case in most cases.

Thus, Pickhardt and Sarda (2011, 2015) use the modified-cash-deposit-ratio (MCDR) to calculate the ratio of shadow economy revenue to official income

in Malaysia (see also Habibullah et al., 2016; Din, 2016; Habibullah et al., 2017; Din et al., 2019),

$$\frac{CC_t - CC_0}{CC_0 + DD_t} = \frac{Y_{Ut}}{Y_{Lt}} \qquad (1)$$

where CC_t signifies currency in circulation at the end of year t; CC_0 is currency in circulation at the end of base year, here 1960; DD_t represents demand deposits at the end of year t; Y_{Lt} and Y_{Ut} denote the size of the legal and shadow economies, respectively. Thus, Y_{Ut}/Y_{Lt} quantifies the proportion of the shadow economy to the legal economy (official GDP).

Column 10 of Table 8 shows the estimated size of Malaysia's shadow economy from 1960 to 2018. The MCDR technique, by definition, assumes that the size of the shadow economy is zero in the base year. As a result, any cash holdings in excess of the base year can be attributed entirely to the underground economy. Pickhardt and Sarda (2011, 2015) state that MCDR analyses all cash used in illicit economic activities, not just those driven by tax pressure or excessive regulation, but also unlawful activities such as drug trading, human trafficking, and so on. According to Masron et al. (2011) in the case of smuggling in Penang, the illegal activities involved in the underground Malaysian economy from 2004 to 2008 include the illegal imports of cigarettes, liquors, drugs, vehicles, electrical and electronic items, VCD/DVDs, fire crackers, and other illegal or prohibited imports. As a result, the MCDR strategy should produce a larger shadow economy than the currency demand approach. Over a 58-year period, the average size of Malaysia's shadow economy has been around 38.3 percent.

6. DETERMINANTS OF SHADOW ECONOMY

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

$$se_{jt} = \theta_0 + \theta_1 rgdppc_t + \theta_2 findev_t + \theta_3 findev_t^2 + \theta_4 taxburden_t$$
$$+ \theta_5 inflation_t + \theta_6 unemployment_t + \varepsilon_t \qquad (2)$$

where se_{jt} is the size of shadow economy (as percentage of GDP), as shown in Table 8, and j =se_ae2013_t (Alm &Embaye, 2013), se_e2009_t (Eng, 2009), se_eo2012_t (Elgin &Oztunali, 2012), se_g2019_t(Gamal et al., 2019), se_k2000_t (Kasipillai, 2000), se_m2012_t (Mohamed, 2012), se_ms2018_t (Medina & Schneider, 2018), $se\_mcdr2021_t$ (this study), and se_t2017_t (Tan et al., 2017). Variable $rgdppc_t$ is real GDP per capita measuring the level of economic development or income or wealth of a nation; $findev_t$ is financial sector development indicator; while $findev_t^2$ is financial sector development squared to establish whether the relationship between shadow economy and financial sector development is non-linear; $taxburden_t$ is the ratio of individual income tax revenue to GDP to proxy for tax burden; $inflation_t$ is the growth in the price level (i.e. consumer price index); $unemployment_t$ is the unemployment rate. All variables are in logarithm, and Equation (2) predicts that the parameters, $\theta_4, \theta_5, \theta_6, \theta_7 > 0$ and $\theta_1 < 0$. The error term, ε_t is expected to have a mean zero and a constant variance. In this study, we use the domestic credit-to-private-sector-to-GDP ratio as a proxy for a financial development measure. Berdiev and Sauronis (2016), Habibullah et al. (2017), and Henri et al. (2017) all utilized a similar proxy for the impact of financial development on the shadow economy

Is it true that financial development diminishes the size of the shadow economy? If our data corroborate the claim stated by Blackburn et al. (2012) and Bose et al. (2012) that the link between the shadow economy and financial development exhibits an inverted U-shape curve, we would expect a *priori* that $\theta_2 > 0$ and $\theta_3 < 0$. This implies that at a lower stage of financial growth,

the shadow economy grows until it reaches a turning point, after which it begins to decline at a higher level of financial development. The claim made by Bose et al. (2012) is corroborated by Blackburn et al. (2012), who used a basic model of tax evasion and financial intermediation to explain the relationship between shadow economy activity and credit market expansion.

Potential borrowers must declare their income or wealth in order to obtain a loan to support their venture, according to Blackburn et al. (2012). The quantity of wealth determines the amount of collateral required to secure a loan, as well as the terms and conditions of the loan contract made available to them. The less wealth stated, the less collateral available to finance the required loan, and the harsher the loan contract's terms and conditions. As a result, the credit situation in a country with a low level of financial development deteriorates. Thus, the value of wealth disclosure grows with the amount of financial development, implying that individual or business participation in the shadow economy decreases as the economy progresses from a low to a high level of financial development.

What does the evidence indicate? The current empirical evidence appears to support this claim. For the period 2003-2014, Bayar and Ozturk (2016) explore the effects of financial development and institutional quality on the shadow economy in nine European Union transition economies. Using the cointegration test developed by Basher and Westerlund (2009), they discovered that both financial development and institutional quality lowered shadow economy in the long run. Berdiev and Saunoris (2016) use the panel vector autoregressive model to explore the dynamic relationship between financial development and the shadow economy for 161 countries from 1960 to 2009. Their findings also show that financial development reduces the shadow economy. Bayar and Aytemiz (2017) reached a similar conclusion for Turkey. Using the Maki (2012) cointegration test, Bayar and Aytemiz (2017) discovered that financial development had a negative impact on the shadow economy in Turkey from 1960 to 2009. Henri (2018), on the other hand, studies the impact of financial development on the shadow economy in a panel of 41 Sub-Saharan African nations from 1991 to 2015. His study, which included both static and dynamic panel data analysis, reveals that financial development has a detrimental and considerable impact on the shadow

economy in Sub-Saharan African countries. For Malaysia, Habibullah et al. (2016), Din (2016) and Din et al. (2019), and Habibullah et al. (2017) discovered that financial development can help to reduce the size of the shadow economy.

The influence of real GDP per capita as a proxy for income, on the other hand, is equivocal. According to Pickhardt and Sarda (2015), the expected sign of real GDP is difficult to predict because it may rely on both the form and stage of development of the shadow economy under discussion. However, a negative sign for real GDP is more likely in wealthy nations (see Schneider, 2008), although Gaspareiene et al. (2016) discovered a negative influence of income on the shadow economy in developing transition economies. On the other hand, studies on the business cycle of the shadow economy by Bajada (2003), Giles (1997), Ferreira-Tiryaki (2008), and Granda-Carvajal (2010) show that the shadow economy and real GDP, consumption, and investment are pro-cyclical. This suggests that there is a positive relationship between the shadow economy and output, and that the shadow economy and real GDP move in lockstep over time. Nonetheless, we predict income or real GDP per capita to have a negative influence on Malaysia's shadow economy.

Numerous studies have found that increased tax burdens are one of the primary reasons of the expansion of the shadow economy (Bajada, 2003, 2009; Schneider, 2003, 2005, 2008). People turn to the shadow economy to avoid paying taxes. This is because a rise in tax affects an individual's cost-benefit and/or labor-leisure choices. Thus, tax burden distortion raises the opportunity cost for legal economic activity while decreasing the profitability of legal work or firms. The wider the gap between total labour costs in the formal sector and after-tax incomes from legal work, the greater the incentive to work in the shadow economy. The impact of tax burden is expected to increase the size of the shadow economy.

An increase in the inflation rate, along with an increase in the unemployment rate, can generate "hardship" for a country's people. The effects of inflation and unemployment rates will drive people into the shadow economy in search of work to supplement their income as well as cheaper goods and services. Inflation diminishes the purchasing power of their earnings, while

unemployment denies them any money that they could have received if the economy was doing better. As a result, rising inflation and unemployment rates would expand the size of the shadow economy as more people engage in illegal activities to maintain their livelihood. Dell'Anno and Solomon (2008), Sahnoun and Abdennadher (2019), and Bajada (2009) are among the studies that suggest a positive association between unemployment and the shadow economy. In contrast, Mazhar and Meon (2017) and Baklaouti and Boujelbene (2019) discovered that inflation has a positive effect on the shadow economy. According to a study conducted by Bittencourt et al. (2014), "a lower (higher) degree of financial growth and higher (lower) inflation creates a larger (smaller) shadow economy."

7. ESTIMATION METHODS

Estimating the long-run model using Equation (2) is difficult since we are dealing with non-stationary time series variables. Running Equation (2) using ordinary least squares (OLS) will result in misleading regression unless we can demonstrate that the variables are cointegrated (i.e. long-run relationship among the variables). The Engle-Granger two-step procedure is the most commonly used method for testing cointegration. To use this cointegration approach, we must first ensure that all variables in their level are in the same order of integration, that is, they are all I(1); this means that the series will become stationary (i.e. I(0)) after first-difference. The unit root test must be used to determine whether the series is I(0) or I(1) in level. The augmented Dickey-Fuller (Dickey & Fuller, 1981) unit root test is the most commonly used unit root test. The null hypothesis of a unit root will be tested, first on the level of the series (containing the deterministic term – intercept or/and trend) and then on their first-differences, according to the usual ADF unit root test procedure. If the null hypothesis cannot be rejected at the level but the unit root can be rejected in first-difference, we can conclude that the series y_t is non-stationary at the level but achieves stationarity after first-differences. In other words, $y_t \sim I(1)$ and $\Delta y_t \sim I(0)$.

We use the traditional Engle and Granger (1987) two-step technique to test for cointegration. The first step is to perform a regression, say Equation (2), and

then save the residuals of the estimated regression. The null hypothesis of non-cointegration or the presence of a unit root in the residuals is tested in the second step. Using the conventional augmented Dickey-Fuller unit root test, we determine if the residuals are I(0) or I(1). If the residual is stationary or I(0), we can conclude that there is cointegration, meaning that the shadow economy and its determinants have a long-run relationship. In this study, we use the Ordinary Least Square (OLS) method with robust standard error due to Newey-West (Newey & West, 1987) heteroscedasticity and autocorrelation consistent (HAC) estimations of the standard error on Equation (2) to estimate the long-run model.

Sources of Data

Data on currency in circulation, demand deposits, and individual income tax receipts were gathered for this study from various publications of Bank Negara Malaysia's Monthly Statistical Bulletin. Data on GDP, real GDP (2010=100) per capita, domestic credit-to-private-sector-to-GDP ratio, inflation, and unemployment rates were obtained from the World Development Indicators, which are available online at the World Bank database (see http://data.worldbank.org/indicator).

8. THE EMPIRICAL RESULTS

Table 9 shows the results of the ADF unit root test for the order of integration of the series. The unit root test results clearly show that all variables are I(1), indicating that the series attained stationarity after first difference. These findings imply that all variables have non-stationary levels and that their first-differences are stationary, i.e. they are I (0). Figures 8 and 9 clearly show that the variables are non-stationary in levels. As a result, regress such integrated variables will yield erroneous regression findings. False regression results mean that inferences cannot be drawn and hypothesis testing is invalid. Unless the variables are cointegrated, estimating Equation (2) with OLS will result in spurious regression. As described in Equation (2), a cointegrating regression indicates a long-run model for the shadow economy. It also implies that the shadow economy and its determinants have long-run relationship. Because all

variables are I(1), that is, they have the same order of integration, we can use the Engle-Granger 2-steps technique to assess cointegration among the variables included in Equation (2).

In Table 10, we present nine estimated long-run regression for shadow economy, using different sizes of shadow economy measured by Alm and Embaye (2013, se_ae2013_t), Eng (2009, se_e2009_t), Elgin and Oztunali (2012, se_eo2012_t), Gamal et al. (2019, se_g2019_t), Kasipillai (2000, se_k2000_t), Mohamed (2012, se_k2012_t), Medina and Schneider (2018, se_ms2018_t), Tan et al. (2017, se_t2017_t), and our own estimate, $se\_mcdr2021_t$. Table 10 displays the cointegration test findings as well as the estimated long-run models for Malaysia's shadow economy for all nine measures. Cointegration is found in all nine measures of the size of the shadow economy, according to the findings. According to the E-G test statistics, the null hypothesis of non-cointegration is rejected in all situations at the 1% significant level. As a result, the nine estimated long-run models for Malaysia's shadow economy are not spurious. This finding shows that the sizes of Malaysia's shadow economy (all nine measurements) have long-run relationship with real GDP per capita, financial development, tax burden, inflation, and unemployment rate.

Result in Table 10 shows that using se ae2013 t, only financial development is significant and the only key variable determining Malaysia's shadow economy from 1971 to 2008. The non-linear relationship between the shadow economy and financial development supports the inverted U-shape curve hypothesis advanced by Blackburn et al. (2012) and Bose et al. (2012). Using data from Eng (2009), only findev-square and tax burden have an effect on the shadow economy from 1971 to 2006. Nonetheless, both factors are statistically significant at the 10% level. The findings imply that as financial development levels rise, the extent of the shadow economy shrinks, whereas tax burdens rise, increasing the size of the shadow economy. Using Elgin and Oztunali (2012)'s shadow economy estimates, our findings indicate that economic development had a negative influence on the shadow economy, whereas an increase in the unemployment rate increased the size of the shadow economy in Malaysia from 1971 to 2008.

Using Gamal et al. (2019) estimate, our findings show that economic progress, financial development, tax burden, and unemployment all explain the shadow economy in Malaysia from 1972 to 2012. Economic progress and the unemployment rate have a negative impact on the shadow economy, although tax burden has a positive impact. Also, the link between se_g2019_t and financial development is non-linear relationship, indicating an inverted U-shape curve. Using Kasipillai (2000) measures of shadow economy - se_k2000_t, our findings show that economic development, financial development, tax burden, and inflation are major factors of Malaysian shadow economy from 1971 to 1994. Economic development has a negative influence on the shadow economy, whereas financial development has a non-linear impact on the shadow economy (an inverted U-shape curve), and tax burden and inflation have a positive impact on the shadow economy. Using data from Mohamed (2012), however, only financial development and unemployment rate explain the extent of Malaysia's shadow economy from 1980 to 2009. The impact of the unemployment rate on the shadow economy is negative, and the non-linear relationship between se_k2012_t and financial development has a U-shaped curve.

Medina and Schneider (2018) assessed the extent of the shadow economy in over 150 nations, including Malaysia. Using Malaysian data, our findings show that economic development and findev-square have a negative impact on se_ms2018_t; whereas tax burden has a positive impact on the size of the shadow economy se_ms2018_t, in Malaysia from 1991 to 2015. Tan et al. (2017) studied Malaysia as one of 80 nations in their sample. Using estimates of the size of the shadow economy se_t2017_t, our findings show that only financial development and unemployment rate affect the shadow economy in Malaysia from 1984 to 2012. Financial development has a non-linear U-shaped relationship with se_t2017_t; whereas unemployment affects the shadow economy positively. Finally, our own estimates of the shadow economy $se\_mcdr2021_t$, indicate that while economic development reduces the size of the shadow economy, increases in tax burden, inflation rate, and unemployment rate increase the size of the shadow economy in Malaysia from 1971 to 2018. The non-linear relationship between $se\_mcdr2021_t$ and financial development, on the other hand, suggests that lower levels of financial development increase the size of the shadow economy, while greater

levels of financial development reduce the size of the shadow economy in Malaysia. This inverted U-shape curve lends support to the notion advanced by Blackburn et al. (2012) and Bose et al. (2012).

9. CONCLUSION

In this study, we presented nine measures of the extent of Malaysia's shadow economy from 1960 to 2018. Regardless of the methodologies used to estimate the size of the shadow economy, the major goal of this study is to see if the determinants can explain each of the estimated sizes of the shadow economy. We explore if the level of economic development, financial development stages, tax burden, inflation rate, and unemployment rate have any effect on the various sizes of Malaysia's shadow economy.

All nine measures of the shadow economy and their determinants – economic development, financial development, tax burden, inflation, and unemployment rates – were discovered to be non-stationary variables. Our cointegration tests show that all nine long-run models with the dependent variable – the various sizes of the shadow economy – and its determinants – economic development, financial development, tax burden, inflation, and unemployment rates – are cointegrated. In other words, the sizes of the shadow economy and its determinants have a long-run relationship. The cointegrated long-run models also indicate that the model with non-stationary variables is valid and non-spurious.

Nonetheless, we can draw as a logical conclusion from this study that the level of economic development, the stages of financial development, the tax burden, the inflation rate, and the unemployment rate are all major drivers of the size of Malaysia's shadow economy. Increased economic development can diminish the size of the shadow economy, while increased financial development can also reduce the size of the shadow economy in Malaysia. Increases in the tax burden, inflation, and unemployment rates, on the other hand, will enhance the size of Malaysia's shadow economy.

An important policy issue is that the Malaysian government and the Central Bank of Malaysia should implement measures to prevent individuals and businesses from participating in the shadow economy. Financial inclusion programmes and future financial sector changes, such as establishing avenues for simple access to credit markets and further capital market reforms, should be prioritized. Monetary policy can help to reduce the rate of inflation. On the fiscal front, the Malaysian government should implement measures to alleviate suffering, poverty, and to close the country's income gap. Fiscal strategies and incentives such as reduced income tax rates and providing opportunities to increase employment levels that can enhance the economy should also be strongly considered.

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Table 1: Descriptive statistics for shadow economy (% of GDP)

	Mean	Std. Dev.	Median	Min	Max
EAP	27.4	14.9	24.9	14.0	66.0
ECA	37.3	19.6	29.0	12.9	69.6
LAC	19.9	5.5	16.9	15.3	31.2
MENA	31.3	18.1	23.3	16.6	63.1
SAS	23.7	13.9	23.1	11.3	44.9
SSA	22.5	6.4	19.5	16.3	37.2
High Income OECD	19.0	12.9	16.4	6.7	48.6
High Income Non-OECD	19.0	10.9	16.7	5.9	36.0
EURO	13.7	6.7	12.0	6.2	30.2
World	23.1	13.5	19.0	5.9	69.6

Notes: EAP, ECA, LAC, MENA, SAS and SSA denote East Asia and Pacific, Europe and Central Asia, Latin America and the Caribbean, Middle East and North Africa, South Asia and Sub-Saharan African countries.
Source: Tan et al. (2017).

Table 2: Comprehensive list of synonyms for the shadow economy

Alternative names for the shadow economy		
Black economy	Informal economy	Twilight economy
Cash economy	Invisible economy	Underground economy
Clandestine economy	Irregular economy	Unobserved economy
Disguised economy	Moonlight economy	Unofficial economy
Dual economy	Parallel economy	Unrecorded economy
Gray (Grey) economy	Second economy	Unreported economy
Hidden economy	Submerged economy	
Household economy	Subterranean economy	

Source: Tan (2016).

Table 3: A taxonomy of types of underground economic activities

Type of activity	Monetary transactions		Non-monetary transactions	
Illegal activities	Trade with stolen goods; drug dealing and manufacturing; prostitution; gambling; smuggling; fraud; etc.		Barter of drugs, stolen goods, smuggling, etc. Produce or growing drugs for own use. Theft for own use.	
	Tax evasion	**Tax avoidance**	**Tax evasion**	**Tax avoidance**
Legal activities	Unreported income from self-employment; Wages, salaries and assets from unreported work related to legal services and goods	Employee discounts, fringe benefits	Barter of legal services and goods	All do-it-yourself work and neighbor help

Source: Mirus and Roger (1997, p.5) with additional remarks (Schneider & Enste, 2000).

Table 4: Paying taxes (2008)

Region or Economy	Payments (number per year)	Time to pay taxes (hours per year)	Total tax payable (% gross profit)
East Asia & Pacific:	27	272	38.5
Indonesia	51	266	37.3
Malaysia	35	166	36.0
Philippines	47	195	52.8
Singapore	5	49	23.2
Thailand	35	264	37.7
Europe & Central Asia	46	451	50.8
Latin America & Caribbean	39	407	56.6
Middle East & North Africa	25	237	36.4
OECD: High income	15	183	46.2
South Asia	31	306	41.4
Sub-Saharan Africa	39	316	68

Notes: These indicators address the taxes and mandatory contributions that a medium-size company must pay or withhold in a given year, as well as measures of the administrative burden in paying taxes and contributions. Taxes and contributions measured include the profit or corporate income tax, social contributions and labor taxes paid by the employer, property taxes, property transfer taxes, the dividend tax, the capital gains tax, the financial transactions tax, waste collection taxes and vehicle and road taxes.
Source: Eng (2009).

Table 5: Methods used in measuring the shadow economy

Methods	Features	Disadvantages
Direct approaches		
Surveys or samples	Based on voluntary responses and replies. Complete information due to direct interview	The reliability of survey results depends greatly on the respondents' willingness to respond and answer truthfully and also sensitive to the formulation and layout of a questionnaire.
Tax auditing	Based on tax returns and undeclared taxable income	Estimates of the shadow economy based upon a biased sample (election of taxpayers for auditing is not random) may not be accurate. Estimates using tax auditing only reflects a fraction of the shadow economy.
Indirect (indicator) approaches **Mainly based on macroeconomic indicators, which leave some "traces" to track the shadow economy over time**		
The discrepancy between national expenditures and income statistics	The gap between the expenditure measures and the income measures as recorded in the national accounts. It produces a good estimate of the shadow economy when all the components of the expenditure side are free from errors.	The estimates become unreliable when there exists an omission and error in the national accounts statistics
The discrepancy between the official and actual labour force	A decrease in labour participation in the official economy, with assumption that the total labour force participation is assumed to be constant, ceteris paribus	Changes in the participation rate may have other factors. It does not consider the fact that people can work in both the formal and the shadow economies, which reflects no change in the participation rate
The transactions approach	Based on the relationship between the volume of transactions and total nominal (unofficial plus official) GDP (GNP). This approach assumes a constant ratio of transactions to official GDP over time and a base year with no shadow economy. The size of the shadow economy is measured by subtracting official GDP (GNP) from total nominal GDP (GNP). An increase in the transactions ratio is attributed to a rise in the shadow economy. This method is theoretically influential, however the application stage is very difficult task in order to obtain reliable estimates	A base year with no shadow economy is problematic and constant ratio of transaction to official GDP (GNP) is not standardized.
The currency demand approach (CDA)	Based on the currency demand by assuming (a) shadow economic activities are undertaken in cash or currency. The basic idea is that a rise in the shadow economy will increase demand for currency; (b) Equal velocity of money in both the official and the shadow economies; (c) The shadow economy is caused by tax burden, because individuals tend to participate in the shadow economy to avoid from high burden of tax.	The results are sensitive to its assumptions. Not all shadow transactions are performed in cash. The money velocity might be different significantly between the legal and illegal economies. Consider only one factor to capture all effects of the shadow economy. Problem in determining a base year with no shadow economy.
The physical input (electricity consumption) method	Assuming that electricity consumption is the single best indicator in estimating total (official and unofficial) economic activity. The difference between the official GDP growth rate and the total electricity consumption growth rate which then attributes to the growth of the shadow economy.	Not all shadow transactions need electricity. For both the official and shadow users, the use of electricity is more efficient than in past due to technological progress. Elasticity of electricity/GDP varies across countries or changes over time.
Model-based approach		
The MIMIC method	Based on the statistical theory of latent (unobserved) variables by considering several causes and several indicators of the shadow economy.	Very sensitive to the causes and indicators. A benchmark from an alternative methodology such as the CDA is required.

Source: Tan (2016).

Table 6: Size of the shadow economy using the CDA method

Authors	Period	Countries	Size of the shadow economy (of GDP or GNP)
Kirchgässner (1983)	1955-1980	West Germany	2.0%-10.3% (Tanzi method); 2.1%-11.2% (Klovland method)*
Tanzi (1983)	1930-1980	United States	2.8% (Average tax rate); 4.2% (Weighted average tax rate)*
Klovland (1984)	1952-1982	Norway and Sweden	3.0%-20.0%
Schneider (1986)	1952-1982	Denmark	6.1%-11.0%*
Schneider and Lundager (1986)	1954-1982	Denmark, Norway and Sweden	Using marginal income tax rate: 4.9% (Denmark); 5.1% (Norway); 6.3% (Sweden)*
Bhattacharyya (1990)	1960-1984	United Kingdom	5.5%*
Ahmed and Ahmed (1995)	1960-1990	Pakistan	41.8% (Currency ratio); 44.4% (Currency bearer bond ratio)
Bagachwa and Naho (1995)	1968-1990	Tanzania	15.90%
Bajada (1999)	1966-1996	Australia	About 15.0%
Kasipillai, Baldry, and Prasada Rao (2000)	1971-1994	Malaysia	6.80%*
Schneider (2000)	1956-1998	Austria	3.80%
Gadea and Serrano-Sanz (2002)	1964-1998	Spain	11.0%-24.0%
Faal (2003)	1964-2000	Guyana	54.10%
Maurin et al. (2006)	1973-1999	Trinidad and Tobago	About 25.0%
Carolina and Pau (2007)	1988-2004	The Netherlands Antilles	About 5.0%-9.0% (Tanzi method); About 8.0%-14.0% (Adjusted Tanzi method)
Embaye (2007)	1982-2003	56 non OECD developing countries	16.20%
Hernandez (2009)	1979-2005	Peru	Tax burden: 48.5% - 50.3% (Johansen), 64.8% - 66.2% (ADL); Government expenditure/GDP: 42.1%-43.7% (Johansen), 72.9%-76.5% (ADL)
Dell'Anno and Halicioglu (2010)	1987-2007	Turkey	10.7% - 18.9%
Alm and Embaye (2013)	1984-2006	111 countries	31.7% (Overall); 16.9% (OECD); 24.3% (High income non OECD); 33.4% (Upper middle income); 37.2% (Lower middle income); 38.2% (Low income)
Dobre and Davidescu (2013)	2000-2010	Romania	45% - 37.4%
Ardizzi, Petraglia, Piacenza, and Turati (2014)	2005-2008	91 Italian provinces	17.5% (Baseline); 26.1% (Without criminal)
Kiani et al. (2015)	1975-2010	Pakistan	26.9%*

Notes: Asterisk * refers to % of GNP.
Source: Tan et al. (2017).

Table 7: Size of the shadow economy using the MIMIC method

Authors	Period	Countries	Size of the shadow economy (of GDP)
Loayza (1996)	1990-1993	14 Latin America countries*	38.8%
Tedds (1998)	1976-1995	Canada	About 15.0%
Giles (1999a)	1968-1994	New Zealand	6.8%-11.3%
Bajada and Schneider (2005)	1989/90–2000/01	Australia and 17 Asia Pacific countries***	13.6% (CDA) and 13.9% (MIMIC) in Australia; 26.3% (17 Asia Pacific countries)
Schneider (2005)	1990/1991-1999/2000	110 countries (66 developing, 23 transition and 21 OECD countries)	33.9%-41.2% (Africa); 34.2%-41.5% (Central and South America); 20.9%-26.3% (Asia); 31.5%-37.9% (Transition); 13.2%-16.8% (Highly developed OECD)
Pickhardt and Pons (2006)	1980-2001	Germany	12.3% (CDA), 12.7% (MIMIC) and 12.4% (Joint model)
Chaudhuri et al. (2006)	1974/75-1995/96;	14 major states of India; 15 Asian countries****	20.3% (All-India); 20.4% (14 major states); 24.5% (15 Asian countries)
Wang et al. (2006)	1961-2003	Taiwan	11.9%
Dell'Anno (2007)	1977-2004	Portugal	29.6% (1978)-17.6% (2004)
Dell'Anno et al. (2007)	1965-2002	France, Spain and Greece	16.0%.0-10.5% (France); 24.5%-26.2% (Spain); 20.9%-31.9% (Greece)
Dobre and Alexandru (2009)	1980-2008	Japan	8.0%-11.0%
Ruge (2010)	1991-2007	35 countries	New Zealand (The best rank); Romania (The worst rank)
Schneider et al. (2010); Buehn and Schneider (2012b)	1999-2007	162 countries	Average shadow economy: 33.0% (World); 32.3% (EAP); 38.9% (ECA); 41.1% (LAC); 28.0% (MENA); 17.1% (High income OECD); 23.0% (Other high income countries); 33.2% (SAS); 40.2% (SSA);
Tafenau et al. (2010)	2004	238 regions of the European Union	The Netherlands and the United Kingdom (The smallest size); Poland (The largest size)
Buehn (2012)	2001-2008	German regions	14.7%
Abdih and Medina (2013)	2008	CCA countries**	27.4%

Notes: Asterisk * denotes Latin America countries cover Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Ecuador, Guatemala, Honduras, Mexico, Panama, Peru, Uruguay and Venezuela. Asterisks** denotes the Caucasus and Central Asia (CCA) countries are Armenia, Azerbaijan, Georgia, Kazakhstan, Kyrgyz Republic and Tajikistan. Asterisks*** denotes Asia Pacific countries include Australia, Bangladesh, China, Hong Kong, India, Indonesia, Japan, Korea (South), Malaysia, Nepal, New Zealand, Pakistan, Philippines, Singapore, Sri Lanka, Taiwan and Thailand. Asterisks**** denotes Asian countries include Bangladesh, China (only free economic zones), Hong Kong, India, Indonesia, Japan, Korea (South), Malaysia, Nepal, Pakistan, Philippines, Singapore, Sri Lanka, Taiwan and Thailand.
Source: Tan (2016).

Table 8: Time series estimates of the size of the shadow economy in Malaysia, 1960-2018

Year	Kasipillai et al. (2000)	Eng (2009)	Elgin & Oztunali (2012)	Mohamed (2012)	Alm & Embaye (2013)	Tan et al. (2017)	Medina & Schneider (2018)	Gamal et al. (2019)	This study: Ratio of shadow economy to GDP
1960			68.85						0.00
1961			68.3						0.76
1962			67.7						2.78
1963			66.65						5.24
1964			65.56						9.25
1965			64.71						10.02
1966			63.71						17.71
1967			62.81						6.26
1968			61.92						7.78
1969			60.98						14.90
1970		10.2	60.46						18.14
1971	8.1	9.69	59.41						21.13
1972	7.62	9.57	57.79					55.95	27.58
1973	7.36	9.21	56.49					57.76	38.38
1974	8.35	10.48	54.75					64.63	49.79
1975	7.87	15.83	52.29					57.85	55.77
1976	8.11	13.5	51.31					60.02	58.78
1977	8.22	15.84	50.3					64.47	65.72
1978	8.61	15.32	48.98					62.91	66.62
1979	8.54	14.53	47.84					61.80	67.24
1980	8.76	18.05	46.55	10.92				67.32	71.75
1981	8.48	18.54	45.13	10.92				62.12	66.97
1982	8.31	17.74	43.66	10.92				55.05	67.88
1983	8.53	18.93	42.2	10.92				60.59	66.06
1984	8.43	18.41	30.97	10.92	28.8	18.9		57.41	65.63
1985	6.84	20.85	39.78	12.19	28.9	21.9		56.88	64.44
1986	6.78	21.23	39.29	12.19	28.2	19.7		56.70	68.39
1987	6.21	13.87	39.11	12.19	25.1	16.8		43.31	68.84
1988	6.15	14.18	39.07	12.19	31.1	17.5		45.46	69.73
1989	5.91	12.73	38.86	12.19	34	17.5		47.13	62.97
1990	5.19	14.87	38.45	17.17	35.4	17.5		50.38	58.51
1991	4.69	16.84	37.97	17.17	36.5	17.6	37.47	51.70	58.99
1992	4.72	17.52	36.91	17.17	36.6	18	37.3	49.30	47.58
1993	3.7	16.69	36.08	17.17	33.3	14.7	36.79	47.10	36.48
1994	3.73	16.29	35.06	17.17	31	15.7	35.04	49.21	37.23
1995		16.58	34	23.19	30.6	16.1	33.22	47.54	35.89
1996		16.31	32.82	23.19	26.8	16.1	30.58	47.13	33.54
1997		17.67	31.85	23.19	27.1	19	30.37	46.14	48.70
1998		18.4	30.7	23.19	25.1	21.5	32.1	31.44	48.03
1999		15.36	30.61	23.19	26.9	14.6	31.63	34.79	48.65
2000		14.45	30.8	18.31	27.9	14.6	31.1	30.47	37.91
2001		22.03	30.5	18.31	31.5	19.3	32.27	31.99	36.05
2002		21.42	30.38	18.31	31.5	15.4	32.65	27.41	35.02
2003		23.47	30.2	18.31	30.5	15	32.03	21.30	33.00
2004		18.81	30.1	18.31	31.1	16.8	30.59	20.57	32.25
2005		18.83	29.9	12.83	29.8	18.1	29.77	21.98	31.10
2006		20.12	29.8	12.83	30.7	17.9	29.21	24.58	30.26
2007			29.6	12.83		15.3	29.23	22.48	26.65
2008			29.34	12.83		16.4	30.03	23.07	27.73
2009				12.83		17.4	31.71	22.62	27.03
2010						12.4	30.17	21.68	26.50
2011						15.4	29.82	20.53	25.62
2012						14.9	29.78	20.79	24.34
2013							29.84		23.48
2014							26.41		24.20
2015							27.87		26.82
2016									28.73
2017									27.78
2018									28.13
Av.	7.1	16.3	45.1	15.8	30.4	17.0	31.5	43.9	38.3

Table 9: Results of unit root tests

Series	Level:		First-difference:	
	Intercept	**Intercept+trend**	**Intercept**	**Intercept+trend**
se_ae2013_t	-2.5415 (2)	-2.5886 (2)	-4.1076*** (0)	-4.0001** (0)
se_e2009_t	-2.3712 (0)	-2.8173 (0)	-6.8241*** (0)	-6.7920*** (0)
se_eo2012_t	-1.5130 (1)	-2.1231 (1)	-9.3675*** (0)	-9.4299*** (0)
se_g2019_t	-0.1401 (0)	-2.7498 (0)	-7.2896*** (0)	-7.3625*** (0)
se_k2000_t	2.1544 (1)	-0.1134 (1)	-5.0248*** (0)	-7.4039*** (0)
se_m2012_t	-1.4449 (0)	-0.8485 (0)	-5.1108*** (0)	-5.4639*** (0)
se_ms2018_t	-1.8422 (0)	-2.5641 (0)	-4.6023*** (0)	-4.5246*** (0)
$se\_mcdr2021_t$	-1.8534 (0)	-4.8420*** (0)	-4.3309*** (0)	-4.5991*** (0)
se_t2017_t	-2.1660 (2)	-2.8644 (2)	-7.9145*** (1)	-7.7393*** (1)
$rgdppc_t$	-1.5093 (0)	-2.4374 (0)	-5.9471*** (0)	-6.0002*** (0)
$findev_t$	-2.9015 (0)	-1.5954 (0)	-5.9374*** (0)	-6.5379*** (0)
$findev_t^2$	-2.4868 (0)	-1.4441 (0)	-5.9376*** (0)	-6.3488*** (0)
$taxburden_t$	-3.1212** (0)	-2.9589 (0)	-6.6046*** (0)	-6.6759*** (0)
$inflation_t$	-2.8701 (2)	-3.3488 (2)	-5.2635*** (2)	-5.2378*** (2)
$unemployment_t$	-1.5652 (0)	-3.0195 (3)	-5.8727*** (0)	-5.8207*** (0)

Notes: Asterisks***,** denote statistically significant at 1% and 5% level, respectively. Critical values are referred to MacKinnon (1996). The figures in round (…) brackets are Schwarz information criterion automatic lag length truncation. Variables se_ae2013_t, se_e2009_t, se_eo2012_t, se_g2019_t, se_k2000_t, se_m2012_t, se_ms2018_t, $se\_mcdr2021_t$, and se_t2017_t are estimates of shadow economy by Alm and Embaye (2013), Eng (2009), Elgin and Oztunali (2012), Gamal et al. (2019), Kasipillai (2000), Mohamed (2012), Medina and Schneider (2018), this study, and Tan et al. (2017), respectively.

Table 10: Estimated long run shadow economy model for Malaysia, 1971-2018[§]

Dependent/ Independent variables	$constant$	$rgdppc_t$	$findev_t$	$findev_t^2$	$taxburden_t$	$inflation_t$	$unemployment_t$
se_ae2013_t	-7.8378 (-1.5571)	0.1178 (0.7079)	4.7454** (2.1275)	-0.5518** (-2.3542)	0.1327 (0.8885)	0.0620 (1.2639)	-0.0459 (-0.3886)
	$\bar{R}^2 = 0.5717$		$EG(ADF) = -3.8223***$				
se_e2009_t	-4.1320** (-2.2647)	0.3508 (1.3251)	1.9775 (1.5327)	-0.2513* (-1.7523)	0.4191* (1.9623)	-0.0395 (-0.8744)	-0.0168 (-0.0759)
	$\bar{R}^2 = 0.6879$		$EG(ADF) = -4.2209***$				
se_eo2012_t	7.9394*** (19.668)	-0.4695*** (-10.573)	0.0686 (0.4079)	-0.0190 (-0.9825)	-0.0697 (-1.1209)	-0.0061 (-0.3695)	-0.1376** (-2.0836)
	$\bar{R}^2 = 0.9506$		$EG(ADF) = -6.0246***$				
se_g2019_t	11.212*** (7.8173)	-1.4241*** (-8.6312)	1.9810** (2.2961)	-0.1990* (-1.9065)	0.3910*** (4.0071)	0.0683 (1.2837)	-0.4051* (-1.8540)
	$\bar{R}^2 = 0.9316$		$EG(ADF) = -5.0787***$				
se_k2000_t	5.6996* (1.9341)	-1.4943*** (-3.8088)	3.6035*** (3.6532)	-0.4084*** (-3.5124)	0.3599** (2.5583)	0.0965*** (3.2919)	0.1146 (0.7146)
	$\bar{R}^2 = 0.9232$		$EG(ADF) = -3.6207***$				
se_m2012_t	9.9194*** (4.1515)	-0.1959 (-0.8980)	-2.9114** (-2.3853)	0.3844*** (2.9971)	0.2973 (1.2260)	-0.0066 (-0.1660)	-0.3552*** (-3.0599)
	$\bar{R}^2 = 0.7764$		$EG(ADF) = -2.9468***$				
se_ms2018_t	1.9094 (0.7144)	-0.3461*** (-11.391)	2.0057 (1.6599)	-0.2247* (-1.7542)	0.1474*** (3.5504)	-0.0136 (-1.5414)	0.0714 (1.6617)
	$\bar{R}^2 = 0.9375$		$EG(ADF) = -4.8826***$				
$se\_mcdr2021_t$	-0.2399 (-0.0864)	-0.7441*** (-4.1836)	3.8349*** (3.4879)	-0.3964*** (-2.9480)	0.4280* (1.9943)	0.1658*** (4.2591)	0.4614** (2.5936)
	$\bar{R}^2 = 0.8611$		$EG(ADF) = -4.2245***$				
se_t2017_t	14.521** (2.7393)	-0.0530 (-0.4422)	-5.1404** (-2.2041)	0.5701** (2.2277)	-0.0369 (-0.1648)	0.0300 (0.7797)	0.2152* (1.9898)
	$\bar{R}^2 = 0.3599$		$EG(ADF) = -5.5893***$				

Notes: [§]The estimations start from 1971 due to availability of unemployment rate data. 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. Variables se_ae2013_t, se_e2009_t, se_eo2012_t, se_g2019_t, se_k2000_t, se_m2012_t, se_ms2018_t, $se\_mcdr2021_t$, and se_t2017_t are estimates of shadow economy by Alm and Embaye (2013), Eng (2009), Elgin and Oztunali (2012), Gamal et al. (2019), Kasipillai (2000), Mohamed (2012), Medina and Schneider (2018), this study, and Tan et al. (2017), respectively.
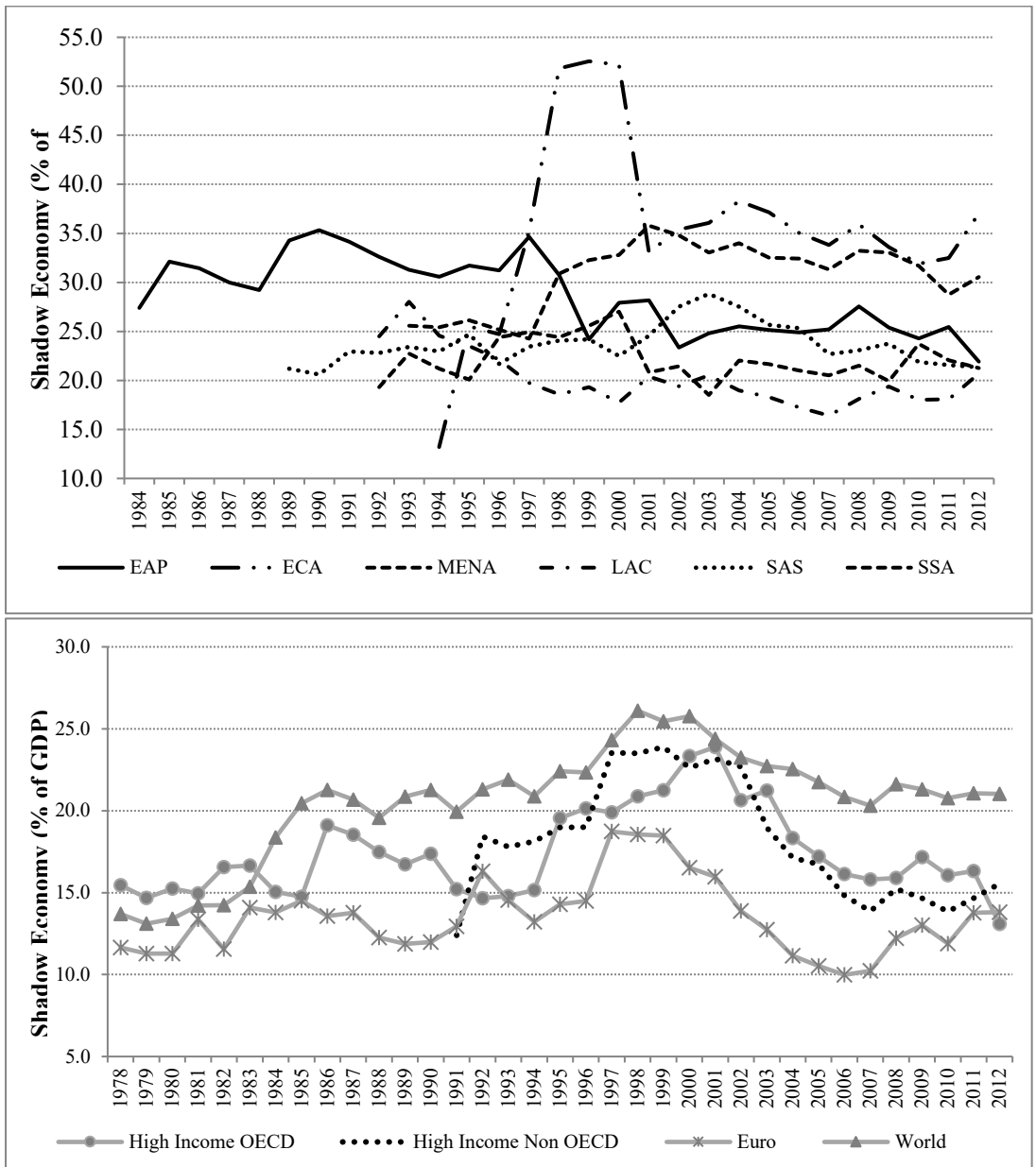
Figure 1: Growth in shadow economy, 2000-2007
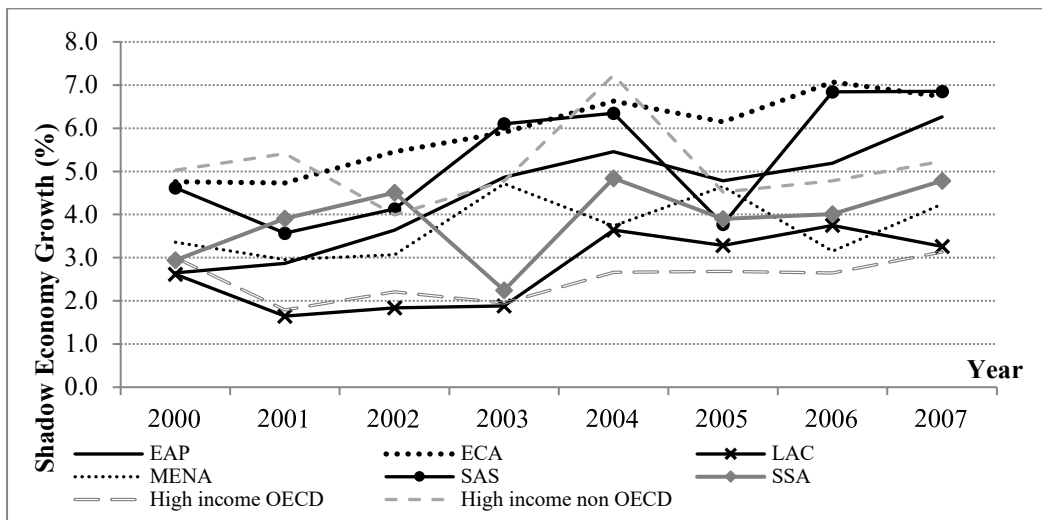
Notes: EAP-East Asia and Pacific; ECA-Europe and Central Asia; LAC-Latin America and the Caribbean; MENA-Middle East and North Africa; SAS-South Asia; SSA-Sub-Saharan Africa.
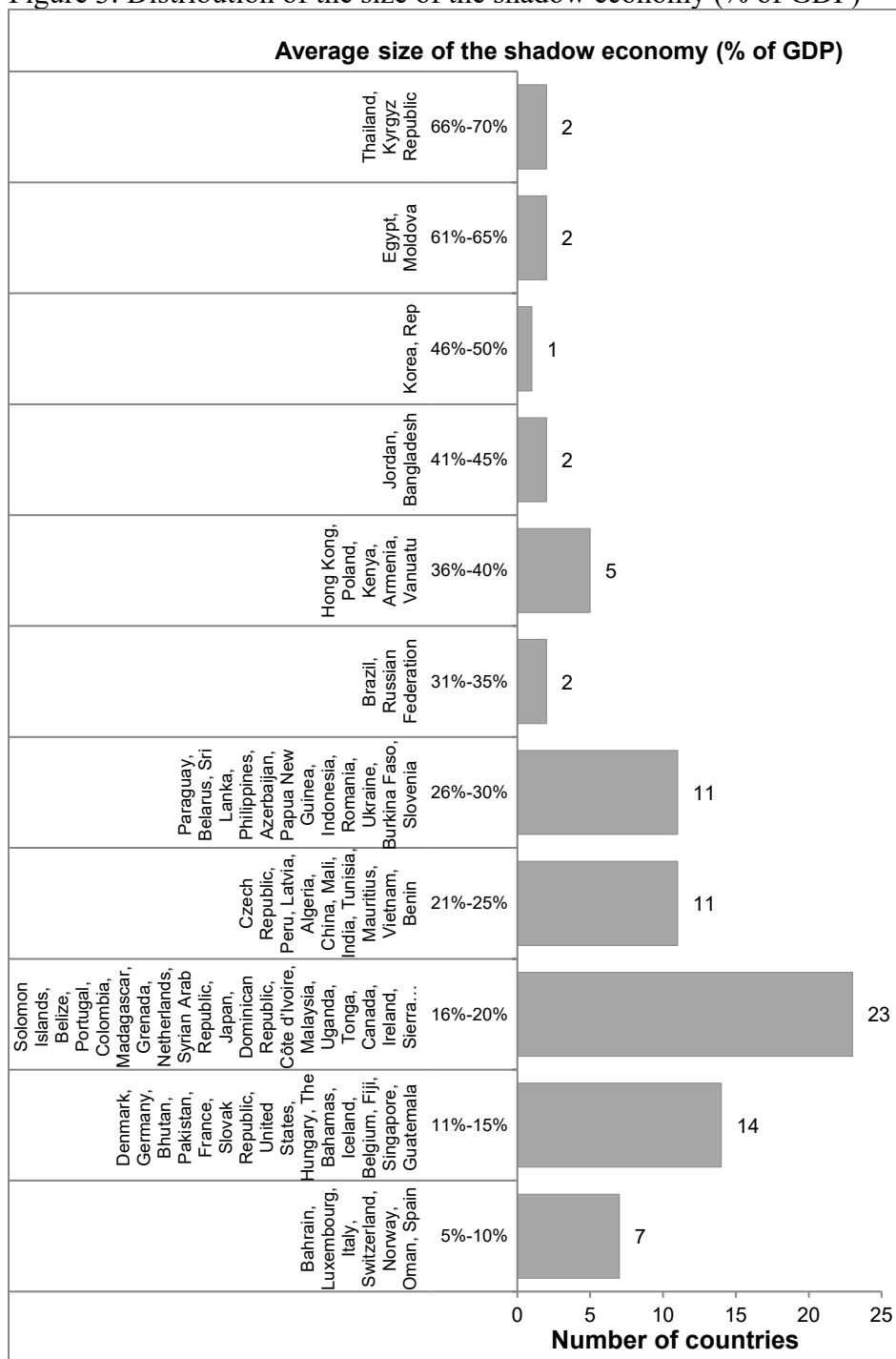Source: Eng (2009).

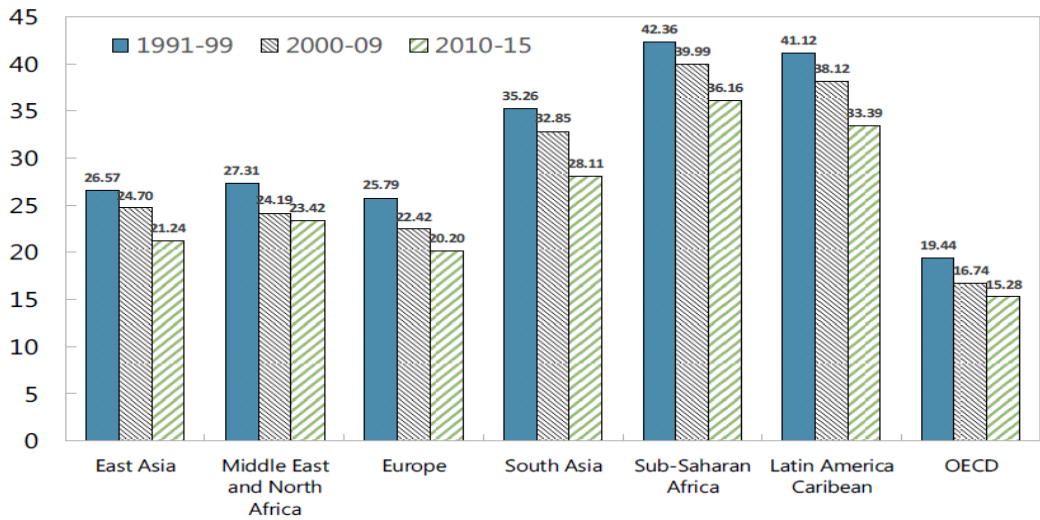Figure 2: Shadow economy (% of GDP) over time by regions

Source: Tan et al. (2017).

Figure 3: Distribution of the size of the shadow economy (% of GDP)

Average size of the shadow economy (% of GDP)

| Range	Countries	Number of countries
66%-70%	Thailand, Kyrgyz Republic	2
61%-65%	Egypt, Moldova	2
46%-50%	Korea, Rep	1
41%-45%	Jordan, Bangladesh	2
36%-40%	Hong Kong, Poland, Kenya, Armenia, Vanuatu	5
31%-35%	Brazil, Russian Federation	2
26%-30%	Paraguay, Belarus, Sri Lanka, Philippines, Azerbaijan, Papua New Guinea, Indonesia, Romania, Ukraine, Burkina Faso, Slovenia	11
21%-25%	Czech Republic, Peru, Latvia, Algeria, China, Mali, India, Tunisia, Mauritius, Vietnam, Benin	11
16%-20%	Solomon Islands, Belize, Portugal, Colombia, Madagascar, Grenada, Netherlands, Syrian Arab Republic, Japan, Dominican Republic, Côte d'Ivoire, Malaysia, Uganda, Tonga, Canada, Ireland, Sierra...	23
11%-15%	Denmark, Germany, Bhutan, Pakistan, France, Slovak Republic, United States, Hungary, The Bahamas, Iceland, Belgium, Fiji, Singapore, Guatemala	14
5%-10%	Bahrain, Luxembourg, Italy, Switzerland, Norway, Oman, Spain	7

Number of countries

Source: Tan et al. (2017).

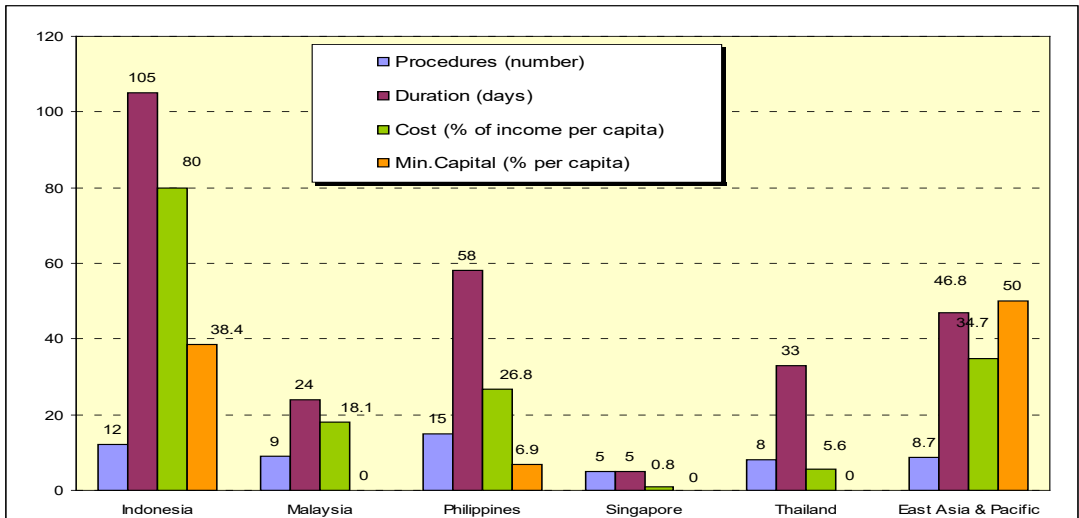Figure 4: Shadow economy by region (average, %GDP)

Source: Medina and Schneider (2018).

Figure 5: Shadow economy by income level (average, %GDP)
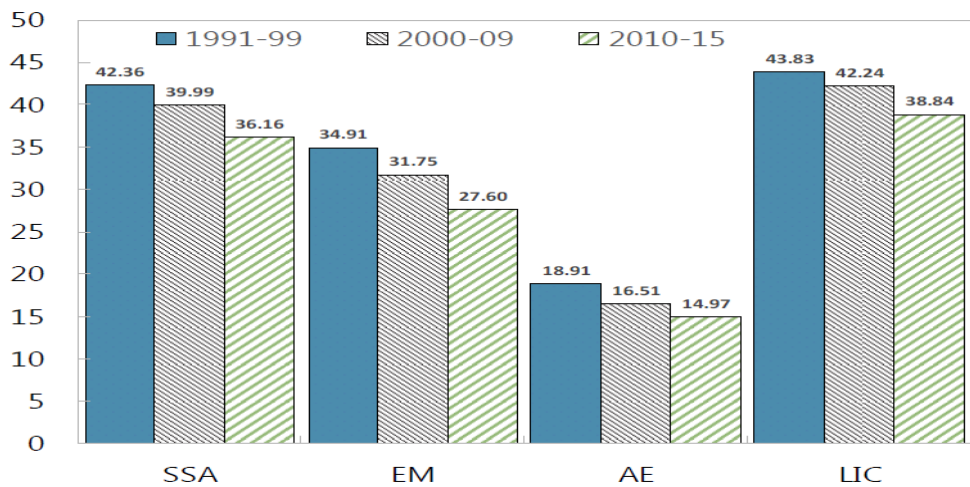

Source: Medina and Schneider (2018)

Figure 6: Starting a business (2008)

Notes: The Starting a Business indicator identifies the bureaucratic and legal hurdles an entrepreneur must overcome to incorporate and register a new firm. It examines the procedures, time, and cost involved in launching a commercial or industrial firm with up to 50 employees and start-up capital of 10 times the economy's per-capita gross national income (GNI).
Source: Eng (2009).

Figure 7: Dealing with licenses (2008)
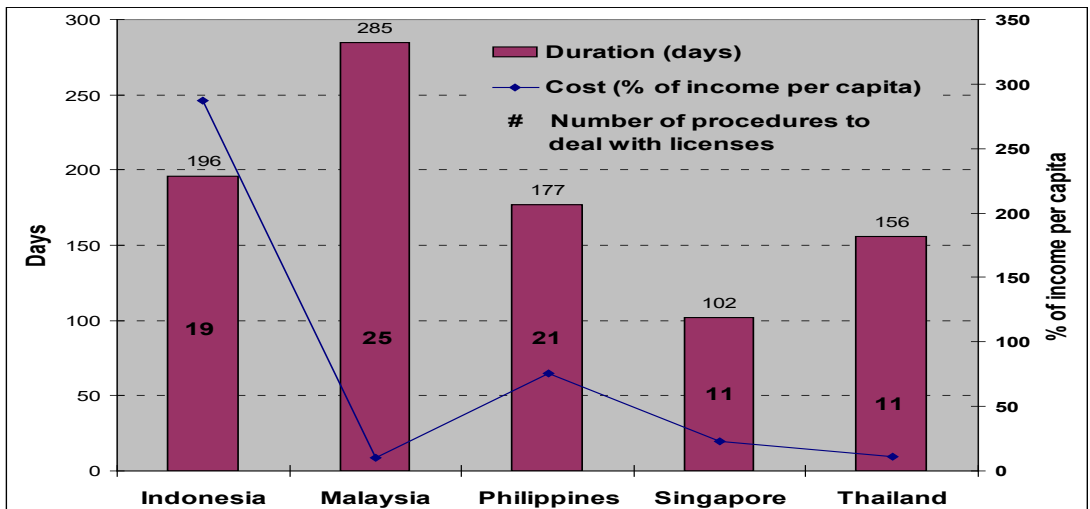
Notes: The dealing with licenses indicator tracks the procedures, time, and costs to build a warehouse, including obtaining necessary licenses and permits, completing required notifications and inspections, and obtaining Utility connections. The business is a small to medium-size limited liability Company, located in the most popular city, domestically owned and operated, in the construction business, with 20 qualified employees.
Source: Eng (2009).

Figure 8: Trend in the size of shadow economy (in log and log differences) in Malaysia, 1971-2018
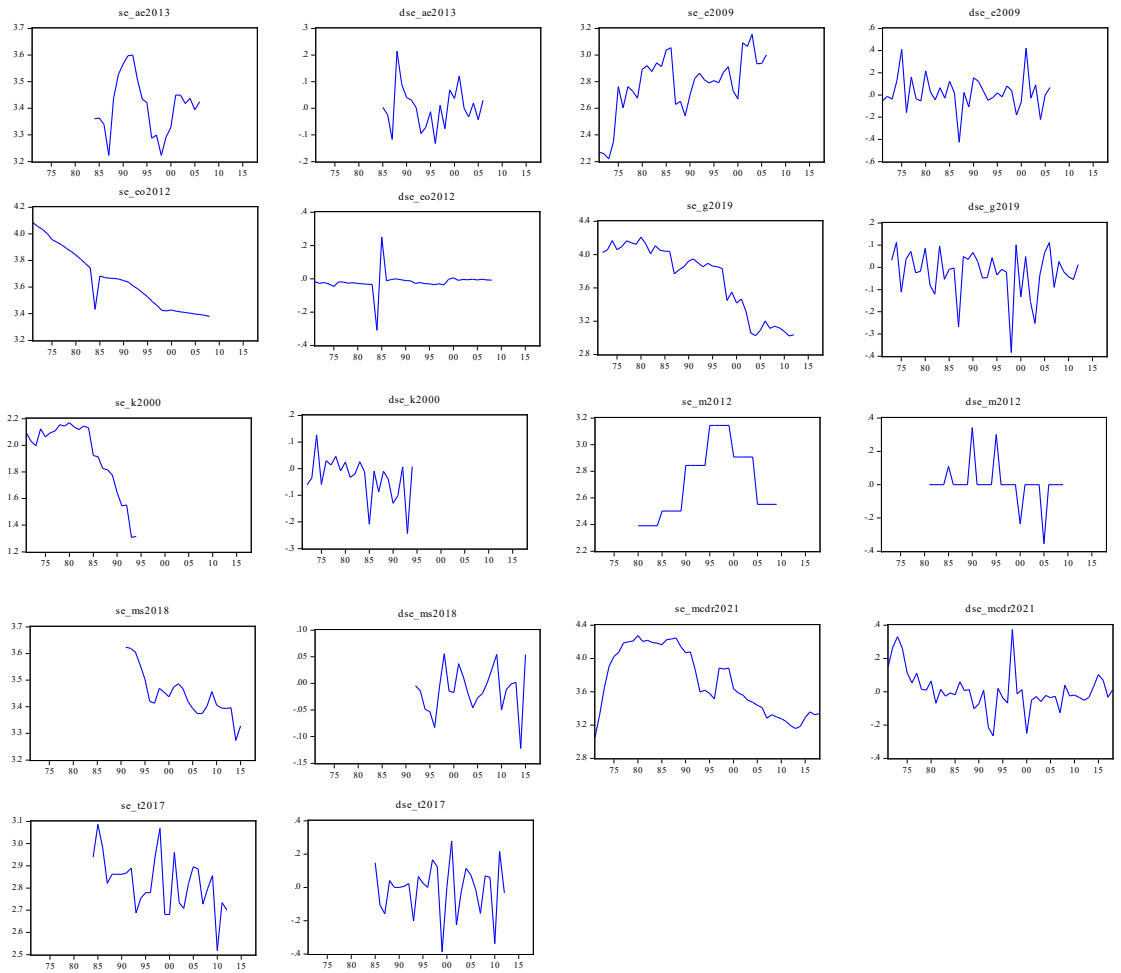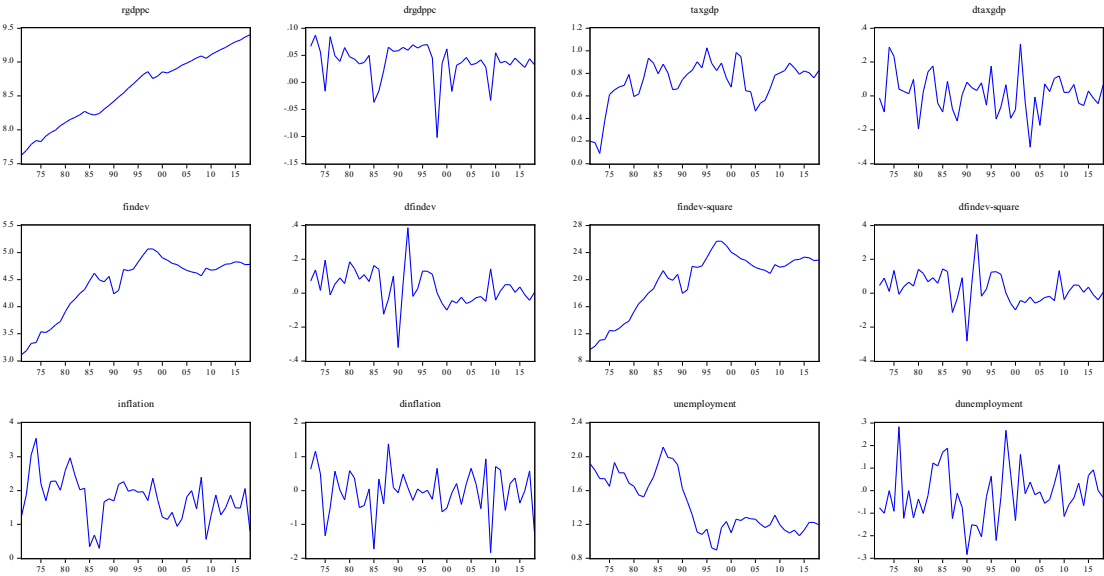
Figure 9: Trend in real GDP per capita (rgdppc), financial development (findev), individual tax revenue (taxgdp), inflation and unemployment rates (both in log and log differences), 1971-2018

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