Using Ordinary Least Squares to Measure the Impact of the Factors Affecting Underground Economy: A Comparison between Bangladesh, India, Pakistan and Turkey

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Abstract
Underground economy is a source of concern since it distorts policy framework of a country and weakens its government. This study sheds light on developing countries that are in dire need of policies that tackle this issue and identifies the reasons as to why these countries have large underground economies in the first place. Using secondary data from 2000-2013 and applying Ordinary Least Squares (OLS) regression model, the impact of tax revenue, unemployment rate, Index of Economic Freedom, population and GDP growth rates, inflation and internet users on the underground economies of Bangladesh, India, Pakistan and Turkey in absolute and comparative dimensions is tested. The first part of the study explains the concept and significance of underground economy. The second part reviews the literature. The third, fourth and fifth parts use OLS to estimate the impact of aforementioned variables on the size of underground economy. Finally, comparative analysis is conducted and policies which can curtail the size of underground economies in the sample countries are recommended.

Keywords: Underground Economy, OLS, Developing Countries
JEL Classifications: E26, C12, O10

I. Introduction
There is no universal definition of underground economy (Friedrich Schneider, 2004) like there is no universal term for its concept. In the literature, underground economy goes by several names; underground, informal, unobserved, unrecorded, black and unofficial economy that refers to all the activities which are out of government’s reach (Chaudhuri, Schneider, & Chattopadhyay, 2006). Like mainstream economy, underground economy produces goods and services, generates income and employs labor however unlike official economy, the output from this sector is neither taxed nor recorded or regulated (Weiss, 1987). Underground economy includes both legal and illegal activities. The types of activities which comprise underground economy are illustrated as under:

Table 1. Activities in the Underground Economy

<table>
<thead>
<tr>
<th>Type of Activity</th>
<th>Monetary Transactions</th>
<th>Non Monetary Transactions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ILLEGAL ACTIVITIES</strong></td>
<td>Trade with stolen goods; drug dealing and manufacturing; prostitution; gambling; smuggling; fraud; etc.</td>
<td>Barter of drugs, stolen goods, smuggling etc. Produce or growing drugs for own use. Theft for own use.</td>
</tr>
<tr>
<td><strong>LEGAL ACTIVITIES</strong></td>
<td>Unreported income from self-employment; wages, salaries and assets from unreported work related to legal services and goods</td>
<td>Employee discounts, fringe benefits</td>
</tr>
</tbody>
</table>

1. Structure of the table is taken from Lipport and Walker ([1997], p. 5) with additional remarks.

Since underground economy cannot be directly observed and is estimated through several different techniques, it is hard to state its size with complete precision however most cited estimates on underground economy have revealed that its weighted average size as a
percentage of official GDP in Asia is 36.4% (Friedrich Schneider, Buehn, & Montenegro, 2010a). This is a relatively high figure and calls out for a look into the factors that are responsible for causing underground economy so that eventually policies can be devised to control these factors and to reduce its size.

Alongside its hidden nature, there are several other problems associated with underground economy that make it an important source of concern for policy makers and the government. Since this part of the economy is unobserved, the social and economic conditions of individuals cannot be estimated with complete accuracy. If an individual is employed in underground economy, that figure will not be reported in official GDP and it will lead to overestimation of unemployment and underestimation of national income, drastically affecting macroeconomic and public policies. Since underground economy escapes taxes, it lowers tax revenue (Frey & Schneider, 2015) which has negative implications on the quality and provision of public goods and services. Furthermore, repercussions on the distribution of income is another adverse consequence (Gupta & Gupta, 1982). In order to compensate for the loss in tax revenue, governments are forced to raise revenue through tax rates which escalates the likelihood of tax evasion, thereby increasing the size of the underground economy further (Alkhdour, 2011). Hence, an economy gets traps in a vicious cycle which culminates in a weak state and adds to the lack of trust the public develops for the government.

Presence of a large underground economy weakens the monetary policy too since firms operating underground avoid using the banking system. The difficulty of raising funds from banks means that there is a focus on short-term gains only and hence large-scale, sophisticated investments are neglected. From a microeconomic perspective, a large underground economy also means distorted safety nets for underground economy labor since their health and safety at work is not guaranteed. In addition to this, due to absence of anti-competitive conduct, the economic surplus is likely to be transferred from consumers to equity owners, increasing inequality (Eilat & Zinnes, 2002).

Despite its drawbacks, underground economy has its benefits. In times of high unemployment levels, especially in developing and transition countries, this sector provides jobs to those who cannot find work in the formal economy (Chowdhury, 2005). Small firms that provide income to the unemployed is likely to have a positive impact on income distribution. This sector maintains economic activity even when there is high corruption and rent-seeking which raises the cost of operating in the official economy. A part of money earned in unofficial economy is likely to be spent in the official economy which will eventually raise tax revenues and formal economic activity. It provides entrepreneurial experience to those who start their own businesses which is likely to have positive implications in the long-run (Eilat & Zinnes, 2002).

However, the problems of underground economy are too many and damaging to neglect and the prolonged existence of the underground economy would ultimately reduce the overall tax revenue and damage the macroeconomic policy framework hence it is important to look at this issue in detail, identify the root causes that determine its size and growth and devise policies that target those causes, bring most of the underground businesses to formal sector and enable the state and policy framework to become strong and efficient.

Keeping the drastic consequences of underground economies and the large underground economies in developing countries that are in need of a reform in perspective, this study aims
to identify the main determinants of underground economy, measure the impact of those
determinants, conduct a cross-country comparison and arrive at measures to reduce the size
of underground economies in Bangladesh, India, Pakistan and Turkey.

II. Literature Review

II.1. Introduction

This section of the study reviews the literature on underground economy. It sheds light on
how the variables are defined in previous studies and the impact that they have on the
underground economy. The literature begins with an explanation of how underground
economy is measured and later explains the independent variables and their link with the
underground economy and, where applicable, with each other. Keeping everything in
perspective, the literature review eventually identifies the gap and how this study aims to fill
it.

II.2. Dependent Variable

II.2.1. Underground Economy as a Dependent Variable

There is no widely accepted definition of underground economy in the literature.
Underground economy is a wide concept and the literature is mostly confined to discussing a
part of the bigger picture. It is also difficult to have a universal definition for this type of
economy because it cannot be observed directly. Since the study in question aims to gauge
the impact on legal underground economic activities, the definition most appropriate in this
scenario is that of Schneider (2008) who stated that ‘underground economy includes
unreported income from the production of legal goods and services, either from monetary or
barter transactions, hence, all economic activities which would generally be taxable were
they reported to the tax authorities’. Underground economy goes by several names in the
literature namely underground, hidden, informal, subterranean, parallel, unofficial and
unreported. Since the name hidden economy implies that this type of economy is hidden from
the formal records, it is difficult to measure it via direct methods therefore most of the
methods of measuring underground economy are indirect (Jamalmanesh, 2011).

Bulk of the literature on underground economy has treated it as dependent variable and has
employed indirect approaches to measure its size. The most common methods of measuring
underground economy in the literature are currency demand approach, MIMIC, DYMIMIC
and physical input method. This study uses estimates of underground economy calculated
using MIMIC from Schneider and Hassan (2016). This is because not only the MIMIC
estimates provided in this study are widely used and authentic, usage of large panel data sets
has provided underground economy estimates for the countries for the time period included
in this study. The idea of MIMIC is to represent the unobserved underground economy as a
latent variable which has observable causes and effects. Thus, MIMIC model connects two
types of observed variables with one unobserved variable (Breusch, 2005).

While many studies on underground economy have provided methods of measuring it, there
are several studies that have used authentic measures of underground economies from other
studies. A study conducted for 69 countries used estimates for OECD countries and United
States from Schneider (1997). For Africa and Asia, estimates from Schneider and Enste
(1998) were used (E. Friedman, Johnson, Kaufmann, & Zoido-Lobaton, 2000). Another
study by Michael Krakowski (2005) used underground economy estimates from Schneider
(2002) and analyzed the determinants of underground economy using cross country
regressions. A sample of 109 countries was employed in this study. Mustafa Sevgin (2009)
used underground economy estimates from Schneider (2004) with the aim of testing the
impact of taxes and regulation on underground economy for 133 countries from 2003 to
2005. The study concluded that tax burden increases while regulatory burden reduces the size of underground economy. Saibal Kar and Shrabani Saha (2012) used Schneider (2007) in their study that investigated the relationship between informal economy, income inequality and corruption for 19 countries in Asia from 1995-2008. The same estimates were used to examine the relationship between the banking sector and the size of underground economy for 137 countries from 1995-2007. The findings of the study revealed that both the depth and efficiency of banking sector have an impact on the underground economy. An improvement in the banking sector therefore leads to a reduction in the size of the underground economy (Bose, Capasso, & Wurm, 2012). Schneider (2007) and Schneider (2005) were used by Roberto Dell Anno (2008) who analyzed the relationship between official and unofficial economies for Latin American countries and empirical analysis for the countries revealed that official and unofficial sectors are complements rather than substitutes. Schneider (2005) was also used in another study that examined the relationship between underground economy and state regulation on a macro level across a broad set of countries. The study concluded that different countries have different regulatory environments which lead to varying levels of underground economies. The lower the state regulation along with better law enforcement, the smaller will be the size of the underground economy (Kus, 2010). Another study used Schneider (2010a) to gauge whether allocating more public resources to education will reduce the size of the underground economy using a cross-section of 70 countries. The results of the study indicated that there is a negative relationship between education and the size of the underground economy (Berrittella, 2015). Same measures for informal economy were also used in another study that highlighted the political determinants of underground economy and measured the impact of political instability, political polarization and various political indicators on it. The study also stated that structural shift from autocracy to democracy could lead to an increase in informal economy if it gives rise to political instability (Elbahnasawy, Ellis, & Adom, 2016). Ceyhun Elgin and Mario-Solis Garcia (2012) also used Schneider (2010b) to argue that high taxes are not the main drivers of underground economy rather it is the trust of producers in government that determines its size. They used panel data to empirically test their claim and it was in line with their theory. Rajeev K. Goel and Michael A. Nelson (2016) also used the same measures for underground economy along with Schneider (2012) to identify the robust determinants of informal economy and to address related modeling uncertainty. This study used three different types of underground economy measures and concluded that bureaucratic and tax complexity as opposed to monetary severity are its major drivers. It also identified that underground economies differ among developed and developing countries in terms of their determinants. A different study by Schneider (2010) was used to assess the importance of factors which have an impact on underground economy for 19 OECD countries from 2003-2008. In accordance with the factors that are strong drivers of underground economy namely taxes, regulatory framework and governance, the study concluded by evaluating the possible gain that Greece can obtain in order to reduce its underground economy (Manolas, Rontos, Sfakianakis, & Vavouras, 2013).

It can be analyzed from the reviewed literature that underground economy in numerous studies is defined using Schneider’s estimates. On the basis of literature, it can be generalized that these estimates are authentic and are provided for a large sample of countries over a long time span. This study aims to use the newest estimates of underground economy provided by Mai Hassan and Friedrich Schneider (2016). This will be an addition to the literature since the most recent (2000-2013) measures of underground economy will be employed. Underground economy is estimated via MIMIC and main drivers of underground economy have been taxes, regulatory burden, unemployment and self-employment. Most of these
determinants are also used in the study in question and their discussion is provided in the next section of literature review.

II.3. Independent Variables

II.3.1. Tax

Bulk of the literature has established a positive relationship between taxes and the size of underground economy. High taxes affect labor-leisure choices and labor is motivated to move underground which is untaxed. High tax rates also mean reduced after tax earnings and profits for employees and employers respectively which motivates them to operate in the underground economy (Siddiki, 2014).

Most of the studies have used tax rates and tax revenues to measure taxes. Tax rates take the form of indirect and direct taxes while tax revenue is used as a percentage of GDP. The studies have also identified that the impact of taxes cannot be seen in isolation rather its impact needs to be seen in combination with other variables especially with the regulatory framework in place. An efficient tax system is useless if there exists weak law enforcement (Alm, 2013; Halıcıoğlu, 1999; H. Hassan, 2016; Mehnaz Ahmed and Qazi Masood Ahmed, 1995; Savasan, 2003).

II.3.2. Inflation

According to the literature, both negative and positive relationship is observed between underground economy and inflation rate. When prices rise, the fall in real income prompts people to work in the official economy. At the same time, falling real incomes and lack of opportunities in the official economy also leads people to work in the underground economy. The decision to operate in the underground economy depends on other factors like tax morality, culture and expectations about the future price levels (Friedrich Schneider, Chaudhuri, & Chatterjee, 2003). This means that the relationship between underground economy and inflation is ambiguous and requires further investigation. Most of the previous studies have measured inflation using consumer price index (Bajada & Schneider, 2005; Erdinç, 2016; Gulzar, Junaid, & Haider, 2010).

II.3.3. Unemployment

There exists a debate on the relationship between unemployment and the size of underground economy. According to Giles (1999), high unemployment and underground economy are likely to be positively related since high unemployment in official economy will force people to operate in the informal economy while there could also be a negative relationship between the two since economic downturn would mean that unemployment exists in both official and unofficial economies.

Unemployment in the previous studies has mostly been measured using unemployment rate as a percentage of total labor force. Its impact on the size of underground economy is influenced by other factors especially the level of education (Gulzar et al., 2010; M. Hassan & Schneider, 2016; Kanniainen, Pääkkönen, & Schneider, 2004; Saafi, Farhat, & Haj Mohamed, 2015; Sarac, 2012; Savasan, 2003)

II.3.4. Index of Economic Freedom

Institutional quality and government regulations are widely discussed in the literature and there are numerous ways to measure them. Institutional quality has a negative relation with the underground economy while high regulations tend to push up the business costs and force them to go underground. Most of the studies have identified index of corruption as the
one most prevalent in developing countries (Dreher & Schneider, 2006; Elgin & Oztunali, 2014; B. A. Friedman, 2014; E. Friedman et al., 2000; Jamalmanesh, 2011).

This study has included indices for property rights, freedom from corruption, fiscal freedom, government spending, business freedom, trade freedom, investment freedom and financial freedom to test their impact on the size of underground economy. The average of all these indices has been taken to arrive at one overall index referred to as governance indicator/index of economic freedom.

II.3.5. GDP
With regards to the relationship between GDP and the size of underground economy, both positive and negative relationship has been observed. Most of the studies have made use of GDP/capita and annual GDP growth to measure GDP. With the development of literature on GDP overtime, it has been observed that its impact cannot be seen in isolation rather it is influenced by the institutional quality and governance (Elgin & Oztunali, 2014; Klinglmair & Schneider, 2004).

II.3.6. Internet Users
Internet users have a negative relationship with the size of underground economy. This is because increased internet users raise awareness among the public about the drastic consequences of corruption. Since large underground economies give rise to high levels of corruption, an increase in internet users is likely to reduce the size of underground economy via reduction in the levels of corruption (Elbahnasawy, 2014; Elgin, 2012; Goel, Nelson, & Naretta, 2012; Shrivastava & Bhattacherjee, 2014).

II.3.7. Population Growth
According to the literature, there is no direct and clear link between population growth and underground economy however it affects the level of corruption in developing countries. Most of the studies have established that underground economy and corruption in developing countries are complements (Choi & Thum, 2005; Dreher, Schneider, Choice, & July, 2010; Johnson, Kaufmann, & Zoido-LobatóN, 1998) and the sample countries in our study have high corruption levels which has contributed towards their large underground economies. Since one of the factors leading towards corruption is population, particularly in developing countries, an indirect and positive link between underground economies and population growth via corruption can be established for this study. Apart from determining the size of underground economy through the channel of corruption, a high population growth, especially for developing countries, means more mouths to feed with limited resources and in such cases, people are forced to move underground since it offers them an income source. This puts an upward pressure on the size of underground economy.

II.4. Conclusion
From the reviewed literature, the following gaps are identified which this study aims to fill. They are:
1. Bulk of the work has been done on the underground economies of developed countries whereas developing countries are the ones in dire need of a reform hence their underground economies need to be looked at.
2. Previous studies have focused on measuring the size of underground economies whereas the reasons as to why these economies exist in the first place need to be investigated in depth.
3. Previous studies have identified ambiguity for unemployment and GDP which this study aims to investigate further. Internet users is a relatively new variable and its relation with the size of underground economy can be explored. Population is a variable relevant to developing countries and need to be looked at.

4. While previous studies have used older estimates of underground economy, this study is an extension since it uses the estimates from 2000-2013.

III. Hypotheses

Figure 3.1 below shows the research model which is a diagrammatic illustration of the research before shaping it into an econometric form. It shows all the independent variables and their hypothesized relationships with the dependent variable.

![Figure 1. Research Model](image)

The size of the underground economy in this study is determined by inflation rate, tax level, unemployment level, population growth, internet users, Index of Economic Freedom and GDP growth. The size of the underground economy is dependent while above mentioned determinants of underground economy are independent variables. The development of the hypotheses is done in the light of literature and economic theory. They are as under:

**H1:** There is a positive relationship between the size of the underground economy and the inflation rate, ceteris paribus

**H2:** There is a significant relation between the size of underground economy and unemployment level but the direction of relationship is ambiguous, ceteris paribus

**H3:** There is a negative relationship between internet users and the size of the underground economy, ceteris paribus

**H4:** There is a positive relationship between the size of underground economy and tax revenue, ceteris paribus

**H5:** There is a negative relationship between Index of Economic Freedom and the size of underground economy, ceteris paribus

**H6:** There is a significant but ambiguous relationship between GDP growth and the size of underground economy, ceteris paribus

**H7:** There is a positive relationship between population growth and the size of underground economy, ceteris paribus

IV. Research Methodology

This is a quantitative study and has made use of annual secondary data from 2000-2013. The countries included in the study are Bangladesh, India, Pakistan and Turkey. Data on
underground economy has been gathered from Mai Hassan and Friedrich Schneider (2016). Data on Index of Economic Freedom is gathered from The Heritage Foundation. Data on remaining independent variables is taken from The World Bank. Ordinary Least Squares analysis has been used to estimate the model.

IV.1. Measurement of Variables

IV.1.1. Dependent Variable
Underground economy (% of official GDP): The study in question will be using calculations of underground economy which are conducted by Hassan Mai and Friedrich Schneider (2016b) using MIMIC approach from 1999-2013. The study has measured underground economy for 157 countries (including sample countries) and has provided the most recent estimates of the underground economy from 1999-2013. Consequently, in order to make use of the latest possible measures of underground economy, data has been taken from this study.

IV.1.2. Independent Variables

Inflation: CPI has been used to measure inflation. This type of measure reflects changes in the cost to an average consumer of acquiring a basket of goods and services. This measure of inflation is employed by the study because it has been used widely in the literature as a suitable measure for capturing the change in prices overtime.

Unemployment: Unemployment refers to that part of labor force that is willing and able to work but cannot find a job. Unemployment as a percentage of total labor force is used in order to capture both male and female rates of unemployment.

Internet users (per 100 users): This measure comprises individuals who have used internet from any location in the past 12 months and is out of 100 users of internet. This measure is used to define the variable because this is the most relevant way to use this variable for the study in question and is used as it is in previous studies.

GDP growth: This refers to the annual growth rate of GDP at market prices based on local currency. Due to less usage of this type of GDP measure, this study has used it in order to check its impact on GDP growth. This variable, being more explanatory for the sample countries in this study, is also another reason of including it in the model.

Tax: Tax revenue as a percentage of GDP has been used due to unavailability of data on tax rates, particularly for Bangladesh, India and Pakistan. Due to similar issue, there were some missing values in the data for tax revenue too however those values have been interpolated for this study using Microsoft Excel.

Index of Economic Freedom: An overall governance index has been used comprising property rights, freedom from corruption, fiscal freedom, government spending, business freedom, labor freedom, monetary freedom, trade freedom, investment freedom and financial freedom. This is the most crucial determinant of underground economies across the globe hence this cannot be ignored in this study.

Population growth: Annual population growth for a year is the exponential rate of growth of midyear population from previous to current year expressed as a percentage. Population is one of those variables that has strong implications for developing countries.
Previous studies which are mostly based on developed countries’ underground economies have not made use of this variable therefore population growth is included in the model for this study in order to see its impact on developing countries’ underground economies. Like tax revenue, the data on population growth had some missing values which have been interpolated using Microsoft Excel.

**IV.2. Model**

Since all the variables have been discussed and their relationships have been defined, it is a good time to put together everything we know in the form of a model below and test our hypotheses empirically.

\[
Y = \alpha + \beta_1 + \beta_2 + \beta_3 + \beta_4 + \beta_5 - \beta_6 + \beta_7 + \mu
\]

Where;

- \( Y \) = Size of underground economy (% of GDP)
- \( \alpha \) = Constant
- \( \beta_1 \) = Inflation (CPI)
- \( \beta_2 \) = Unemployment (% of total labor force)
- \( \beta_3 \) = Internet users (per 100 users)
- \( \beta_4 \) = GDP growth (annual %)
- \( \beta_5 \) = Tax revenue (% of GDP)
- \( \beta_6 \) = Index of Economic Freedom (out of 100)
- \( \beta_7 \) = Population growth (annual %)
- \( \mu \) = Error term

**V. Results**

The first part of this section provide graphical illustrations as to how the data for the sample countries looks like from 2000-2013 followed by a discussion of their econometric results. The analysis is conducted along absolute and comparative dimensions.

From figure 5.1 above, it can be clearly seen the size of Bangladesh’s underground economy is the highest followed by Turkey. India has the smallest underground economy and its size is stable and has decreasing trend overtime. The highest level of underground economy can be seen for Bangladesh in 2007 while the lowest is for India in the year 2011. It can be concluded that Bangladesh and Turkey are relatively in a greater need for a reform that can enable them to curtail the size of their underground economies.
From the figure above, it can be clearly seen that Turkey has the highest tax revenue throughout as opposed to the other sample countries. The tax revenue of Bangladesh is lowest throughout in comparison with the other countries however it is slowly rising overtime. India has struggled to improve its tax revenue overtime though a slight decline can be seen in its tax revenue after 2007. The same can be seen for Pakistan however the level of increase in India is more than in Pakistan. Keeping this analysis in perspective, it can be concluded that Bangladesh should revisit its tax system and design it to facilitate an increase in its tax revenue. Pakistan and India seem to be struggling for improvement and can devise a better fiscal policy framework in order to do so.

It can be seen that Turkey has done well in terms of significantly reducing its high levels of inflation overtime. Turkey has, in the past, been hit by several financial and economic crises which have made it volatile but the economy has recovered well. After 2003, Turkey’s inflation rate seems stable until 2013. The situation of inflation in Bangladesh and India looks stable. A relatively higher rate of inflation can be seen in Pakistan, especially in 2008 which is likely to be due to change in government and global economic recession.
Figure 5.4 clearly shows that of all the sample countries, the highest level of unemployment from 2000-2013 can be seen in Turkey, especially from 2007-2009, likely due to the global economic recession. With regards to Pakistan, it can be seen that overtime, the country managed to bring down its level of unemployment, especially after 2006. India and Bangladesh seem to have stable levels of unemployment, with no drastic changes throughout.

From the figure above, it can again be seen that Turkey stands out as opposed to the other countries since it is the only country in the sample that faced negative GDP growth which means falling levels of GDP in 2001 and 2009 though it must be added that it has recovered well, especially after 2009. The other countries have positive GDP growth rates which means that their GDP was growing overtime. The highest rates of GDP growth can be seen for India. Although the rate of GDP growth in Bangladesh is slow in comparison to Pakistan, it has relatively greater stability.
Almost all countries are similar to each other in terms of economic freedom but a detailed look at this figure shows that Turkey has the highest level of economic freedom, followed by Pakistan, India and Bangladesh. There are no drastic oscillations in the index overtime for any of the countries however there is enough room to increase this index further.

From the figure above, it is clear that the trend of internet users is increasing for all the countries, with Turkey having the most rapid increase overtime, followed by India, Pakistan and Bangladesh. This indicates that Turkey has the strongest infrastructure while there is a dire need for one in Bangladesh. With regards to India and Pakistan, the growth in internet users exists but the rate of growth is terribly slow.

With regards to population growth, Pakistan seems to be on top. The growth rates are positive for all the countries which means that population has been increasing throughout.
Pakistan’s rate of increase is the highest and looks stable overtime. India and Bangladesh have almost similar rates of population growth however Bangladesh managed to lower its growth rate overtime. For India, however, the decline has been slow. Although Turkey has lower rate of population growth initially, it grew at an increasing rate after 2008.

The following section discusses the results obtained from estimating the model using OLS.

V.1. Bangladesh

The R-square obtained for Bangladesh is 0.68.

H1: Inflation and underground economy (+)
Coefficient = 1.16, t-stat = 1.41, p-value > 0.05 ns

H2: Unemployment and underground economy (ambiguous)
Coefficient = - 0.27, t-stat = - 0.06, p-value > 0.05 ns

H3: Internet users and underground economy (-)
Coefficient = 1.18, t-stat = 0.66, p-value > 0.05 ns

H4: Tax revenue and underground economy (+)
Coefficient = 2.57, t-stat = 0.58, p-value > 0.05 ns

H5: Index of Economic Freedom and underground economy (-)
Coefficient = - 1.57, t-stat = -2.91, p-value < 0.05 s

H6: GDP growth and underground economy (ambiguous)
Coefficient = 0.86, t-stat = 0.49, p-value > 0.05 ns

H7: Population growth and underground economy (+)
Coefficient = 20.07, t-stat = 1.78, p-value > 0.05 ns

It can be seen that the significant determinant of the underground economy in Bangladesh is Index of Economic Freedom. Hence, high quality institutions are pivotal to curtailing the size of its underground economy.

V.2. India

The R-square for India is 0.61.

H1: Inflation and underground economy (+)
Coefficient = 0.37, t-stat = 2.15, p-value < 0.1 s (at 10%)

H2: Unemployment and underground economy (ambiguous)
Coefficient = - 0.30, t-stat = - 0.26, p-value > 0.05 ns

H3: Internet users and underground economy (-)
Coefficient = - 0.05, t-stat = - 0.23, p-value > 0.05 ns

H4: Tax revenue and underground economy (+)
Coefficient = 0.36, t-stat = 1.13, p-value > 0.05 ns

H5: Index of Economic Freedom and underground economy (-)
Coefficient = - 0.57, t-stat = - 1.69, p-value > 0.05 ns

H6: GDP growth and underground economy (ambiguous)
Coefficient = - 0.09, t-stat = - 0.62, p-value > 0.05 ns

H7: Population growth and underground economy (+)
Coefficient = - 0.20, t-stat = - 0.02, p-value > 0.05 ns

From the results above, it can be seen that inflation is the only significant determinant of the size of underground economy in India. It is significant at 10%.

V.3. Pakistan

R-square for Pakistan is 0.87. The results of econometric estimation are as under:
H1: Inflation and underground economy (+)
Coefficient = -0.11, t-stat = -0.58, p-value > 0.05 ns

H2: Unemployment and underground economy (ambiguous)
Coefficient = -0.45, t-stat = -0.25, p-value > 0.05 ns

H3: Internet users and underground economy (-)
Coefficient = 0.40, t-stat = 0.67, p-value > 0.05 ns

H4: Tax revenue and underground economy (+)
Coefficient = 1.54, t-stat = 1.49, p-value > 0.05 ns

H5: Index of Economic Freedom and underground economy (-)
Coefficient = -0.53, t-stat = -0.81, p-value > 0.05 ns

H6: GDP growth and underground economy (ambiguous)
Coefficient = -0.99, t-stat = -3.23, p-value < 0.05 s

H7: Population growth and underground economy (+)
Coefficient = 10.46, t-stat = 0.78, p-value > 0.05 ns

For Pakistan, GDP growth is the significant variable at 5%.

V.4. Turkey

For Turkey, the R-square is highest at 0.88. The estimated results are shown below:

H1: Inflation and underground economy (+)
Coefficient = 0.30, t-stat = 2.51, p-value < 0.05 s

H2: Unemployment and underground economy (ambiguous)
Coefficient = 1.71, t-stat = 2.96, p-value < 0.05 s

H3: Internet users and underground economy (-)
Coefficient = 0.63, t-stat = 2.87, p-value < 0.05 s

H4: Tax revenue and underground economy (+)
Coefficient = -1.66, t-stat = -0.90, p-value > 0.05 ns

H5: Index of Economic Freedom and underground economy (-)
Coefficient = -0.61, t-stat = -2.33, p-value < 0.1 s (10%)

H6: GDP growth and underground economy (ambiguous)
Coefficient = -0.09, t-stat = -0.61, p-value > 0.05 ns

H7: Population growth and underground economy (+)
Coefficient = -2.49, t-stat = -0.43, p-value > 0.05 ns

Inflation, unemployment and internet users are significant for Turkey at 5% and Index of Economic Freedom is significant at 10%.

V.5. Comparative Analysis between Bangladesh, India, Pakistan and Turkey

All countries included in this study have one thing in common; Index of Economic Freedom and their underground economies are negatively related. This means that high quality institutions and governance is pivotal to reducing the size of underground economies in all the countries.

Positive relationship between population growth and the size of underground economy is observed for Pakistan and Bangladesh and the opposite is true for India and Turkey. A likely explanation for this could be the fact that India and Turkey have relatively high levels of literacy and even if they experience a growth in their populations, a literate population is likely to be absorbed in the formal economy. For Pakistan and Bangladesh, low levels of literacy make it difficult for people to find work in formal economy hence they are forced to move underground.
A negative relationship between GDP growth and the size of underground economies is seen for all the sample countries except Bangladesh. This means that even if the economy is prospering, the level of underground economy is still rising in Bangladesh. A possible explanation for this is the uneven spread of economic growth in Bangladesh due to which not everyone is made better off hence they continue to engage in the underground economy. Another possible explanation could be that people who are engaged in the formal sector are also engaged in the informal sector in order to have multiple sources of income.

With regards to internet users, a comparison between sample countries has revealed that a positive relation exists between internet users and underground economy for all countries except India. A possible explanation is the advanced information and communication technology (ICT) in India and greater transparency due to which an increase in internet users lowers corruption and the size of its underground economy.

High tax revenue leads to increase in underground economy for all countries except Turkey. This indicates existence of an efficient fiscal framework and a wider tax base in Turkey as opposed to its counterparts. Tax morality is likely to be higher in Turkey which increases the willingness to pay taxes consequently less incentive to escape them by moving underground. As revealed by the econometric results above, it can be concluded that most of the explanatory variables included in this study explain Turkey’s underground economy the most as opposed to the other countries in the sample. Moreover, it has the most significant variables that determine the size of its underground economy.

VI. Conclusion
The first objective of this study was the identification of determinants of underground economy for emerging developing economies in Asia namely Bangladesh, India, Pakistan and Turkey. Seven factors which determine the size of underground economy in these countries have been identified.

The second and third objectives of the study have been achieved through using OLS regression model whereby the impact of seven variables namely inflation, unemployment, internet users, tax revenue, Index of Economic Freedom, GDP growth and population growth on the size of underground economy has been gauged. The results have been discussed along absolute and comparative dimensions.

The final objective of the study is to recommend policies which can curtail the size of underground economy. The countries included in this study have underground economies ranging between 25-35% which is a large number and it is therefore important to have certain policy recommendations which can eventually curtail its size. Keeping the results of the study in consideration, it can be recommended that countries especially India, Pakistan and Bangladesh can improve the efficiency of their tax system by widening tax base and lowering tax rates. Widening tax base would mean that the tax burden would be spread out and more tax payers would curtail the size of underground economy and increase tax revenue which will ultimately benefit their economies. Furthermore, tax collection system should be simple and comprehensive so that common people can understand it. This is likely to lessen the chances of tax evasion. Tax collection units should have staff that is efficient and honest in order to ensure proper tax revenue collection. High Index of Economic Freedom has a negative impact on underground economies for all the countries. It is therefore recommended that better quality institutions need to be in place which ensure that all the laws related to property rights, labor market, businesses, anti-corruption and trade and investment are
properly enforced. This would create a favorable environment for businesses to operate in formally and there will be little incentive to move underground. With regards to internet users and the size of underground economy, it is recommended that better transparency systems need to be in place and proper monitoring needs to be carried out in order to track any informal activity online. Effective campaigns on honest usage of ICT should be developed and carried out.

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