Examining the Impact of Corruption and Other Macro-Economic Variables on Capital Accumulation in Pakistan

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ABSTRACT

This study explored the complex relationship between corruption and capital accumulation in the presence of law and order, government stability, inflation, market size gross savings, and income inequality. This study fills the empirical gap in the existing literature, which mainly focused on the impact of corruption on growth in the context of Pakistan, by focusing on the corruption and capital accumulation nexus over the time period 1984 to 2022, employing the Auto-regressive Distributed Lag (ARDL) bounds testing technique. The findings of the study indicate that corruption and inflation are negatively and significantly affecting capital accumulation during the long run. Whereas, the effect of gross savings, market size, law and order, and government stability has a positive and significant influence on capital accumulation. The short-term results of the study are consistent with long-run results except the infrastructure quality variable which appears significant in the short run only. The findings of the study suggest that the government should take appropriate measures to curb corruption and control the level of inflation. Furthermore, it is needed to invest more in infrastructure, improve law and order along with making policies to attain government stability.

Keywords: Capital Accumulation, Corruption, Income Inequality, ARDL

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INTRODUCTION

The roots of corruption are grounded in cultural and social history, political and economic development, bureaucratic setup and traditions of countries. Factors that promote corruption are both direct and indirect (Thu et al., 2023; Owusu et al., 2019; Shan et al., 2017; Oto-Peralías et al., 2013). Direct factors that promote corruption comprise authorizations and regulations, spending decisions, taxation, financing political parties and providing goods and services at less than market prices (Leff, 1964; Nye, 1967; Friedrich, 1972; Bosco & Savona, 2014; Asomah, 2024; Dokas, et al., 2023). Whereas the indirect factors that promote corruption include public sector wage level, bureaucratic quality, controls on institution and transparency of laws, rules and processes (Krueger, 1974; Mauro, 1995; Murphy et al., 1993; McMullan, 1961; Myrdal, 1968; Tanzi & Davoodi, 1997; Ogunode et al., 2022; Zouaoui, et al., 2022). Corruption affects capital accumulation but this is not a necessary indicator to attract foreign investors as indicated by general equilibrium repercussions (Badur et al., 2024; Lambsdorff, 1999). Corruption reduces investment and lowers GDP. A high level of corruption reduces productivity and this reduced level of productivity requires a high capital stock to produce the same level of output (Lambsdroff, 1999; Gunter, 2021). Thus, investments may provide an opportunity to extract money as opposed to small labor contracts and the ratio of capital to labor is likely to increase with increase in corruption as indicated by Badur et al. (2024), Mauro (1995), and Alesina and Weder (2002). There are very few studies that have considered the effect of corruption on capital accumulation (Torgler & Piatti, 2013; Lin & Zhang, 2009). This study aims to explore the corruption and capital accumulation nexus in the case of Pakistan because its economic, political and economic conditions build a significant case to study the reasons behind the presence of high corruption in the country and its implications on capital accumulation. Despite the existence of extensive literature on the impacts of corruption on growth, this study addressed a unique research gap by focusing on the corruption and capital accumulation nexus in the case of Pakistan which will evaluate the reasons explaining how corruption impedes capital accumulation in developing economies (Wei, 2000).

Capital accumulation generally denotes real investment in palpable production means such as research and development, and acquisitions, etc. that can enhance capital flow. Demir and Lee (2022) and Ainabor et al. (2014) viewed low capital formation as a responsible factor for other problems of emerging economies. The emerging economies have less or no opportunity costs or the approach to sacrifice present consumption or save some for future consumption that comprises investment to increase future income and national output (Jhingan, 2006). Capital formation is equivalent to an upsurge in a nation's physical stock of capital with investment in economic and social infrastructures. Gross fixed capital formation has two types namely gross private domestic investment and gross

public domestic investment. The former includes investment by government or public enterprises while later adds net changes in the level of inventories to gross fixed capital formation. Capital formation leashes to the manufacturing of tangible goods, for instance, machinery & tools, plants, etc. whereas intangible goods consist of a qualitative and high standard of scientific tradition, health, education, and research in a country.

Pakistan is an emerging economy and suffers from hitches of corruption, political instability, budget deficit due to low tax base, low investment, high consumption rate, terrorism and low savings rate (Khan, 2016; Farooq et al., 2013; Ullah et al., 2022). During the fiscal year 2022-23, the consumption rate was 86.09 per cent of GDP in Pakistan while savings was just 6 per cent of GDP (Economic Survey, 2022-23). Growth in real GDP was 4.9 per cent during 2023 while it was 3.4 per cent in 2022. To capture the influence of fiscal policy on capital accumulation, the variable of government expenditure has added to the study. Government expenditure was 19.48 per cent of GDP and the government fiscal deficit was 4.6 per cent of GDP (Economic Survey, 2022-23). The Pakistan Corruption Perception Index (CPI) was 140th among 175 countries and Pakistan scored 27 out of 100 points in 2022. Pakistan was placed at the 104th spot among 167 states on the global Democracy Index in 2021 (Economist Intelligent Unit, 2021). The inflation rate had risen from 13.4 percent in April 2022 to 36.4 percent in April 2023 and the share of capital accumulation was 15.14 per cent of GDP which was too low (Economic Survey, 2022-2023). The above statistics show that accumulation of capital that is a combination of both gross fixed capital formation and inventories is very low in Pakistan.

Corruption is endemic, persuasive, institutional, and deeply rooted in Pakistani society and culture (Farooq et al., 2013; Noor, 2009; Ullah et al., 2022). Pakistan achieved a high growth rate during the 1960s and 1970s but after that its macroeconomic performance became unstable. Cohen (2004) argued that this poor performance was due to political instability prevailing in countries on and off, government instability and external factors etc. Pakistan is highly indebted and suffers from an energy deficit, twin deficit, fiscal deficit etc. This state of the economy can be explained from several factors. These comprise the policy of Zulfiqar Ali Bhutto's nationalization program in the 1970s, Zia ul Haqq's support of domestic debt in the 1980s, widespread corruption and irresponsible spending in the 1990s. Corruption during the decade of 1958-71 was more in the form of political patronage, nepotism, and favouritism (Noor, 2009). During Bhutto's nationalization era, corruption, lack of accountability, inefficiency, and incompetency flourished within institutional and bureaucratic setups. The underground economy flourished during 1977-88 and it is known as the most corrupt and darkest period in Pakistan's history. Pakistan failed to acquire the status of middle-income country due to entrenched, persistent and systematic corruption in the 1980s (Burki & Laporte, 1984). The corruption perception index, human

development index, world governance indicators and similar indices showed Pakistan at the bottom stage. The decade of 1988-98 was declared as a decade of kleptocracy because corruption was systematic in this period rather than petty or isolated. The corruption survey in 2002 and 2006 by Transparency International Pakistan found corruption prevailing in Pakistan's economy despite taking several anti-corruption measures and campaigns. This survey found the judiciary as 3rd most corrupt institution in Pakistan. The decade of the 2000's also reported several calamities for instance economic instability, unprecedented corruption, political and individual victimization and the problem of law and order (Mitra, 2006). The 2008–2013 PPP-led coalition government was criticized as being the most corrupt. Pakistan's rank in the corruption perception index during 2012 was 139, 116 in 2016, 126 in 2020 and 140 in 2021 (Transparency International, 2021). This indicates that corruption in Pakistan got worse whenever it had a coalition government.

Very little evidence is available on the relationship between corruption and capital accumulation. Mathur and Singh, (2013), and Bai and Wei (2001) observed in their study that most corrupt countries imposed restrictions on capital because the government's ability to collect tax revenue reduces corruption. Politicians rely on capital goods to raise revenue for public goods. Edwards (1999) examined that controls on capital may breed corruption. According to the efficient grease hypothesis, corruption is neither considered as good nor bad as it is related to human nature and occurs only for the advantage of at least one party involved. Němec (2022) indicated in their study that corruption in public administration has a much more destructive and long-term effect on capital accumulation than on the size of the workforce in the Czech Republic. They argued that corruption can become a significant obstacle to the transition, underlining that the task of public policies is not only to support digitization, robotization, and further development of technologies but especially to ensure a transparent non-corrupt environment of public administration.

The primary objective of this study is to empirically examine how the level of corruption affects capital accumulation in the presence of other macroeconomic determinants of capital accumulation. The other determinants of capital accumulation included in this study are gross savings, market size, inflation, law and order, income inequality and government stability. To the best of our knowledge, this is a novel study that empirically examined the nexus between corruption and capital accumulation in Pakistan. For this purpose, we applied the ARDL estimation approach after applying a stationarity check.

The remaining part of the study is structured as follows. Section 2 represents a literature review. Section 3 portrays the methodology. Section 4 depicts the results and discussions. Section 5 concludes the study by providing relevant policy recommendations.

LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

Corruption and Capital Accumulation Nexus

Very few researchers have empirically examined the nexus between corruption and capital accumulation. Shan et al. (2017) empirically examined the issue of corruption in the public construction sector by using data from China. They performed a multivariate analysis to find results. They found immorality, followed by opacity, unfairness, procedural violation, and contractual violation as major factors responsible for corruption in public sector corruption in China. Purwanto et al. (2021), and Lin and Zhang (2009) analyzed the influence of corruption on infrastructure development, labour and capital markets, on output and capital accumulation by computing overlapping generation model. They found that an upsurge in corruption in development of infrastructure decreases output and capital accumulation when the decline in ordinary workers saving rate was sufficiently large and an upsurge in corruption in the capital market lessens capital accumulation and output. Furthermore, an upsurge in labour market corruption lessened output and accumulation of capital when the supply of labour was perfectly inelastic. The results obtained using a simulation of plausible parameter values indicated that an upsurge in labour market corruption reduced output, the supply of labour, and capital accumulation. Atitianti and Chikelu (2021) and Athanasouli et al. (2012) found that corruption was inversely related to firm size and growth in Nigeria and Greece as the heterogeneous firms were engaged in corruption. They found that small and medium-level firms were less co-related with corruption compared to large firms. Asiedu and Freeman (2009) empirically examined and measured corruption at the firm and country-level by using investment data of firms. They argued that the influence of corruption on investment significantly differs across regions. They found corruption to adversely influence investment growth in transition economies. Moreover, they found no significant influence of corruption on investment growth for firms in Sub-Saharan African and Latin American countries. They inferred that corruption is an important investment determinant in Transition economies. Uroos et al. (2022), Farooq et al. (2020) and Farooq et al. (2013) found that corruption impedes economic growth in Pakistan.

Zeneli (2016) found corruption as one of the major issues that the Western Balkans faced in domestic and foreign capital accumulation. The study argued that corruption was inversely related to regional income level as low per capita income countries suffer from the high prevalence of corruption. The study also pointed out that other factors like tax evasion, low levels of economic innovation, the distorted composition of government expenditure, lack of competitiveness, and negative current account balances hindered economic development. The empirical literature indicated an inverse relationship between capital accumulation and level of corruption

(Campos et al., 1999), capital accumulation and social barriers (Owusu et al., 2020; Grafton et al., 2007), productivity and corruption (Demir et al., 2022; Del Mar Salinas-Jim´enez & Salinas-Jim´enez, 2007), corruption and social capital (Carmeci et al., 2021; Bjørnskov, 2003), a positive relationship between capital accumulation and responsibility (Ucar & Staer, 2020; Breuer & McDermott, 2013), and capital accumulation and trust (Sturn & Epstein, 2021; Yamamura & Shin, 2010). Everhart et al. (2009) indicated that the impact of corruption on private capital accumulation was damaging. Tawiah et al. (2023) and Žemgulienė (2012) empirically estimated that government expenditure hadan adverse and significant impact on capital formation. Aysan et al. (2007) and Pastor and Sung (1995) found a positive influence of some democratic institution's indicators on private investment in the developing world. Mauro (1995) indicated that corruption inversely influence economic growth via channels of investment. Similar findings have been reported by other studies (Tawiah et al. 2023; Knack & Keefer, 1995; Dridi 2013; d'Agostino et al., 2016; Ezzati, 2017; Cieślik & Goczek, 2018). These researchers argued that corruption lowered the accumulation of capital by creating hurdles for investors through red-tapism and horse-trading. Based on the above discussion, we hypothesize that corruption inversely affects capital accumulation.

Market Size and Capital Accumulation Nexus

The impact of market size on capital accumulation has been rarely studied in prior literature. Stiglitz (1989) showed the relevance of financial institutions to an economy's development process, by focusing on the critical role of capital formation. Thus, capital formation is essential but not an enough condition for economic growth. However, Ayadi et al. (2023) argued that market size is a positive determinant of capital accumulation. De Long et al. (1992) opined that the rate of capital formation is a key determinant of the rate of economic growth in any economy. Bagehot (1873) concluded that the English Industrial Revolution was made possible by the existence of efficient capital markets. Therefore, we assume that market size is positively associated with capital accumulation.

Inflation and Capital Accumulation Nexus

Theoretically, it has been established that inflation causes many distortions in an economy. When prices of consumables increase, the real income of households decreases and hence, they cannot buy as much as they used to buy previously. In developing economies, there is a very high possibility that inflation will discourage economic agents from saving because money is worth more today than tomorrow (Rapach & Wohar, 2005; Lioui & Poncet, 2008). In the long run, therefore, inflation reduces economic growth because the economy needs a certain level of savings to finance investment projects which stimulate economic growth. Another devastating effect of inflation is that it makes it more difficult for entrepreneurs to plan their activities,

especially about how much to produce since under inflationary periods, it is more difficult to predict effective demand and the average costs of production (Faria & Carneiro, 2001; Feldstein, 1982; Barro, 1995). Furthermore, higher rates of inflation may also impair the effective functioning of financial institutions and markets as well as discourage their integration with global markets (Madsen, 2003; Byrne and Davis, 2004). By keeping this discussion in mind, we assume that inflation has an inverse relationship with capital accumulation.

Infrastructure and Capital Accumulation Nexus

Various studies have discussed the relationship between infrastructure and economic growth. Agenor and Moreno-Dodson (2006) identified two additional conventional channels through which infrastructure may affect growth, namely complementarity and crowding out effects. The first channel promotes growth through private capital formation. That is, public infrastructure raises the marginal productivity of private inputs, thereby raising the perceived rate of return on private capital and possibly also increasing private sector demand for physical capital. The second channel, crowding out, captures the idea that, in the short run, an increase in public capital stocks may displace or crowd out private investment. This negative crowding out effect of infrastructure may turn into a long-term negative effect if the decrease in private capital formation persists over time. Estache (2009) suggested that investment in public infrastructure can also impact investment adjustment costs, the durability of private capital, and both the demand for and supply of health and education services. In the same vein, Agenor and Moreno-Dodson (2006) argued that infrastructure may reduce investment adjustment costs via two channels: through complementarity between public capital and private investment and the decreased costs associated with capital reallocation between sectors following a shock. Maintaining the quality of public infrastructure may positively affect growth by improving the durability of private capital (Agenor & Moreno-Dodson 2006). Therefore, we hypothesize that infrastructure has a positive effect on capital accumulation.

Income Inequality and Capital Accumulation

Since the seminal work of Kuzmets (1955) asserting that inequality first rises and later falls as an economy develops and that this is schematized as an inverted-U relationship between inequality and the level of per capita product, it has been widely and generally acknowledged that a country's level of economic inequality can be viewed as an outcome of its economic performance. A classical analysis of Kaldor (1957) argued that income distribution has a critical effect on capital accumulation, through which economic growth can be affected. Besides capital accumulation, technology progress and its diffusion appeared to contribute to economic growth (Segerstrom, 1991). Accordingly, economic growth is considered to be attributed to several channels such as efficiency improvement, technological

progress, and capital accumulation (Kumar & Russell, 2002). The existing literature (Yamamura & Shin 2010) has used data envelopment analysis to construct the production frontier and decompose labor-productivity growth into the three components of efficiency improvement, capital accumulation, and technological progress to more closely investigate economic growth. Chen (2003) provides further evidence that: inequality enhances efficiency improvement as well as capital accumulation and then undermines them as inequality widens. However, other factors such as human capital, openness, and government consumption have different effects on efficiency improvement and capital accumulation, respectively. Therefore, we hypothesize wider income inequality reduces capital accumulation.

METHODOLOGY

Data Sources

Capital accumulation is a dependent variable of the study and is formed by combining the Gross fixed capital formation and changes in inventory variables. The independent variables of the study are gross savings, market size, infrastructure development, inflation, law and order, income inequality and political stability. Data was collected from ICRG and World Development Indicators from 1984 to 2022. The ICRG Corruption Index (CRPTN) is used as a measure of corruption and is the key explanatory variable. The ICRG index of corruption is coded on a scale ranging from 0 to 6 points. Zero indicates most corrupt while 6 signifies least corrupt. Data for gross savings, market size, inflation, infrastructure and income inequality has obtained from World Bank databases. Real GDP is used as a measure of market size. Consumer Price Index (CPI) is used as a proxy for inflation. Infrastructure variables are measured as the lengths of roads in kilometres. Government stability and law and order indexes data are collected from the ICRG.

Unit Root Test

This research considered two types of unit-root tests Augmented Dickey-Fuller and Phillips-Perron Unit root test to check for the status of unit-root properties of each series. Nelson and Plosser (1982) argued that macroeconomic time series are often characterized by the unit-root problem.

The equation for the Augmented Dickey-Fuller unit root test is as follows:

$$\Delta y_t = \alpha y_{t-1} + x_t'\delta + \epsilon_t \quad \ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Where α=*p-1*. The null and alternative hypothesis are as follows:

$$H_0: \alpha = 0$$

$$H_1: \alpha < 0$$

And elevated by using the conventional ratio for α.

$$t_\alpha = \hat{\alpha}/(se(\hat{\alpha}))$$

Where $\acute{\alpha}$ is the estimator of α. And $se(\acute{\alpha})$ is the coefficient standard error.

The equation for Phillip-Perron unit root test is as follows:

$$\tilde{t}_\alpha = t_\alpha\left(\frac{\gamma_0}{f_0}\right)^{1/2} - \frac{T(f_0 - \gamma_0)(se(\hat{\alpha}))}{2f_0^{1/2}s} \quad \ldots\ldots\ldots\ldots\ldots\ldots (2)$$

Where $\acute{\alpha}$ is the estimate, t_α and t-ratio of α, $se(\acute{\alpha})$ is coefficient standard error and *s* is the standard error of the test regression. The γ_0 is a consistent estimate of error variance. f_0 is an estimator of the residual spectrum at frequency zero.

ARDL Bound Testing Approach

The ARDL model is an appropriate econometric method for evaluating cointegration when both stationary and non-stationary variables are existed in the model. However, it is crucial for researchers to ensure that the dependent variables are integrated of order one, while the explanatory variables are not integrated of order higher than one. The ARDL approach is applicable when the observation size is small. This makes it a valuable tool in situations where data availability is restricted. Monte Carlo studies have also demonstrated that the ARDL approach provides comparatively more accurate results than other co-integration tests, especially when dealing with little samples (Pesaran & Shin, 1999). Furthermore, the ARDL model efficiently checks for the endogeneity problem. By assuming all variables as endogenous, it provides unbiased, consistent and significant estimates for both short- and long-run relationships.

The relationship among capital accumulation, corruption, gross savings, market size, inflation, infrastructure, inequality, law and order, and political stability has examined by applying the ARDL bound testing approach. The estimation approach was developed by Pesaran et al. (2001). The Bound Test has numerous benefits. Firstly, it is more suitable for small sample size (Tang, 2001). Secondly, it avoids unit-roots pre-testing (Pesaran et al., 2001). Thirdly, it estimates long-run and short-run parameters simultaneously. Fourthly, it assumes all variables are endogenous. Lastly, this estimation technique does not require that variables in time series regression equation have integration order I (1). The test can be used without consideration of

integration order of variables whether they are integrated as I (1) or I (0) or fractionally integrated. Moreover, the bound testing approach is appropriate for this study because it simultaneously estimates long-run and short-run components, eliminates problems allied with omitted variables and autocorrelation and, lastly, this model can distinguish between dependent and independent variables (Narayan, 2004).

The written form of the ARDL equation is as follows:

$$\Delta LCA = \beta_0 + \beta_1 Corruption_{t-1} + \beta_2 LMS_{t-1} + \beta_3 LGS_{t-1} + \beta_4 INF_{t-1} + \beta_5 INFRA_{t-1} + \beta_6 INEQLT_{t-1} + \beta_7 ROL_{t-1} + \beta_8 GS_{t-1} + \sum_{i=0}^{k} \beta_9 \Delta LCorruption_{t-i} + \sum_{i=0}^{k} \beta_{10} \Delta MS_{t-i} + \sum_{i=0}^{k} \beta_{11} \Delta GS_{t-i} + + \sum_{i=0}^{k} \beta_{12} \Delta LINF_{t-i} + \sum_{i=0}^{k} \beta_{13} \Delta INFRA_{t-i} + \sum_{i=0}^{k} \beta_{14} \Delta INEQLT_{t-i} + \sum_{i=0}^{k} \beta_{15} \Delta ROL_{t-i} + \sum_{i=0}^{k} \beta_{16} \Delta GS_{t-i} + \varepsilon_t \quad \ldots\ldots\ldots\ldots\ldots\ldots (3)$$

Where β_0 denotes intercept, Δ signify difference operator and ϵ_t notifies error term. The natural log is applied to all variables. Lag length for selected variables is 2 years for ARDL equation estimations. We omitted all those variables that were not significant from the model by following general to specific technique due to the limitation of restricted numbers. We tested the accuracy and reliability of the model by using various diagnostic tests*. We tested joint significance by using the following null hypothesis of bounds testing:

$$H_0 = \beta_0 = \beta_1 = \beta_2 = \ldots\ldots\ldots = \beta_7$$

$$H_1 \neq \beta_0 \neq \beta_1 \neq \beta_2 \neq \ldots\ldots\ldots \neq \beta_7 \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots (4)$$

Bounds testing technique checks significance by using F-statistics. The null hypothesis describes variables do not have a co-integration relationship without consideration of integration order whether it is I (0) or I (1) and F-statistics of asymptotic distribution is unusual. There are two sets of critical values to check the level of significance as suggested by Pesaran et al. (2001). First set hypothesize integration order for all variables I(0) whereas the second set assumes integration order I(1) for all variables. If the calculated f-statistics exceeds the critical value of upper bounds, then we reject H_0 and if the calculated value of f-statistics remains less than the critical value of lower bounds, then there exists no cointegration.

*Such as ARCH test for heteroscedasticity; LM test for serial correlation; normality test; CUSUM and CUSUMSQ for structural stability.

RESULTS AND DISCUSSIONS

Descriptive Statistics and Correlation Analysis

The results of the descriptive statistics are presented in Table 4.1. The results of descriptive statistics shows that government stability has the lowest mean value whereas Market size (MS) has the highest mean value. The market size, infrastructure, inequality and law and order are negatively skewed. Whereas capital accumulation, CPI, gross savings, inflation and government stability are positively skewed. The corruption, inflation and law and order variables have leptokurtic distribution. Whereas capital accumulation, gross savings, market size, infrastructure, inequality and government stability have a mesokurtic or normal distribution.

Table 4.1: Descriptive Statistics

	LCA	CPI	GS	MS	INF	INEQLT	LAO	GS
Mean	23.52	8.02	17.09	25.55	9.07	30.89	2.77	6.85
Median	23.37	7.76	17.08	25.53	7.68	31.25	3.00	6.72
Maximum	24.72	20.28	22.31	26.27	38.51	33.45	3.91	10.83
Minimum	22.46	2.52	12.21	24.74	0.40	27.64	1.00	2.16
Std. Dev.	0.70	3.87	2.79	0.44	6.69	1.94	0.72	2.15
Skewness	0.11	0.76	0.14	-0.09	2.55	-0.13	-0.98	0.04
Kurtosis	1.66	3.87	2.18	1.92	11.62	1.57	3.14	2.14
Jarque-Bera	2.73	4.69	1.12	1.78	150.83	3.17	5.89	1.10
Probability	0.25	0.09	0.56	0.41	0.00	0.20	0.05	0.57
Observations	36	36	36	36	36	36	36	36

Source: Authors compilation

Table 4.2 shows the result of the correlation analysis. The results indicated that all the variables are positively related to capital accumulation expect gross savings, inflation and inequality. The results of the correlation test show that data is free from serial correlation problem.

Table 4.2: Correlation Analysis

	LCA	CPI	GS	MS	INF	INEQTI	LAO	GS
LCA	1.00	0.09	-0.55	0.98	-0.04	-0.75	0.66	-0.03
CPI	0.09	1.00	-0.27	0.05	0.39	-0.09	0.04	-0.37
GS	-0.55	-0.27	1.00	-0.50	0.05	0.52	-0.43	0.32
MS	0.98	0.05	-0.50	1.00	-0.05	-0.75	0.70	0.03
INF	-0.04	0.39	0.05	-0.05	1.00	0.03	0.06	0.09
INFRA	0.87	0.04	-0.32	0.92	0.03	-0.70	0.75	0.24
INEQLT	-0.75	-0.09	0.52	-0.75	0.03	1.00	-0.64	0.07
LAO	0.66	0.04	-0.43	0.70	0.06	-0.64	1.00	0.49
PS	-0.03	-0.37	0.32	0.03	0.09	0.07	0.49	1.00

Source: Authors compilation

Results of Unit Root Test

The study applied the Augmented Dickey-Fuller and Phillips-Perron Unit root test to determine which test should be applied for further analysis. All included variables have different order of integration (see table 4.3). Corruption (CRPTN), inflation (INF) has 1(0) orders of integration while capital accumulation (CA), market size (LMS), gross savings (LGS), law and order (LAO), government stability (GS) and income inequality (INEQLT) have 1(1) integration order. The result of unit root test suggests that the ARDL bound testing approach is appropriate for the estimation of empirical nexus.

Table 4.3: Results of Unit Root

	Augmented Dickey-Fuller Test		Phillips-Perron Test		
Variable	**Level**	**Difference**	**Level**	**Difference**	**Decision**
LCA	-0.68	-5.79***	-0.65	-5.76***	1(1)
Corr	-4.36**	-4.11**	-2.77*	-6.65***	1(0)
LMS	-1.09	-3.15**	-1.65	-3.64**	1(1)
LGS	-1.18	-6.91***	-1.23	-6.98***	1(1)
LINF	-5.40***	-6.90***	-5.40***	-19.33***	1(0)
INEQLT	-2.12	-4.04***	-1.45	-3.42**	1(1)
LAO	-1.92	-4.11***	-1.64	-4.37***	1(1)
GS	-1.60	-5.31***	-1.81	-5.33***	1(1)

Note: *; **; * represents significant level at 1 %; 5 %; 10 % respectively.**

Source: Author's compilation

Results of ARDL Bounds Testing Approach

All variables showed significant relationships during the long run. However, some variables have a positive relationship with capital accumulation, and some have an inverse relationship. Gross savings, market size, Law and order, and political stability showed positive and significant impact on capital formation. Hence confirming the hypothesis that these variables expedited the process of capital formation. LGS and LMS contributed 0.15 per cent and 0.35 percent, respectively, in capital formation while the share of law and order and government stability is 0.05 per cent and 0.33 percent correspondingly. Corruption and inflation have an inverse and significant impact on capital formation. Corruption has 0.08 percent adverse influence on capital accumulation whereas inflation has 0.43 percent inverse impact on capital accumulation. While Infrastructure quality has a negative sign, but it is insignificantly related to capital formation in the long run.

Table 4.4: Long Term Results

Dependent Variable: LCA		
Variable	**Coefficient**	**T-Statistics**
CORR	-0.08	-2.40**
LGS	0.15	2.02**
LMS	0.35	1.71*
LINF	-0.43	-2.87***
INEQLT	-0.15	-1.27
LAO	0.005	1.88*
GS	0.33	3.56***
C	0.37	4.12***
ARDL Bounds Tests		
	F-Statistics	**[Upper Bound: 1%, 5%]**
F-Statistics	7.7801	[4.19, 3.59]
Wald Test	70.0209	[37.76, 32.34]

Note: Critical values of Bounds Testing is given in [ ]; *, **, *** show significance at 10%, 5% and 1% respectively.

Source: Author's compilation

An increase in corruption corresponding to a decrease in CPI has an inverse impact on capital formation. The influence of corruption on capital formation is 0.08 percent in long run. This means that one percent increase in corruption corresponding to decreasing CPI will decrease capital accumulation by 0.08 percent during the long run. The results of the study demonstrated that an increase in corruption reduces capital formation by slowing down business and commerce via red-tapism and horse-trading. It

erodes investor confidence, discourages foreign and domestic investments, and undermines the rule of law, impeding the development of a conducive environment for sustained capital formation. Subsequently, it prevents economic growth and distorts resource allocation, hence, lowers influence on efficiency. These findings were also supported by Myrdal (1968), McMullan (1961), Krueger (1974), Mauro (1995), Lin and Zhang (2009), Everhart et al. (2009), Erum and Hussain (2019) and Tawiah et al. (2023).

Gross savings have a positive influence on capital accumulation. Gross savings positively impacted capital accumulation by providing a pool of funds for investment in physical assets, infrastructure, and productive enterprises. Increased savings contributed to a higher capital stock, fostering economic growth, job creation, and improved productivity over the long term. As savings go up, investment also increases. Savings led microfinance programs to increase capacity to lend these savings for investment purpose and generates more capital. These findings are supported by previous studies (Karlan et al., 2017; Bustos et al., 2020; Demir et al., 2022).

Market size (MS) has a positive impact on capital accumulation. When MS increases by one percent then the capital accumulation increased by 0.35 percent. A larger market size positively influenced capital accumulation by offering enterprises greater opportunities for sales and profits. A sizable market incentivizes companies to invest in expanding production capacity, infrastructure, and innovation, contributing to increased capital accumulation and overall economic development. This may be because of new investments projects installed over time. The share of MS in long run was less as compared to the short run. This might be because of the depreciation of capital. Expansion in market size over time is an indication of growth in capital formation over time. These results are also supported by previous studies (Hassan & Murtala, 2016; Lin & Zhang, 2009; Asiedu & Freeman, 2009; and Zhang et al., 2020).

Inflation also showed a negative impact on capital formation. Inflation has an inverse impact on capital accumulation as it erodes the purchasing power of money over time. This diminishes the returns on investments, discourages long-term planning, and creates uncertainty, hindering both private and public sector efforts to accumulate and invest in fixed capital. Inflation has an inverse but insignificant impact on capital formation during the short run. The reason for this can be all income being consumed due to inflation and saving rate is zero or very less. Hence, indicating no impact on capital accumulation during the short run. As in Pakistan, around 86.09 per cent of income is consumed while the saving rate was only 6 per cent (Economic Survey, 2022-203). These results are also supported by prior studies (Adeniyi, 2022; Mishchenko et al., 2018; Azariadis & Smith 1996; Asiedu & Freeman, 2009; Schreft & Smith, 1997, 1998).

The effect of rule of law and government stability also positively and significantly contributed to the accumulation of capital. The prevalence of law and order in countries provides more confidence to investors and they invest fearlessly. These findings are supported by Hamdaoui et al. (2021) and Peres et al. (2018). Similarly, government stability also boosts the confidence of both local and foreign investors. Government stability affects capital accumulation through channels of investment and human capital accumulation. (Pal, 2023; Uddin et al., 2017). A strong legal framework and political stability foster confidence, encouraging long-term investments in physical assets, infrastructure, and productive enterprises, contributing to sustained capital accumulation and economic growth. An effective or stable government makes sure that the rules of doing business are relaxed and the the government facilitates investors by providing subsidies and relaxations. Government effectiveness also helps consumers to save more to increase investments which in return generates more capital. Moreover, infrastructure quality is positively associated with the capital accumulation as infrastructure development can be a key factor in promoting capital accumulation by improving productivity, attracting investment, fostering economic growth, creating jobs, and generating positive economic spillover effects.

Table: 4.5: Short Term Result

Dependent Variable: DLCA		
Variable	**Coefficient**	**T-Statistics**
CORR	-0.37	-1.87*
LGS	0.54	4.99***
LMS	0.37	2.06**
INF	-.18	-1.44
INEQLT	0.05	2.15**
LAO	0.16	1.79*
GS	0.43	4.36***
ECM (-1)	-0.43	-6.82***
R-squared	0.87	
Durbin-Watson stat	2.14	
0.37*CORR-0.54*LGS-0.37*LMS+0.18*INF+0.05*INEQLT+-0.16*LAO-0.43*GS		

Note: ***, ** and * indicate the level of significance at 1%, 5% and 10% respectively.
Source: Author's compilation

After estimating coefficients for the long run, coefficients are normalized by creating a series of estimated coefficients. The results indicated all variables except inflation as statistically insignificant in the short run. The Error Correction (ECM) coefficient is significant and negative [-

0.43] that fulfils the mandatory condition for the ARDL model equation. ECM shows that the rate of adjustment to reach towards equilibrium is 43 % per annual. The findings specified that gross savings, market size, law and order and government stability have a positive relationship with capital formation. Corruption and inflation have a negative and significant association with capital formation.

Diagnostic Tests

Table 4.6: Diagnostic Tests

	F Statistics	P-Value
Serial Correlation LM Test	1.4538	0.2573
Normality Test	0.6239	0.7319
Heterosecdasticity test	0.6570	0.6601
Functional form test	0.0923	0.7612

Source: Author's compilation

We also applied several diagnostic tests (see table 4.6) such as normality test; Heteroskedasticity Test; Serial Correlation LM test; functional form test and stability tests such as CUSUM and CUSUMSQ test to test the stability of the model over time and the findings are presented in Figure 4.1 and Figure 4.2. The results exposed the model as stable and free from the problem of heteroscedasticity, functional form is correct, residuals are normally distributed, and the model is gratis from the problem of serial correlation. The results of the CUSUM and CUSUMSQ squares test show that data is stable during the sample period.

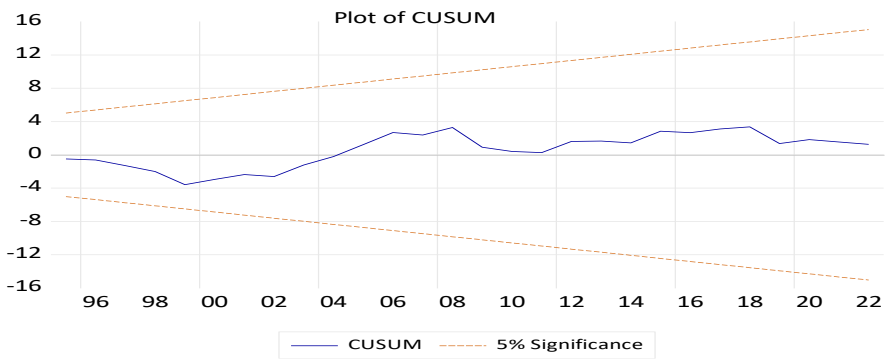

Figure 4.1: Plot of CUSUM
Source: Author's compilation

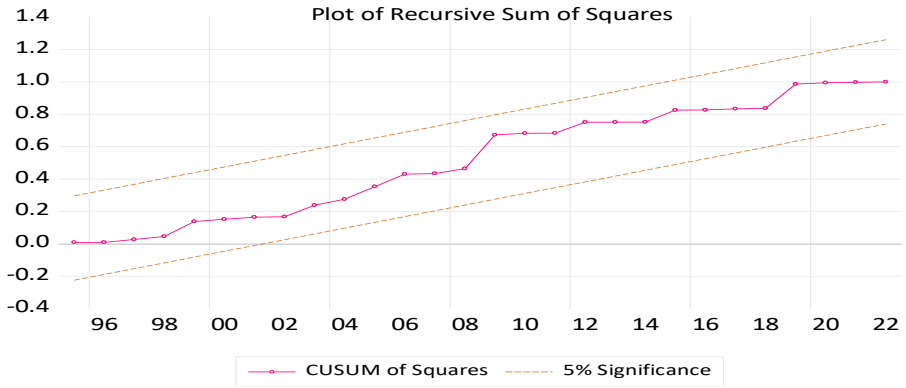

Figure 4.1: Plot of Recursive Sum of Squares
Source: Author's compilation

CONCLUSIONS AND RECOMMENDATIONS

The study empirically investigated the nexus between corruption and capital accumulation along with other determinants of capital accumulation namely gross savings, market size, inflation, infrastructure quality, law and order, and government stability of Pakistan's economy by employing time series data from 1984-2022. Results of unit root tests suggested using the ARDL estimation technique. The findings of the study indicated that an upsurge in corruption had an inverse and significant influence on capital formation both in the long and short run. The findings support the hypothesis that corruption reduces capital formation by slowing down business and commerce via red-tapism and horse-trading. Therefore, it deterred economic growth and distorted resource allocation. Gross savings and market size have a positive influence on capital accumulation both in the short run and long run. Expansion in market size over time is an indication of growth in capital formation over time. Savings helps in reinvestment and generates more capital. Inflation is also showing a negative impact on capital formation in long run but the negative and insignificant effect for a short run. The reason of this is most of the income has been consumed because of inflation and less amount remains for saving that are also called future investments. Moreover, infrastructure quality is only significant in the short run in the case of Pakistan. Government stability also has a positive association with capital formation both in the short and long run. Government investment in development projects also enhances the confidence of investors in economies where the government is stable. Rule of law also has a positive impact on capital accumulation. As better implementation of law-and-order increases investor confidence and has a positive impact on capital accumulation.

The findings of the study suggest that the government should take appropriate measures to control the level of corruption and inflation in the country. To combat corruption, governments should bolster legal frameworks, establish independent anti-corruption agencies, and enhance transparency and accountability in public operations. Whistleblower protection mechanisms, ethics training for officials, and the integration of technology are essential components. International cooperation is crucial to tackle cross-border corruption. To boost capital accumulation, policymakers should adopt strategies such as offering investment incentives, facilitating access to financing, and prioritizing infrastructure development. Creating a stable regulatory environment, promoting research and development, and fostering public-private partnerships are also crucial. The measure should be taken to increase the saving ratio which in turn increases future investment ratio in the country. There should be proper check and balance on ongoing projects. There should be a participatory government system and the confidence of investors should be restored by introducing appropriate measures for investment opportunities and giving rebates on investment projects. So that more capital can be generated. The process of new investments should be easy and approachable for the common man. The government should also invest in new projects. In the context of inflation, central banks should focus on price stability, adopting inflation targeting frameworks, and coordinating fiscal policies are paramount. For future research, this study suggests that the corruption indicator should be disaggregated sector-wise because it would be more helpful to capture the adverse influence of corruption on the indicators like investment and productivity. There should be a study that analyzes the impact of the disintegrated (high, moderate or low) level of inflation on capital accumulation in Pakistan as it will help capture the impact of inflation on capital accumulation. Future studies may consider additional macroeconomic variables like tax burden, ease of doing business and activities of international firms in accumulation of capital.

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APPENDIX A

Data Set									
TIME	**LCA**	**CRPTN**	**LGS**	**LMS**	**INF**	**INFRA**	**LAO**	**GS**	**IEQLT**
1984	22.46227	6.087167	22.39316	24.74213	9.653554	11.68242	2	5.25	33.45
1985	22.46504	5.614839	22.23754	24.81531	4.534943	11.74596	2	7.583333	33.38
1986	22.51259	3.506414	22.51957	24.86886	3.292001	11.80524	2	8	33.34
1987	22.57668	4.681219	22.64058	24.93139	4.518206	11.87019	2	6.75	33.32
1988	22.65921	8.837937	22.62417	25.00488	9.617561	11.928	2	4.416667	33.3
1989	22.75101	7.844265	22.65805	25.05328	8.585048	11.99748	2	4	33.27
1990	22.74827	9.052132	22.69926	25.0969	6.451999	12.04838	1.083333	2.166667	33.25
1991	22.88058	11.79127	23.00026	25.14628	13.49242	12.11565	1	3.416667	33.12
1992	23.01062	9.509041	23.07405	25.22051	10.20141	12.1512	1.25	4.583333	31.45
1993	23.09591	9.973665	22.84617	25.23794	8.838553	12.19003	2	4.75	30.65
1994	23.04121	12.36819	23.02532	25.27463	13.02842	12.24359	2.916667	6.75	29.21
1995	23.14321	12.34358	23.06282	25.32306	13.00648	12.29383	3	7	28.56
1996	23.21056	10.37381	23.01402	25.37039	8.37361	12.34407	3.583333	8.25	28.67
1997	23.13807	11.37549	23.02733	25.38049	13.38351	12.39207	3.916667	9.75	31.34
1998	23.12252	6.228004	23.10291	25.40567	7.526037	12.4191	3	10.16667	33.12
1999	23.00584	4.142637	23.07636	25.44162	5.862286	12.42255	3	9.25	32.54
2000	23.39173	4.366665	23.47295	25.48333	38.51199	12.4291	3	10.83333	31.42
2001	23.35013	3.148261	23.51715	25.51826	5.310636	12.43584	3	9.583333	30.5
2002	23.27871	3.290345	23.55886	25.54303	3.729013	12.43785	3	9.833333	31.23
2003	23.45092	2.914135	23.70955	25.5992	3.258605	12.45321	3	9.5	31.27
2004	23.59737	7.444625	23.90304	25.67195	7.330612	12.46154	3	9.416667	32.33
2005	23.78087	9.063327	23.88988	25.73511	7.839764	12.46466	3	9.291667	32.69
2006	24.00176	7.921084	23.92737	25.79242	8.872815	12.46534	3	9	32.01
2007	24.07768	7.598684	23.98644	25.83962	7.274319	12.46207	3	6.708333	31.42
2008	24.20957	20.28612	23.78942	25.85649	13.20401	12.46207	3	5.5	31.23
2009	24.10799	13.64777	23.95485	25.88441	20.66652	12.47136	3	6.416667	30.42
2010	24.05548	12.93887	24.06156	25.90035	10.85024	12.46637	3.416667	5.833333	29.59
2011	24.12978	11.91609	24.22136	25.92746	19.64465	12.47455	3.5	5	29.12
2012	24.24455	9.682352	24.16291	25.96193	5.968574	12.48149	3.50	5.25	29.02
2013	24.26666	7.692156	24.24701	26.00496	6.965943	12.48278	3.50	7.17	28.32
2014	24.30018	7.189384	24.343	26.05065	7.411553	12.48348	3.21	7.17	28.43
2015	24.47268	2.529328	24.4768	26.09687	4.110249	12.60838	3.00	6.00	27.96
2016	24.50085	3.765119	24.45279	26.15067	0.400236	12.62462	3.00	6.38	27.648
2017	24.61894	4.085374	24.40515	26.20472	4.013378	12.64059	3.310897	5.463384	28.74427
2018	24.72245	5.078057	24.37212	26.26145	2.459286	12.65631	3.33196	5.282003	28.6052
2019	24.49448	10.57836	24.25761	26.27129	8.620803	12.67179	3.353022	5.100622	28.46613
2020	24.73959	8.161436	24.66794	26.32867	8.25506	12.755	3.678135	7.031433	28.32706
2021	24.80528	8.168862	24.73151	26.37036	8.210575	12.77812	3.726997	7.040933	28.18799
2022	24.87097	8.176289	24.79507	26.41204	8.16609	12.80123	3.775859	7.050433	28.04892

APPENDIX B

List of Abbreviations

Autoregressive distributed lag	ARDL
Gross Domestic Product	GDP
Corruption Perception Index	CPI
Corruption Index	CRPTN
Inflation	INF
Capital Accumulation	LCA
Market Size	LMS
Gross savings	LGS
Law and order	LAO
Government stability	GS
Income inequality	INEQLT