

CORRUPTION AND UNDERGROUND ECONOMY: ESTIMATING ITS SIZE IN PAKISTAN

Fatima Javed¹, Khawaja Asif Mehmood², Muhammad Zahir Faridi³, Roela Kausar⁴, Muhammad Aurmaghan⁵.

¹ MPhil Scholar, School of Economics, Bahauddin Zakariya University, Multan, Punjab, Pakistan.

² Assistant Professor, School of Economics, BZ University, Multan, Punjab, Pakistan.

³ Professor, School of Economics, Bahauddin Zakariya University, Multan, Punjab, Pakistan.

⁴ Lecturer, Department of Economics, Bahria University Karachi Campus, Sindh, Pakistan.

⁵ PhD Scholar, School of Economics, Bahauddin Zakariya University, Multan, Punjab, Pakistan.



ARTICLE INFO

ABSTRACT

Article History:

Received: March 26, 2024

Revised: April 24, 2024

Accepted: April 27, 2024

Available Online: April 30, 2024

Keywords:

Corruption

Underground

Economy

Estimating

Pakistan

Funding:

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

Copyrights:



Copyright Muslim Intellectuals Research Center. All Rights Reserved © 2021. This work is licensed under a [Creative Commons Attribution 4.0 International License](https://creativecommons.org/licenses/by/4.0/)

The study aims to evaluate the influence of corruption on the size of underground economy of Pakistan against tax revenue, political stability, voice and accountability, gross domestic product, inflation, and corruption. To assess the influence of corruption on the magnitude of the underground economy, annual time series data from 1972 to 2021 is used. For the regression analyses, Auto Regressive Distributed Lag (ARDL) framework is utilized. The explained variable in the study is the ratio of currency in circulation and money supply. The empirical findings reveal significant impact of explanatory variables. Appropriate tax adjustments, promotion of education and awareness, and price stability are the policy recommendation to combat the issue of underground economy.

Corresponding Author's Email: zahirfaridi@bzu.edu.pk

INTRODUCTION

Developing nations like Pakistan have been grappling with numerous challenges for decades, including corruption and the presence of underground economy. Evaluating the exact extent of the un-recorded economy is a complex mission faced by many countries. Corruption is typically described as misappropriation of public and private positions for personal gain, encompassing activities such as nepotism, bribery, and embezzlement. It leads to the inefficient resource allocation and also hampers the institutional and legal structure of a nation, ultimately contributing to income inequality and poverty. The underground economy, on the other hand, refers to unrecorded economic activities resulting from tax evasion and it has an influence on the Gross Domestic Product (GDP).

Statement of the Problem

Pakistan, like other developing nations, is not away from tackling the extent of the underground and the prevalence of corruption. This research aims to investigate the extent of the underground in the presence of corruption and examine its impact on the formal sector of the country. These problems have plagued Pakistan for several decades, and they are common issues faced by many developing nations. The underground economy in such countries arises due to factors such as; tax evasion, bribery, corruption, and various other dishonest practices.

Objectives of the Study

The main goal of the present research is to examine the correlation between corruption and the informal sector. Study also assesses the credibility and effectiveness of the currency demand approach. This study further evaluates the immediate and long-lasting effects of corruption on the underground economy in Pakistan. Moreover, this study determines whether tax evasion is the sole driver of the underground economy or if other variables also contribute to its growth.

Significance of the Study

The aim of this research is to analyse the correlation between corruption and the informal economy. Its significance lies in determining the interplay between the illegal economy, corruption, and the repercussions on the formal sector of the country. By conducting this research, the aim of this research is to shed light on the occurrence of corruption, the size of the unrecorded sector, and its impact on the Pakistan's economic growth. Additionally, this study indicates the macroeconomic indicators which influence economic growth and conclude that whether their impact is positive or negative.

Scope and Limitation of Study

The focus of this study is to delve into the segment of the economy that operates outside the purview of governmental regulation. This research endeavours to highlight the shadow or informal economy of Pakistan, with the aim of integrating it into the documented economy and fostering its contribution to the improvement of Pakistan's overall economic condition.

REVIEW OF LITERATURE

Empirical research work has evaluated the effects of corruption on unrecorded economic activities, and it is thus crucial to conduct a detailed literature review to incorporate data and methodological considerations for authentic research. The primary focus is on relevant studies conducted at the country and cross-country levels, given their significance and ongoing progress.

Ngouhou et al (2022) examined the correlation among growth and underground economy during the presence of corruption. The sample was taken from 112 developing countries between the years 1991-2015. The results of this study are based on FE, system GMM, MG, AMG, and IV-2SLS. Independent variables in the study are economic growth and corruption. The conclusion of this study showed that informality hampers economic growth when interacted with corruption. In addition, this negative effect is robust in every area except for high income or upper middle-income countries.

Quantifying the extent of underground economy poses a challenging endeavour. According to Duong et al. (2021), an assessment should be conducted on the effect of corruption and the unrecorded sector on economic growth. For this purpose, the data was taken from BRICS countries over the period 1991-2017. Other variables included in the model are public expenditure, foreign direct investment, trade openness, inflation, and tax revenue. In this study, the Bayesian linear regression method is employed. Outcome showed that the variables (public expenditure and trade openness) increased the country's progress up to 75.69% and 67.11%. While the control variables (Tax revenue, inflation, and Foreign direct investment) affect positively, the likelihood of this positive effect is uncertain, varying from 51.13% to 56.36%. Also, Duong et al. (2021) found that the black market and corruption control had a productive contribution on the economic growth of these nations. Despite that, the probability of this positive effect is 62.23% and 65.25%, which is not high.

According to Esaku (2021), Both in the sustained duration and short term, a positive correlation exists among the extent of the parallel economy and corruption. For this study, the country selected for the analysis was Uganda. Periods covered in the study include 1984-2008. The research utilised ARDL (Auto regressive distributed lag model) and Granger causality methodology to check the causality. The variables employed in the analysis included annual percent GDP growth per capita, the ratio of government spending on consumption to GDP, measures of democracy, and institutional quality. The study demonstrated a bidirectional causal relationship between these parallel economy and corruption.

Nemec et al. (2021) performed research to probe the implications of corruption on the extent of black economy and components of sustained national prosperity. The study also explored corruption-related transmission channels that affect taxation. Time period covered was 2002-2019. The study employed Dynamic Stochastic General Equilibrium (DSGE) modelling. The findings showed that corruption has an effect on the extent of the unrecorded economy positively, while capital accumulation and labor force size are also affected. Moreover, tax evasion is also negatively affected by corruption and had destructive effect on the economy's growth.

Komin et al (2020) researched the ramification of covid-19 on the workers of hidden economy. The area for the research analysis selected was Thailand. The sample was taken from 384 informal sector workers. A t-test and ANOVA were used for the analysis. The results showed that there was dramatic decline in their monthly income, although the decline in incomes varied across occupation and geographic regions. For the compensation of declined incomes, workers of the informal sector reduce their savings and increase their debt. The government also contribute and initiated income support schemes but it reaches less than half to the IS workers.

However, another research by Hoinaru et al. (2020) found the negative role of underground economy and corruption on the economic and sustainable progress of the nations. In addition, the results indicated that in wealthy nations, corrupt practices and un-recorded economy had a more significant and detrimental impact on development compared to developing nations. The study described whether there is a way in

Corruption and Underground Economy: Estimating its Size in Pakistan

which underground economy & corruption affect sustainable and economic growth. For this purpose, data was taken from 185 countries for the time 2005-2015. Techniques applied in the study were Ordinary Least Squares (OLS), Fixed-effects Model (FEM) & Random-effects Model (REM). The study used corruption and shadow economy as explanatory variables while economic and sustainable development as explained variable. Corruption was measured by Corruption Perception Index (CPI) while economic and sustainable development was quantified by Human Development Index (HDI). Also, Environmental performance index was also used. Another notable finding is that corruption can be viewed as a means to attain greater economic benefits and foster economic development. Interestingly, in the case of underdeveloped countries, there was some evidence suggesting favourable outcomes of corruption and the off-the-books sector on economic and sustainable advancement.

Awad and Alazzeah (2020) estimated the shadow economic system in Palestine via Currency Demand Approach (CDA). The study calculated the un-recorded market over the time 2008-2017. A set of econometric approaches of time series including Vector Error Correction Model (VECM), Unit Root Tests, Augmented Dickey Fuller (ADF) Tests, Engel Granger test for co-integration, and Johansen cointegration test were applied. In the study, the scale of the illegal economy served as the dependent variable, while several independent variables were considered, including the tax-to-GDP ratio, the ratio of public sector wages and salaries to nominal GDP, the interest rate on stored funds in US\$ in commercial banks, the ratio of self-employed individuals to the employed population and per capita GDP. The econometric outcomes indicated that all variables exhibited statistical significance, other than the variable of government salaries and wages. This suggests that the salaries received by government workers did not significantly contribute to the underground economy due to their low wages and the high cost of living. However, these circumstances lead some government workers to indulge in informal commercial engagements, thereby increasing the dimension of the hidden economy. Notably, the positive sign of per capita GDP contradicted expectations, indicating that Palestinian citizens continued to rely on cash transactions and were less inclined to adopt innovative financial instruments such as cheques and credit cards.

Khounq et al (2020) delve into the ramification of underground economy on economic growth in Pakistan. The study used Currency Demand Approach (CDA) and Auto Regressive Distributed Lag (ARDL) technique for the analysis. The data was collected from 1973 to 2017. The study encompassed several factors, including gross domestic product (GDP), gross net product (GNP), inflation rate, real GDP growth rate, foreign currency accounts (FCA), demand deposits (DD), currency in circulation (CC), money supply (M1 and M2), banking services (BS), and total tax revenues. The findings of the analysis unveiled that the un-recorded economy accounted for 56% of the Gross Domestic Product (GDP). Furthermore, the outcomes indicated that the underground economy played an essential role in the decline of the legal sector within the Pakistani economy.

Fernandez et al. (2020) conducted research to locate the effects of corruption and unrecorded economy on innovation. The data for this research was taken from the Spanish regions. Moreover, the period covered was 2000-2012. The explained variable in the study was patent growth which is reflected to

innovation. The research examined multiple explanatory factors, encompassing expenditure on Research & Development (R&D), the aggregate count of patents recorded in each area, Foreign Direct Investment (FDI), joblessness, the ratio of debt to GDP, Corruption Perception Index (CPI), economic expansion in the Spanish regions, the frequency of Crimes against the Public & Justice Administration (CPJA), the extent of illicit economy in relation to GDP (SE), and the frequency of crimes against the tax authorities (CTA). The research utilized various statistical methods such as Ordinary Least Squares (OLS), Generalized Method of Moments (GMM), fixed effects estimation, and dynamic panel data analysis. The results showed an inverse correlation of corruption on innovation. Additionally, the study found that the presence of a shadow economy, directly associated with underground activities, led to a decline in regional innovations.

Bayar & Ozturk (2019) investigated the effectiveness of globalization and economic independence on the underground economy in the European Union Transition Economies. The data was taken from the period 2000 to 2015. The study employed Persyn and Westerlund (2008) cointegration test to investigate the impacts. In addition, Multiple Indicator and Multiple Cause method (MIMIC) was used in the study. According to the empirical analysis, economic freedom is found to have a long-term effect in reducing the extent of the shadow economy across the entire panel. However, the impact of globalization on the shadow economy varied with some countries experiencing a relatively smaller decrease as a result.

THEORETICAL FRAMEWORK OF THE MODEL

Cagan (1958) introduced the monetary technique by utilizing the currency demand approach to explore the relationship among tax pressure and currency demand in the US economy from 1919 to 1955. Gutmann (1977) later adopted a similar approach, but with different statistical techniques, to analyze the ratio of demand deposits to currency from 1937 to 1976.

The currency demand approach finds its origins in the Quantity Theory of Money, initially proposed by economist David Hume in the 18th century. The Quantity Theory of Money posits that there exists a solid correspondence among the amount of cash in circulation & the general price level in an economy. In simpler terms, an expansion in the money supply points to inflation, while a decrease results in deflation. Tanzi (1980; 1983) expanded on Cagan's methodology by constructing an econometric cash demand equation, aiming to gauge the extent of the unrecorded economic framework in the United States spanning the years 1929 to 1980. Tanzi's model considered the impact of unobserved cash payments in the shadow economy on the demand for cash. To isolate this "surplus" demand, Tanzi's function incorporated various factors such as interest rates, payment habits, income changes, as well as the main drivers of participation in the underground economy, including tax burden, tax system complexity, and government regulations. The primary statistical model for cash demand suggested by Tanzi (1983) can be summarized as follows:

- $\ln(C/M2) = B0 + B1 * \ln(TW) + B2 * \ln(WS/Y) + B3 * \ln(R) + B4 * \ln(Y/N)$
- With $B1 > 0$, $B2 > 0$, $B3 < 0$, $B4 > 0$

- The natural logarithm (ln) is applied to the variables in the equation.

Corruption and Underground Economy: Estimating its Size in Pakistan

- $C/M2$ represents the cash-to-deposit ratio.
- TW is a weighted average tax rate employed as an approximation for fluctuations in the magnitude of the shadow economy.
- WS/Y captures the share of labor income in national income serves as an indicator of shifting transactions and cash management behaviours.
- R signifies the return earned on savings deposits, reflecting foregone opportunities associated with holding cash.
- Y/N represents income per person.

The "surplus" demand for money, unresolved by normal economic factors, is given to growing tax burden and other motivators for individuals to take part in the underground economy. By comparing currency growth during periods of low tax burden to current conditions of higher taxation and government restrictions, initial forecasts of the scale and expansion of the unrecorded economy can be derived. Assuming that both the official and informal economies have the same income velocity for currency, the magnitude of the illegal economic framework can be calculated and contrasted to the formal economy or GDP.

METHODOLOGY & SOURCES OF THE DATA

Brief explanation of variables

Currency in Circulation/Money Supply (CM)

Proportion of money in circulation and money supply is used as explained variable in this research. The logarithmic form of this ratio is taken which gives elasticities for the interpretation of this variable. The unit of this variable used in the research is billion US\$.

The description of independent variables are as follows:

Tax Revenue (TXR)

Tax revenue denotes to the total monetary accumulated amount by a government from individuals, businesses, and other entities within its jurisdiction through the enforcement of taxes. These taxes can be direct or indirect in nature.

Inflation (INF)

Inflation serves as a macroeconomic gauge, reflecting the dynamics of price levels within a country. Inflation, which indicates a broad increase in prices, can have different impacts on the economy, either optimistic or pessimistic, Contingent upon the prevailing economic circumstances.

To measure inflation, this study relies upon year-on-year growth of the GDP implicit deflator which represents the price fluctuation rate across the macro economy. The GDP implicit deflator is computed by dividing the GDP measured in the current local currency by the GDP measured in constant local currency.

Gross Domestic Product (GDP)

In this study, GDP is figured out by evaluating the growth rate of GDP per capita. GDP per capita is computed by dividing the gross domestic product by the population at the midpoint of the year. The growth rate is computed using a constant local currency. The calculation of GDP per capita considers the combined contribution of all domestic producers to the economy's value, along with any product taxes,

while subtracting any grants that are not included in the product value. However, it does not take into account deductions related to the downswing of artificial possessions or the wear and tear and worsening of nature's wealth.

Corruption (CORR)

Corruption is a pervasive and detrimental phenomenon characterized by the abuse of power, typically involving individuals in positions of authority or public office. It encompasses various illicit practices, such as bribery, embezzlement, fraud, nepotism, favouritism, and the misuse of entrusted resources for personal gain or to achieve unfair advantages. Corruption undermines the values of clarity, liability, fairness, eroding public trust in institutions and hindering socio-economic development. Undertakings to tackle corruption incorporates executing powerful legal foundations, encouraging ethical standards, enhancing answerableness mechanisms, and facilitating an environment of trustworthiness and good governance.

Political Stability (PS)

Political Stability and Absence of Violence/Terrorism indicator examines the level of confidence in the political system's stability and the extent to which the country is affected by violence with political motivations. It encompasses estimation of chances of political unrest, social unrest, armed conflict, and acts of terrorism.

Voice & Accountability (VA)

Voice and Accountability indicator evaluates the degree to which individuals have the opportunity to actively engage in the political deliberation procedure, express their opinions freely, form associations, and access unbiased information through a free media.

Sources of Data

The data was gathered from reputable sources, including the World Development Indicators (WDI), the State Bank of Pakistan (SBP), Transparency International, Global economy & the Handbook of Statistics compiled by the Federal Bureau of Statistics.

The General Equation of ARDL

The general equation of ARDL is as follows:

$$\Delta(LCM)_t = \alpha_0 + \sum_{i=1}^a \alpha 1i\Delta(LCM)_{t-i} + \sum_{i=1}^b \alpha 2i\Delta(CORR)_{t-i} + \sum_{i=1}^c \alpha 3i\Delta(PS)_{t-i} + \sum_{i=1}^d \alpha 4i\Delta(TXR)_{t-i} + \sum_{i=1}^e \alpha 5i\Delta(GDP)_{t-i} + \sum_{i=1}^f \alpha 6i\Delta(INF)_{t-i} + \sum_{i=0}^g \alpha 7i\Delta(VA)_{t-i} + \mu_t \quad \text{Eq. 1(With tax)}$$

$$\Delta(LCM)_t = \alpha_0 + \sum_{i=1}^a \alpha 1i\Delta(LCM)_{t-i} + \sum_{i=1}^b \alpha 2i\Delta(CORR)_{t-i} + \sum_{i=1}^c \alpha 3i\Delta(PS)_{t-i} + \sum_{i=1}^e \alpha 4i\Delta(GDP)_{t-i} + \sum_{i=1}^f \alpha 5i\Delta(INF)_{t-i} + \sum_{i=0}^g \alpha 6i\Delta(VA)_{t-i} + \mu_t \quad \text{Eq 2 (Without tax)}$$

The equations above depict the general form of the Autoregressive Distributed Lag (ARDL) model, which captures the long-lasting & short-term connections among the factors.

In equation 1 and equation 2, Intercept is represented by α_0 and $\alpha 1, \alpha 2, \alpha 3, \alpha 4, \alpha 5, \alpha 6, \alpha 7$ are the Short-Term coefficients. The Long-Term coefficient are given as $\alpha 8, \alpha 9, \alpha 10, \alpha 11, \alpha 12, \alpha 13, \alpha 14$. The Disturbance term is given as u_t .

Corruption and Underground Economy: Estimating its Size in Pakistan

With the aim to assess the occurrence of a long-term association among the parameters, this study compares the computed F -statistic with the tabulated F -statistic of Wald Test. To do so, we formulate null and alternative hypotheses, aiming to establish the presence of a long run association among the parameters.

HYPOTHESIS OF THE STUDY

The Null Hypothesis is given: (With & Without Tax)

$$H_0 : \alpha_8 = \alpha_9 = \alpha_{10} = \alpha_{11} = \alpha_{12} = \alpha_{13} = \alpha_{14} = 0$$

(No persistent association)

Alternative Hypothesis

$$H_1 : \alpha_8 \neq \alpha_9 \neq \alpha_{10} \neq \alpha_{11} \neq \alpha_{12} \neq \alpha_{13} \neq \alpha_{14} \neq 0$$

(Persistent association exists)

During hypothesis testing to assess the manifestation of prolonged affiliation or association amid the parameters, this study examines the computed F -statistics. If these F -statistics surpass the upper threshold, it indicates the existence of long-term association. Conversely, if the calculated F -statistics fall below the designated lower threshold, it advocates the absence of the long run cointegration.

The equation provided demonstrates the prolonged association amid the explained & explanatory factors. The parameter "i" represents the optimal number of lags, which can be determined by employing criteria such as AIC (Akaike Information Criterion) or SBC (Schwarz Bayesian Criterion).

$$LCM_t = \alpha_0 + \sum_{i=1}^{a1} \alpha_{1i}(LCM)_{t-i} + \sum_{i=0}^{a2} \alpha_{2i}(CORR)_{t-i} + \sum_{i=0}^{a3} \alpha_{3i}(PS)_{t-i} + \sum_{i=0}^{a4} \alpha_{4i}(GDP)_{t-i} + \sum_{i=0}^{a5} \alpha_{5i}(INF)_{t-i} + \sum_{i=0}^{a6} \alpha_{6i}(VA)_{t-i} + \sum_{i=0}^{a7} \alpha_{7i}(TXR)_{t-i} + \mu_t \text{ Eq. 3 (with tax)}$$

$$LCM_t = \alpha_0 + \sum_{i=1}^{a1} \alpha_{1i}(LCM)_{t-i} + \sum_{i=0}^{a2} \alpha_{2i}(CORR)_{t-i} + \sum_{i=0}^{a3} \alpha_{3i}(PS)_{t-i} + \sum_{i=0}^{a4} \alpha_{4i}(GDP)_{t-i} + \sum_{i=0}^{a5} \alpha_{5i}(INF)_{t-i} + \sum_{i=0}^{a6} \alpha_{6i}(VA)_{t-i} + \mu_t \text{ Eq. 4 (without Tax)}$$

After estimating the long-run model and establishing the associated long run elasticities, the short run dynamic parameters can be derived by estimating the results. The inclusion of the lag term of explained variable in this equation allows for data adjustment and captures short term dynamics.

$$\Delta(LCM)_t = \gamma_0 + \sum_{i=1}^{b1} \gamma_{1i}\Delta(LCM)_{t-1} + \sum_{i=0}^{b2} \gamma_{1i}\Delta(CORR)_{t-i} + \sum_{i=0}^{b3} \gamma_{3i}\Delta(PS)_{t-i} + \sum_{i=0}^{b4} \gamma_{4i}\Delta(GDP)_{t-i} + \sum_{i=0}^{b5} \gamma_{5i}\Delta(TXR)_{t-i} + \sum_{i=0}^{b6} \gamma_{6i}\Delta(INF)_{t-i} + \sum_{i=0}^{b7} \gamma_{7i}\Delta(VA)_{t-i} + \lambda(ECM)_{t-1} \text{ Eq.5 (With tax)}$$

$$\Delta(LCM)_t = \gamma_0 + \sum_{i=1}^{b1} \gamma_{1i}\Delta(LCM)_{t-1} + \sum_{i=0}^{b2} \gamma_{1i}\Delta(CORR)_{t-i} + \sum_{i=0}^{b3} \gamma_{3i}\Delta(PS)_{t-i} + \sum_{i=0}^{b4} \gamma_{4i}\Delta(GDP)_{t-i} + \sum_{i=0}^{b5} \gamma_{6i}\Delta(INF)_{t-i} + \sum_{i=0}^{b6} \gamma_{7i}\Delta(VA)_{t-i} + \lambda(ECM)_{t-1} \text{ Eq.6 (Without tax)}$$

After estimating the long run model and establishing the associated long run elasticities, the short-run dynamic parameters can be derived by estimating the results. The inclusion of the lag term of explained variable in this equation allows for data adjustment and captures shortterm dynamics.

$$\Delta Pt = \gamma + \delta \Delta X_{t-1} + \lambda(ECM)_{t-1} + \varepsilon_t \text{ Eq. 7.}$$

The aforementioned equation illustrates the transition from a state of disequilibrium to the equilibrium level. In this context, the sign of the parameter indicates the speed at which the system converges towards equilibrium.

RESULTS OF THE STUDY

Augmented Dickey Fuller Test

To select the proper econometric technique and to check the stability of the dataset, the Augmented Dickey Fuller (ADF) test of unit root diagnosis is utilized.

Table 1 shows the results of ADF.

Table 1. Augmented Dickey Fuller (ADF) Unit Root Test

Variables	At level		At 1 st difference		Conclusion
	Intercept	Trend & intercept	Intercept	Trend & Intercept	
GDP	--	-6.32*(0.00)	--	--	I(0)
INF	--	-6.08*(0.00)	--	--	I(0)
CC/MS	--	--	--	-4.59*(0.00)	I(1)
PS	--	--	--	-4.47*(0.00)	I(1)
CORR	--	-3.55*(0.01)	--	--	I(0)
VA	--	--	--	-9.56*(0.00)	I(1)
TXR	--	-5.84*(0.00)	--	--	I(0)

“**” steric on the values shows the significance at 5% respectively.

From the results, it is evident that all the variables exhibit stationarity, although not at the same level. Specifically, GDP, INF, CORR, and TXR are stationary at the level, while CC/MS, PS, and VA show stationarity after taking the first difference. Therefore, it can be inferred which pointing to the fact that the time series data not uniformly stationary.

Autoregressive Distributed Lag (ARDL)

To explore the link among the extent of unrecorded economy and corruption in Pakistan, this study utilized the ARDL framework, using data spanning from 1972 to 2021. The study not only analysed the descriptive variables' results in the time being but also investigated their impact over the course of time. The long-run analysis reveals that the CM, dependent variable, has a is significant effected by various macroeconomic variables such as; CORR, PS, TXR, GDP, INF, and VA.

Table 2. Long-run ARDL Results

Results of ARDL with TXR				
Regressors	Coefficients	St. Error	t-statistics	Prob.
TXR	0.0186	0.0054	1.5880	0.0235
GDP	0.1324	0.2223	5.9581	0.0000
INF	-0.0175	0.0053	-3.3000	0.0026
CORR	-0.0873	0.0424	-0.1738	0.0632
PS	0.0746	0.1040	0.7170	0.0793
VA	0.0446	0.2091	0.2135	0.0325
C	-1.6709	0.4196	-3.9820	0.0004
Results of ARDL without TXR				
Variables	Coefficients	St. Error	t-statistics	Prob.
GDP	0.01749	0.0068	2.5443	0.0193
INF	-0.04412	0.0020	-2.0194	0.0570
CORR	-0.0371	0.0081	-0.8839	0.0872
PS	0.0430	0.0131	3.2739	0.0038
VA	-0.0542	0.0471	-0.0905	0.0288
C	-0.6087	0.0763	-7.9729	0.0000

Source: The author's data analysis computed using E-views Software

Corruption and Underground Economy: Estimating its Size in Pakistan

In Table 2, the coefficient of TXR is 0.0186, showing the positive relationship with the dependent variable, CM. This shows that the consequences of tax revenue on the CM is positive. Moreover, the probability value shows that the variable is significant too. Resultantly, it is concluded that TXR is the most important causation of CM. Results show that, in the long run, the 1 unit rise in tax revenue will boost the CM by 0.018 percent. The rise in direct & indirect taxes leads to an increase in shadow economy. There is a favourable association between Tax Revenue and the shadow economy, which supports the findings of this study. When the tax burden becomes excessive or when tax compliance becomes overly complicated, it creates incentives for economic actors to seek alternative ways to minimize their tax liabilities. This can lead to the expansion of the shadow economy as individuals and businesses attempt to evade taxes by engaging in unreported or underground economic activities. High tax rates can discourage formal economic activities and incentivize individuals and businesses to operate in the shadow economy, where tax obligations are often lower or non-existent. This can include activities such as undeclared income, off-the-books transactions, or operating businesses without proper registration. The theory suggests that an increase in TXR contributes to the growth of the illegal market, leading to greater money circulation among individuals and increased demand for money.

The coefficient of another explanatory variable, GDP, is 0.1324 and 0.01749. This demonstrates a direct correlation between GDP and CM, indicating a positive relationship between the two. In addition, the probability value of GDP shows the significance of the variable in the model. The results reveal that, in the long run, one unit increase in GDP will lead to 0.1324 and 0.01749 percent increase in CM. This indicates that a growth in GDP has a positive impact on the currency to money supply ratio, suggesting that an increase in GDP is effective in boosting CM within the country. My research aligns with the findings of Farooq et al. (2010), which demonstrated that an expansion in GDP enhances the CM ratio. As the GDP increases, there will be rise in economic activities, leading to an increase in formal sector, which in turn increases employment opportunities, higher incomes and improved standards of living. Moreover, as the GDP of a country expands, the demand for goods and services also increases. This increased demand can spill over into the shadow economy as individuals seek lower-cost alternatives or engage in unreported transactions to avoid taxes or regulations. For example, individuals may turn to informal labour, undeclared income, or black-market transactions to meet their needs. While there may be various factors contributing to this phenomenon, the most apparent reason is that the rise in GDP reflects an increase in underground economic activities, leading to a greater demand for currency in society.

Inflation is another regressor in our model. The coefficient of the INF is -0.0175 and -0.04412, showing the negative relationship among the dependent and independent variable. The outcome shows that the one unit increase in inflation will decrease the CM by 0.017 and 0.044 percent. Resultantly, we can conclude here that there is negative relationship between inflation and the dependent variable, CM. As inflation rises, the purchasing power of consumers decreases, particularly affecting low-income individuals who can no longer afford goods and services from the informal sector due to higher prices. Additionally, informal producers face challenges as the cost of doing business increases due to rising raw material prices. Moreover, the indirect taxes they have to pay for production equipment also escalate.

Consequently, it becomes more difficult for producers to sustain operations in the underground economy, leading to a decline in its activities.

The estimated coefficient of CORR is -0.0873 and -0.0371. Results show that the one unit increase in corruption will cause the decrease in dependent variable, CM, by 0.087 and 0.037 percent. Corruption encompasses various forms, such as bribery, favouritism, hoarding, drug trafficking, money laundering, and embezzlement. The concept of the "resource diversion theory" suggests that when bribery occurs, resources that would have otherwise been used for productive economic activities are redirected towards illicit purposes. As a result, the money obtained through bribery is often saved or hoarded by the recipients rather than being reintroduced into the economy. When considering corruption as a whole, a prevailing theory suggests that the presence of bribery leads to a diversion of funds away from circulation in the economy. The individuals receiving bribes tend to save this illicit money rather than inject it back into the economy. In addition, the money supply remains stable, and an increase in corruption does not necessarily indicate an increase in government money printing. Therefore, the overall money supply in the economy remains unchanged, maintaining a consistent ratio between currency in circulation and the total money supply. This line of reasoning implies that there may be a decrease in the non-registered economy, even when corruption is widespread in a given economy.

The coefficient of another PS is traced to be 0.074 and 0.043. The outcome reveals that the increase in one unit of PS leads to an increase in dependent variable by 0.074 and 0.043 percent. The Quantity Theory of Money posits that the demand for money is related to the level of transactions in the economy. Political certainty bolsters economic stability, ultimately triggering a rise in economic activity, business transactions, and trade. With the extent of increased economic activity, the demand for money increases to facilitate investments. With the increase in number of small businesses, People will tend to go underground to avoid taxes as they are not willing to register themselves on a bigger level.

The estimated coefficient of VA is 0.044 and -0.054. The results are diverse. In addition, the probability value is showing the significance too. The Principal Agent Theory suggests that in a capitalist economy, individuals and organizations act as agents, while the government and its institutions act as principals. The theory posits that when voice and accountability mechanisms are weak, agents (individuals and businesses) may exploit their positions and misuse resources for personal gain, leading to a dominance of economic interests. Moreover, an increase in voice and accountability within a capitalist economy can potentially lead to the dominance of economic interests in a country. In such a scenario, individuals may exploit the system and misuse available resources for personal gains. Consequently, tax evasion becomes prevalent as people seek to avoid their tax obligations, thereby driving them towards engaging in shadow economic activities. On the other hand, Limited voice and accountability often contribute to institutional voids by restricting individuals' ability to participate in formal decision-making processes and access unbiased information. In such environments, the shadow economy can thrive as an alternative to the formal economy. When there is a lack of transparency and opportunities for individuals to engage in the formal economy, people are unable to freely express their opinions, participate in political processes, or access unbiased information through a free media, it contributes to an environment where informal economic activities thrive. In such circumstances, individuals may resort to participating in the shadow

Corruption and Underground Economy: Estimating its Size in Pakistan

economy as a means of survival or to avoid the constraints of formal regulations and oversight. Additionally, without mechanisms for accountability and transparency in governance, there may be increased corruption and inefficiency, further facilitating the growth of the shadow economy. Therefore, limited voice and accountability can perpetuate the existence and expansion of the shadow economy by hindering the development of a transparent and inclusive formal economic system.

The short-run results are given in Table 3. Nature of relationship between the explained and explanatory variable is traceable in long-run. However, in short-run relationship, the essential reading is of coefficient of error correction term. Findings confirm that in both models, the said coefficient is significant and correctly specified. The results show that 81 percent and 56 percent of the deviation from equilibrium are adjusted in long-run.

Table 2. Long-run ARDL Results

Results of ARDL with TXR				
Regressors	Coefficients	St. Error	t-statistics	Prob.
D(LCC_MS(-1))	-0.0282	0.1110	-0.2540	0.8010
D(LCC_MS(-2))	-0.1774	0.0860	-2.0440	0.0500
D(TXR)	-0.0070	0.0046	-1.5090	0.1420
D(GDP)	0.0196	0.0069	2.8400	0.0000
D(GDP(-1))	-0.0230	0.0050	-4.150	0.0000
D(GDP(-2))	-0.0240	0.0132	-1.8770	0.0700
D(INF)	0.0016	0.0017	0.9310	0.3590
D(CORR)	0.1250	0.1890	0.6600	0.5140
D(CORR(-1))	-0.331	0.1956	-1.6930	0.1010
D(CORR(-2))	0.4765	0.1985	2.4004	0.0233
D(PS)	0.7119	0.3626	1.9630	0.0596
D(VA)	-0.1110	0.1179	-0.9454	0.3525
CointEq(-1)	-0.8103	0.2252	-3.5982	0.0012
Results of ARDL without TXR				
Variables	Coefficients	St. Error	t-statistics	Prob.
D(LCC_MS(-1))	0.5750	0.2402	2.3939	0.0266
D(LCC_MS(-2))	0.4517	0.2242	2.0146	0.0576
D(LCC_MS(-3))	1.0599	0.2685	3.9480	0.0008
D(LCC_MS(-4))	0.6985	0.2066	3.3800	0.0030
D(GDP)	0.0084	0.0045	1.8587	0.0779
D(INF)	0.0017	0.0013	1.2541	0.2243
D(INF)	0.0072	0.0023	3.1927	0.0046
D(INF)	0.0007	0.0015	0.4586	0.6510
D(INF)	0.0037	0.0016	2.2396	0.0366
D(CORR)	0.6466	0.2421	2.6714	0.0147
D(CORR(-1))	-0.0292	0.1141	-0.2557	0.8008
D(CORR(-2))	0.3048	0.1178	2.5876	0.0176
D(PS)	0.4351	0.0920	4.7308	0.0001
D(PS(-1))	0.3719	0.1852	2.0076	0.0584
D(PS(-2))	0.0941	0.1231	0.7648	0.4533
D(PS(-3))	-0.4345	0.1498	-2.9004	0.0088
D(VA)	0.0571	0.0541	1.0551	0.3039
D(VA(-1))	0.2741	0.0834	3.2855	0.0037
CointEq(-1)	-0.5668	0.3563	-4.3978	0.0003

Source: The author's data analysis computed using E-views Software

ESTIMATED SIZE OF SHADOW ECONOMY

The magnitude of the illegal market is determined based on the calculated values of the currency demand model. Each year, the calculated estimates of the currency demand model with taxes (CM)T and without taxes (CM)WT are determined using a regression equation.

$$LCM = \alpha_0 + \alpha_1 CORR + \alpha_2 PS + \alpha_3 TXR + \alpha_4 GDP + \alpha_5 INF + \alpha_6 VA \quad \text{Eq.8}$$

Here,

$$\alpha_0 = -1.6709, \alpha_1 = -0.0873, \alpha_2 = 0.0746, \alpha_3 = 0.0186, \alpha_4 = 0.1324, \alpha_5 = -0.0175 \text{ and } \alpha_6 = 0.0446$$

For the year 1972, equations are solved as follows.

$$LCM = -1.6709 + (-0.0873 * -5.3572) + 0.0746 * (-1.17815) + 0.0186 * 0.076391 + 0.1324 * (-1.8166) + (-0.0175 * 6.7745) + 0.0446 * (-0.0835) \quad \text{Eq. 9}$$

$$LCM = -1.6656$$

While,

$$LCM = \alpha_0 + \alpha_1 CORR + \alpha_2 PS + \alpha_3 GDP + \alpha_4 INF + \alpha_5 VA \quad \text{Eq. 10}$$

Here,

$$\alpha_0 = -0.608710, \alpha_1 = -0.037188, \alpha_2 = 0.043035, \alpha_3 = 0.017495, \alpha_4 = -0.044122 \text{ and } \alpha_5 = 0.054273$$

$$LCM = -0.608710 + (-0.037188 * -5.3572) + 0.043035 * (-1.17815) + 0.017495 * (-1.8166) + (-0.044122 * 6.774575) + 0.054273 * (-0.0835) \quad \text{Eq. 11}$$

$$LCM = -0.77006; CM \text{ GAP} = CM(T) - CM(WT)$$

$$CM \text{ GAP} = -1.6656 - (-0.77006); CM \text{ GAP} = -0.8955; CM \text{ GAP} = | -0.8955|$$

In this study, the similar procedure is applied for the calculations of rest of the years.

The difference between CM with and without tax indicate the amount of cash held specifically due to taxes, suggesting that the tax revenue influences individuals to hold a higher amount of cash. This increase in cash demand reflects the presence of a community engaged in tax evasion, commonly referred to as "illegal money." The illegal money can be obtained by multiplying the money supply (M2) with the gap of CMT & CMWT. Where M2 includes the currency in circulation, other deposits & total deposits including Resident Foreign Currency Demand Deposits (RFCD'S). The mathematical expression for illegal money (IM) can be defined as follows.

$$IM = [(CM)T - (CM)WT] * M2 \quad \text{Eq. 12}$$

Given the money supply of year 1972 in billion rupees,

$$IM = [-1.6656 - (-0.77006)] * 22.059 \quad \text{Eq. 13}$$

$$IM = -19.755$$

Tanzi observed that legal money (LM) can be obtained by calculating the difference between M1 and IM. M1 represents the total money supply, which includes the sum of currency and demand deposits, while IM represents the estimated amount of illegal money. This relationship can be expressed mathematically as follows.

Corruption and Underground Economy: Estimating its Size in Pakistan

The money supply M1 for the mentioned year is in billion rupees

$$LM = M1 - IM \quad \text{Eq. 14}$$

$$LM = 15.13 - (-19.755)$$

$$LM = 34.8854$$

Once the legal money has been obtained, the income velocity (IV), also known as the circulation velocity, of legal money can be calculated by dividing the Gross National Product (GNP) by LM. This mathematical calculation is further explained below.

$$IV = \frac{GNP}{LM} \quad \text{Eq. 15}$$

GNP of 1972 is still the same in billion rupees

$$IV = \frac{654.516}{34.8854}$$

$$IV = 18.7618$$

According to the basic assumption of the model, the velocity of legal money is considered to be the same as the velocity of illegal money. Accordingly, the magnitude of the unrecorded economy is determined by multiplying the illicit funds by the income velocity of money. This relationship can be expressed mathematically as follows.

$$UE = IM * IV \quad \text{Eq. 16}$$

$$UE = 19.755489 * 18.7618$$

$$UE = 370.6494$$

Graphical Representation of Underground Economy of Pakistan

In the below mentioned Figure 1, the shadow economy of Pakistan is shown. Time taken for the measurement is 1972 to 2021. Moreover, the size of underground economy is measured in billion Rupees. It has been seen that there is a rising trend of shadow economy in Pakistan.

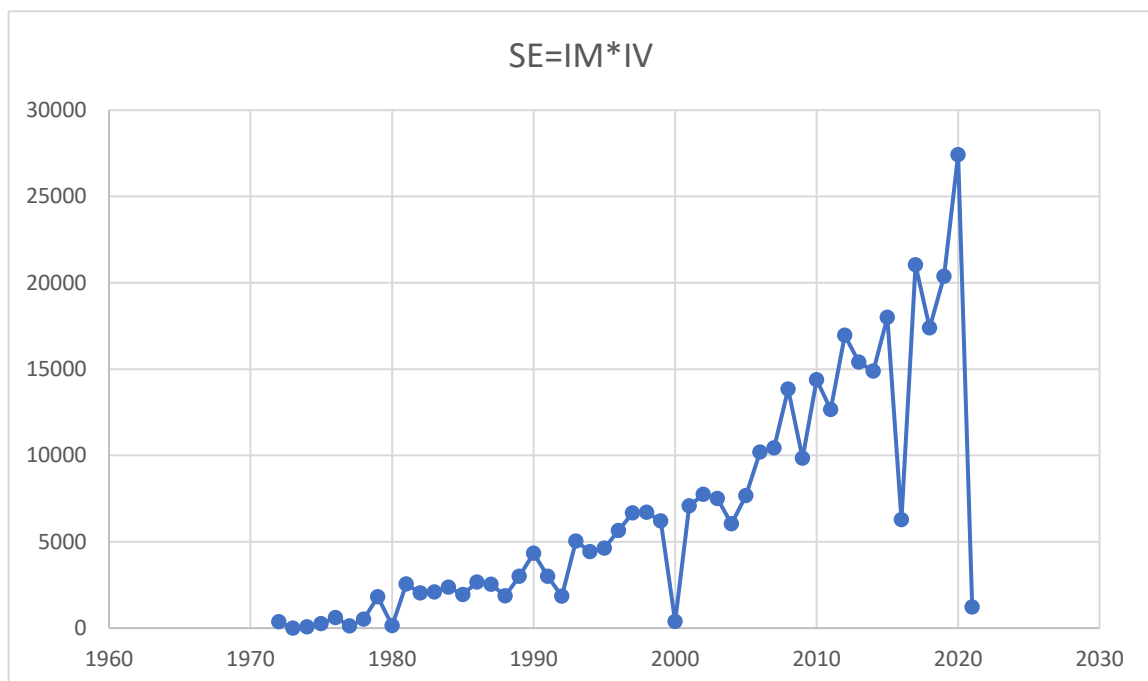


Figure 1: Shadow Economy of Pakistan

After the representation of underground economy of Pakistan, in Figure 2, it is represented the underground economy as the percentage of GDP. Here, it is clearly seen that the points are much higher than the points presented in Figure 3.

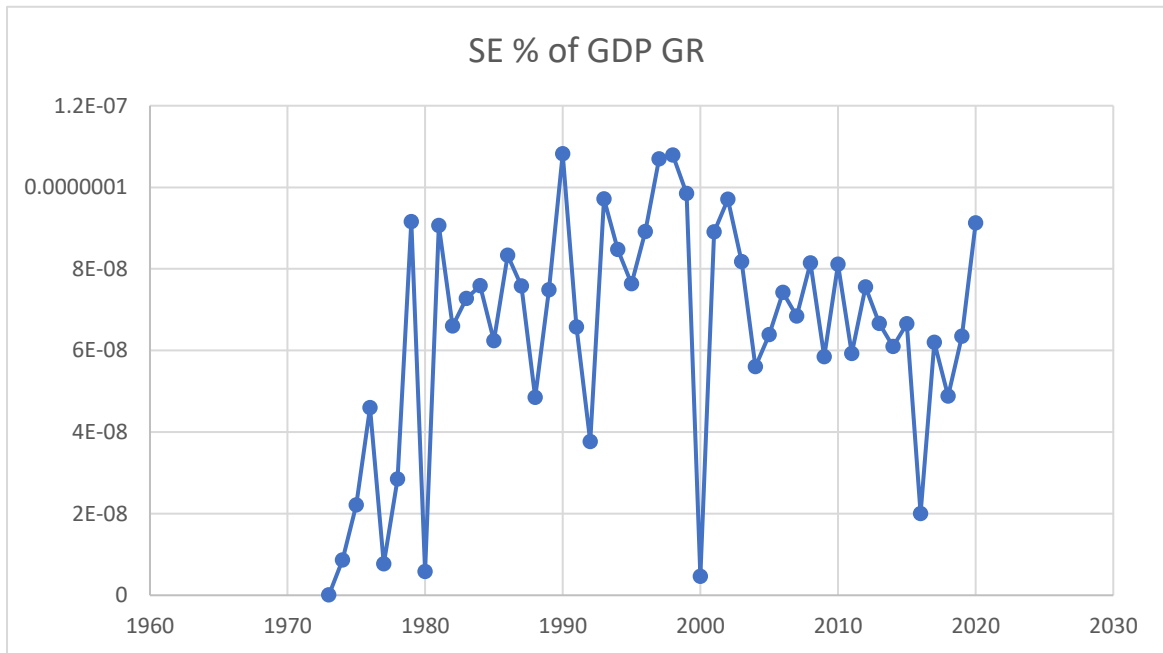


Figure 2: Shadow economy as a percentage of GDP

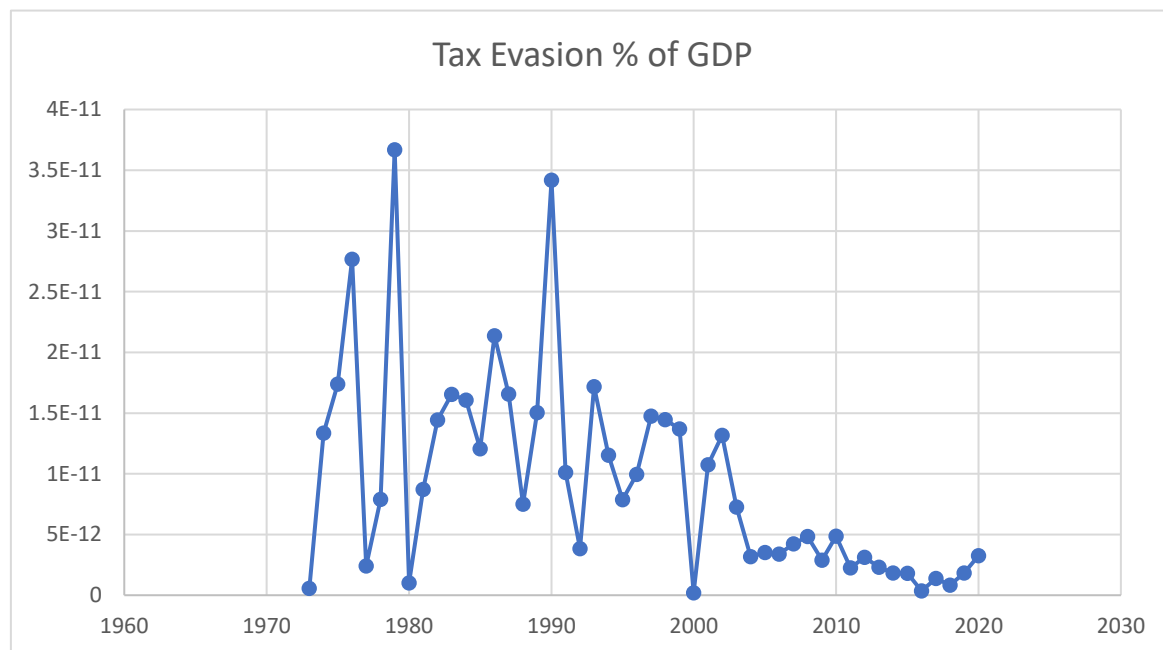


Figure 3: Tax avoidance as a percentage of GDP

Figure 3 is given to show tax avoidance as a percentage of GDP. Taxes hold great significance in the existence of the illegal economy, although they are not solely responsible for its creation. Even in the absence of taxes, the shadow economy can still exist. It encompasses various elements such as corruption, unregistered businesses, beggars, and street vendors. The provided graphs reflect this definition, showing similar slopes but differing values. The shadow economy demonstrates higher values, while tax evasion is represented by comparatively lower values in corresponding years. The disparity between these values highlights that taxes are not the sole cause of the non-registered economy; additional elements also contribute to its existence. Finally, in figure 4, the velocity of illegal money is also shown.

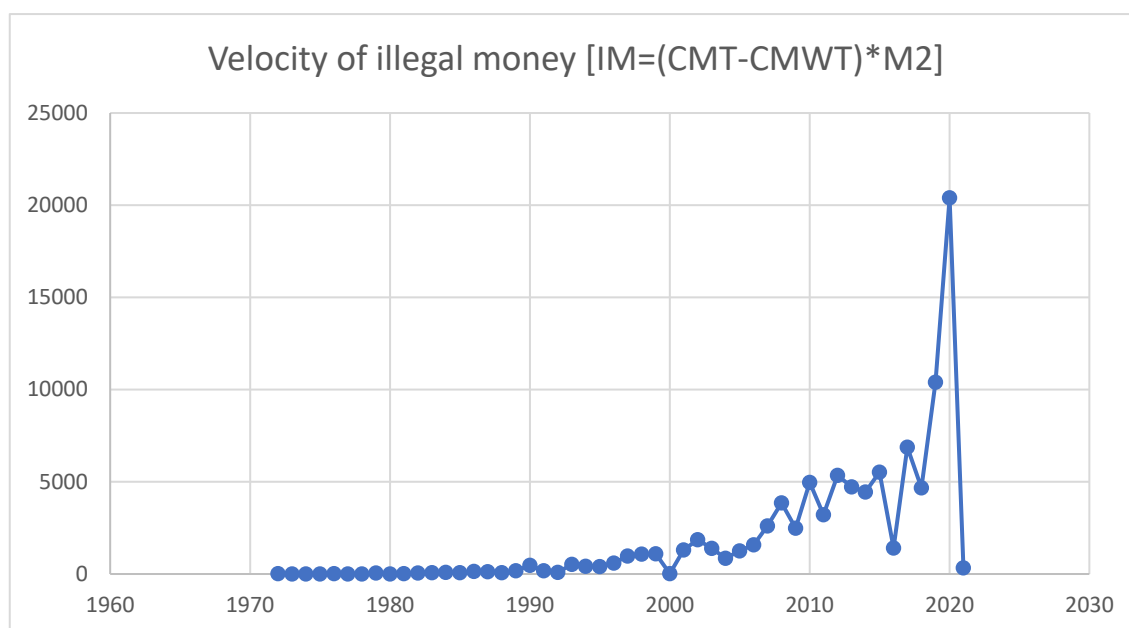


Figure 4: Velocity of illegal money

CONCLUSION AND POLICY RECOMMENDATIONS

In order to explore the correlation between corruption and underground economy, this study was based upon a thorough review of existing literature and theories related to the size of illegal market and corruption. Based on outcomes, the study proceeded with the ARDL technique to investigate the brief and persistent bond among the scale of unrecorded market and macroeconomic variables such as tax revenue, Political Stability, Corruption, Gross Domestic Product, inflation, and voice & accountability. The inferences indicate that these indicators have a notable impact on shaping the long-term dynamics of the illicit economic framework in Pakistan. Moreover, corruption and inflation have the inverse relationship while the other factors have direct effect on the scale of underground economic sphere in the long-term. In addition, these variables also exhibit a significant impact in the short run.

The empirical findings of this research showed that higher tax revenues and political stability, linked to increased business investments, leads to a larger shadow economy. To tackle this, it is suggested to lowering taxes for businesses and individuals to deter tax avoidance and shrink the illegal market. Simplifying the tax system will also close loopholes and discourage the shift to the shadow economy by promoting voluntary compliance. Moreover, Rising GDP in Pakistan expands the shadow economy as people look for cheaper or unreported transactions. To counter this, the government should boost education and vocational training, improving skills and formal sector employability. A better-educated workforce may prefer formal jobs, lessening the appeal of the shadow economy. In addition, Inflation is linked to a larger shadow economy as people seek cheaper transactions. To combat this, the government should focus on price stability through monetary policies, like setting interest rates and managing money supply. Stable inflation reduces incentives for illegal economic activities. And lastly, initiative should be taken to foster a culture of ethics and integrity in society through educational campaigns, awareness programs, and training initiatives. Improving public sector wages and benefits will ensure that public sector wages and benefits are sufficient to discourage officials from engaging in corrupt practices.

REFERENCES

- Awad, I. M., & Alazzeah, W. (2020). Using currency demand to estimate the Palestine underground economy: An econometric analysis. *Palgrave Communications*, 6(1), 1-11.
- Bayar, Y., & Öztürk, O. F. (2019). Economic freedom, globalization, and the shadow economy in the European Union transition economies: a panel cointegration analysis. *Organizations and Markets in Emerging Economies*, 10(2), 378-391.
- Cagan, P. (1958). The demand for currency relative to the total money supply. *Journal of Political Economy*, 66(4), 303-328.
- Duong, T. H. M., Nguyen, T. A. N., & Nguyen, V. D. (2021). Social capital and the shadow economy: A Bayesian analysis of BRICS. *Asian Journal of Economics and Banking*, 5(3), 272-283.
- Esaku, S. (2021). Does corruption contribute to the rise of the shadow economy? Empirical evidence from Uganda. *Cogent Economics & Finance*, 9(1), 1-22.
- Fernandez, M. G., Gonzalez-Velasco, C., & Fanjul, J. L. (2020). Corruption, the shadow economy and innovation in Spanish region. *Panaeconomicus*, 67(4), 509-537.
- Gutmann, P. M. (1977). The subterranean economy. *Financial Analysts Journal*, 33(1), 24-27.
- Hoinaru, R., Buda, D., Borlea, S. N., Văidean, V. L., & Achim, M. V. (2020). The impact of corruption and shadow economy on the economic and sustainable development. Do they “sand the wheels” or “grease the wheels”? *Sustainability*, 12(2), 1-27.
- Khuong, N. V., Shabbir, M. S., Sial, M. S., & Khanh, T. H. T. (2021). Does informal economy impede economic growth? Evidence from an emerging economy. *Journal of Sustainable Finance & Investment*, 11(2), 103-122.
- Komin, W., Thepparp, R., Subsing, B., & Engstrom, D. (2021). Covid-19 and its impact on informal sector workers: A case study of Thailand. *Asia Pacific Journal of Social Work and Development*, 31(1), 80-88.
- Němec, D., Kotlánová, E., Kotlán, I., & Machová, Z. (2021). Corruption, taxation and the impact on the shadow economy. *Economies*, 9(1), 1-16.
- Ngouhou, I., Njoya, L., & Asongu, S. (2022). Corruption, economic growth and the informal sector: Empirical evidence from developing countries (Working Paper No. WP/22/014). African Governance and Development Institute (AGDI), Yaoundé.
- Persyn, D., & Westerlund. (2008). Error-correction-based cointegration tests for panel data. *Stata*, 8(2), 232-241.
- Tanzi, V. (1980). The underground economy and tax evasion in the United States: Estimates and implication. *Banca Nazionale Del Lavoro Quarterly Review*, 32(1), 427-453.
- Tanzi, V. (1983). The underground economy in the United States: Annual estimates (IMF Staff Working Paper No. 30/2), 283-305.