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Crowding-Out Effect of Natural Resources on Domestic Investment: The Importance of Information Communication and Technology (ICT) and Control of Corruption in the Middle East and Central Asia

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Abstract: Countries of the Middle East and Central Asia depend heavily on natural resources for their exports, income, and employment. This study is a preliminary investigation that explores the effect of natural resources on domestic investment in a sample of 12 highly resource-dependent countries in the Middle East and Central Asia from 2000 to 2019. The recently advanced cross-sectional dependent auto-regressive distributed lag (CS-ARDL) model and panel quantile regression are employed. The results validate the accelerator theory that an increase of the non-oil GDP growth rate has a robust positive impact on domestic investment, while natural resources crowd-out domestic investment. The long-run estimate of ICT reveals a significant positive impact, while corruption shows a significant negative effect. These findings urge sample resource-dependent countries to focus on developing ICT-based enterprises and control prevailing corruption levels. Moreover, adopting liberal trade policies can also enhance domestic investment opportunities.

Keywords: natural resources; crowding out; domestic investment; ICT; corruption; CS-ARDL; QR regression

1. Introduction

The resource-dependent countries in the Middle East and Central Asia do not enjoy the same sound economic prosperity as many other resource-rich countries, such as Australia, Canada, Chile, Malaysia, Norway, and the Netherlands. Despite the strong desire for economic diversification, these countries still rely on natural resources for income and employment. According to [1], the major constraint of capital formation is the lower level of domestic saving than is required for sustainable economic prosperity. Figure 1 presents the gross domestic investment in physical assets that is a prerequisite for both short-term and long-term economic growth. The graphs in Figure 1 reveal that the most sampled resource-dependent countries are witnessing a lower and sluggish pattern of gross domestic investment. According to traditional and contemporary theories of economic development, an increase of domestic investment is the only channel to attain short-term and long-term economic growth. For instance, Harrod and Domar's growth model and the Solow–Swan growth model urge physical capital accumulation through investment [2–5]. In contrast, the

contemporary endogenous growth proposition urges investment in physical and human capital [6,7].

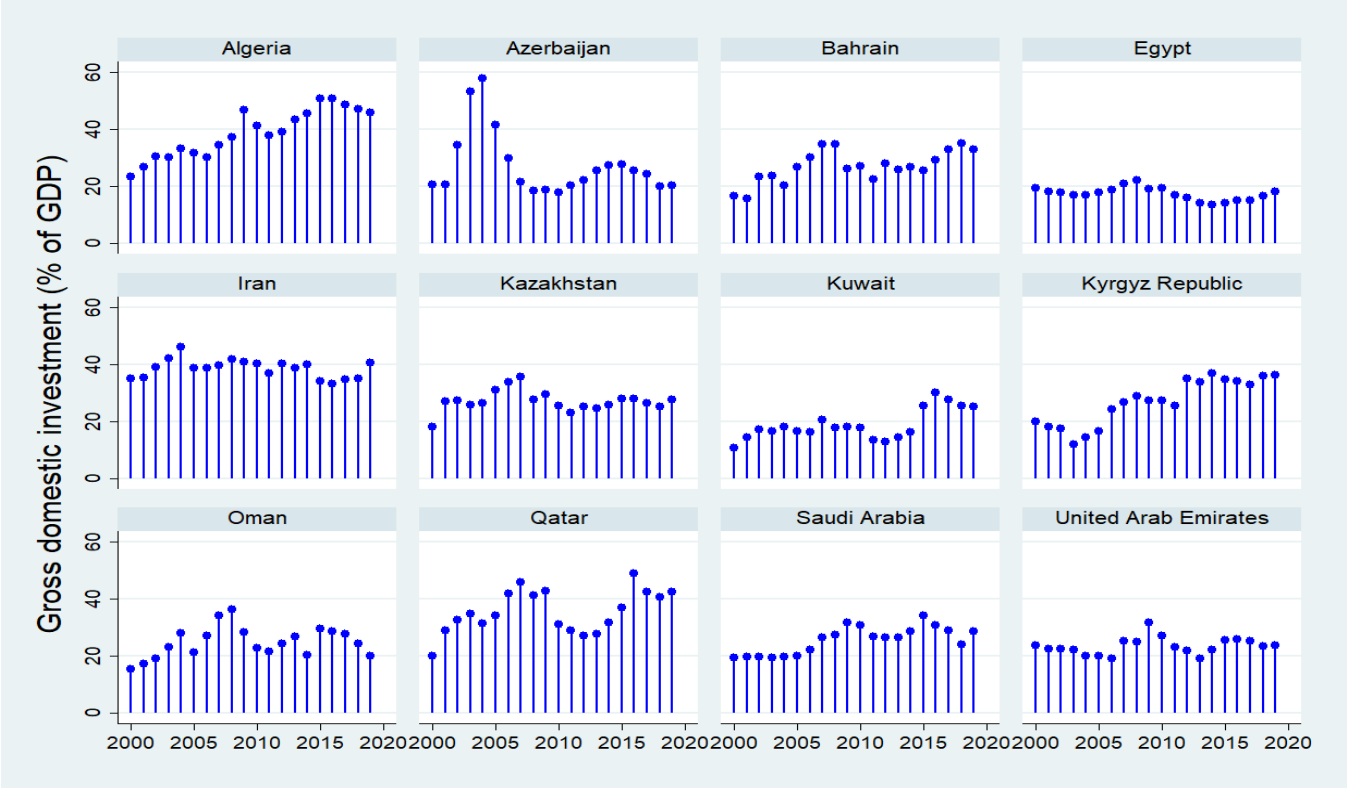

Figure 1. Domestic investment in the Middle East and Central Asia. Source: Authors' estimation, based on data from World Bank, (2022) [8].

Furthermore, trade cycle theories also focus on domestic investment to explain short-term economic oscillations. The previous literature has mostly focused on other dynamics and overlooked the effect on domestic investment. Therefore, this study fills this gap by investigating whether natural resources have a crowd-in or crowd-out impact on the domestic investment of the sampled countries in the Middle East and Central Asia.

Several arguments motivate us to conduct this research. First, previous empirical studies on natural resources have focused mainly on the aggregate effect on economic indicators such as gross domestic product [9–11]), other tradeable industries [12], development of the financial sector [13–15], and development of human capital [16]. Furthermore, these studies' findings concluded that there was a mixed impact of natural resources on aggregate economic indicators. The empirical literature has overlooked the impact of natural resources on domestic investment, which is an important driver of both short-term and long-term economic growth.

Second, information and communication technology (ICT) has revolutionized the landscape and social behavior of business by introducing user-friendly and cost-effective e-commerce, and turning remote areas into active markets. Smartphones and internet technology are changing society's tastes, cultures, value systems, and preferences. In doing so, it has created opportunities for new businesses and unprecedented investment opportunities for ICT-based small- and large-scale businesses [17]. The previous empirical studies on ICT addressed various dimensions of its influence. For instance, Ref. [18] argues that the ICT diffusion has created considerable employment opportunities for women in Saudi Arabia. Whereas, Ref. [19] highlighted that the ICT innovations had reduced environmental degradation. Many studies reveal that ICT has considerably enhanced

sustainable economic growth and development prospects [20–22]. The prior empirical literature has overlooked the impact of ICT on domestic investment activities.

Third, these resource-abundant countries are witnessing higher corruption levels, as [23] noted that three out of ten highly corrupt countries belong to the Middle East and North Africa (MENA). Moreover, Ref. [1] observed that corruption and governance quality profoundly negatively impact private investment in the MENA region. Whereas Ref. [24] concluded that corruption level significantly positively affects private investment in GCC countries. These contradictory findings urge a comprehensive analysis to examine whether corruption is sanding the wheel of investment or greasing the wheel of investment in resource-dependent countries. Therefore, this study augments the standard accelerator investment theory to examine the long-term and short-term effects of prevailing high corruption levels.

Finally, this study has considered the Middle East and Central Asian countries for several reasons. These countries have vast natural resources dominated by oil and natural gas, which are the major source of income and employment. Resource rents account for more than 40 percent of GDP and 70 percent of total export receipts [8]. Depletion in natural reservoirs and higher dependence are major concerns for sampled countries. Therefore, these economies strive to diversify their economies by developing other industries, and an increase of domestic investment can realize this objective. Second, the sampled countries witness a high domestic consumption that leaves little income for domestic investment and capital formation. Finally, the recent revolution in ICT has provided many investment opportunities in low-cost services industries.

Therefore, the main research objectives of this study are the following: to validate the accelerator principle, to examine the crowd-out and crowd-in effect of natural resources, and to explore the effects of ICT, corruption, and globalization on domestic investment in the sampled countries. In doing so, this study makes several contributions to the existing literature. First, it is a preliminary study that assesses the effect of natural resources on domestic investment by augmenting standard accelerator theory. Second, given the potential cross-sectional heterogeneity and common correlation in panel data, the current study addresses these issues using the second generation of panel econometrics. For instance, the Cross-Sectional Autoregressive Distributed Lag (CS-ARDL) approach is employed to explore long-run and short-run parameters that can address cross-sectional dependency, while panel quantile regression can explore asymmetries in relationships. Finally, the findings reinforce that sampled countries efficiently utilize resource wealth to develop other manufacturing and services sectors.

Our empirical findings are as follows. We validated the hypotheses selected for the study. First (H1), the estimated results of CS-ARDL, reveal that increase of non-oil GDP growth has a significant positive impact on domestic investment in both the short-run and long run. Second (H2), the estimates of natural resources reveal a significant negative impact in the short and long run. Third (H3), the study also finds that ICT can enhance domestic investment activities. Fourth (H4), the long-run estimates of political corruption significantly distort domestic investment activities in the long run. The last (H5), reveals a significant positive effect of trade openness on domestic investment in sampled resource-rich countries in both the short and long run.

The rest of the study is organized as follows: next, Section 2 provides a comprehensive review of existing literature. Section 3 discusses model specification and estimation strategies. Section 4 analyses the results of the various econometric analyses, while Section 5 concludes with practical policy interventions.

2. Survey of Literature

This section reviews the literature concerning the effect of natural resources and domestic investment. It is evident from the classical theories of economic growth [2–5], contemporary growth theories [6,7], and business cycle theories [6,7] that domestic investment is the most important channel for attaining sustainable economic prosperity.

Therefore, a plethora of empirical literature investigated the impact of various economic aggregates on domestic investment. For instance, Ref. [25] explored the impact of public and foreign direct investment on the domestic investment of Malaysia from 1960 to 2003. The results show that both public and foreign direct investment complement domestic investment. Whereas, Ref. [26] found that FDI negatively impacts domestic investment in the host country, while Ref. [27] reported that foreign aid to developing countries distorts domestic investment dynamics. Similarly, Ref. [28] performed a comparative analysis to explore the effect of remittances on domestic investment in South Asia from 1980 to 2017. The finding reveals a significant positive impact of remittances on the sampled countries, except for Pakistan, which reported a negative effect in the long run. Ref. [29] examined the channelization of tourism receipts into domestic capital formation in South Asia by augmenting acceleratory theory. The finding reveals significant positive effects in both the long and short run. This study has not found any study on the nexus between natural resources and domestic investment.

2.1. Natural Resources and Domestic Investment

The literature on the macroeconomic effect of natural resources reveals a mixed impact on economic growth dynamics. For instance, *the staple economic development* theory urges that the export revenue from natural resources provides the necessary capital for aggregate economic activities [30]. According to this proposition, the exports of natural resources can stimulate domestic investment in other manufacturing industries that supply the required inputs (backward linkages) along with enhancing investment in the raw material processing industries (forward linkages).

However, the investment in input and export processing industries can deteriorate instead of increase if a resource-dependent country relies on import inputs and processes raw materials abroad.

The second popular proposition concerning the impact of natural resources on the economic aggregate is the Dutch Diseases proposition. According to this theory, the resource boom and associated increase of capital flow can appreciate the domestic real effective exchange rate by increasing wages and prices of other tradeable industries, and hence, deteriorate export competitiveness [12,31–33]. This real exchange rate-induced reduction in the export performance of these industries can reduce domestic investment and economic growth. Furthermore, Ref. [34] noted that there is highly sluggish structural adjustment in resource-rich countries. The Ref. [35] report found that e-government is one of the best potential resources for socioeconomic development, and offers strategies for strengthening the effectiveness and efficacy of public administration.

The literature on natural resource rent suggested a dual impact on the domestic economy. First, the increase of natural resources rent should increase domestic income, which can induce domestic investment. Second, the increase of domestic prices would force domestic wages and appreciate a real effective exchange rate and can cause Dutch diseases on other tradable industries by reducing or diverting investment. The prior empirical literature has mostly focused on the effect of natural resources on economic growth [10,11], with some studies on financial development [14] and human capital development [15].

Empirical studies on natural resources have mainly focused on their impact on other aggregate economic aggregates. For instance, Ref. [11] investigated the effect of natural resource on physical and human capital and revealed a significant positive effect. At the same time, Ref. [10] concluded that natural resource dependence starts de-industrialization in other exporting industries by appreciating the real effective exchange rate.

Moreover, Ref. [15] investigated the impact of resource income on human capital development in 30 countries in the Asia Pacific region from 1996 to 2016. The findings reveal a significant positive impact using the second generation of panel econometrics and bootstrapped quantile regression. These findings contradict the findings of [11]. Similarly Refs. [36,37] reported the prevalence of Dutch diseases in Azerbaijan. Furthermore, Ref. [9] reveals that the rent from natural resources considerably improves economic growth

performance during the COVID-19 era in G7 countries. Thus, the reviewed literature shows that the natural resource can have varying impacts on domestic investment to the relative difference in utilization of income from natural resources.

2.2. ICT and Domestic Investment

Information and communication technologies (ICT) transform social and economic structure through innovative, user-friendly e-commerce technology that has transformed remote areas into an active marketplace. It has reduced entry barriers and made production processes more cost-efficient [17]. The empirical studies on ICT explored various dimensions of its economic influences. For instance, Ref. [20] explores the effect of ICT on Brazil and India's domestic production growth by using a unique data set on manufacturing firms. The findings reveal ICT's strong, robust positive impact on domestic productivity growth in the sampled countries.

Moreover, poor infrastructure quality and labor market policies strongly influence ICT-based businesses. Similarly, Ref. [21] found a bidirectional causal relationship between domestic investment and economic growth in Korea's ICT industries' development. Furthermore, Ref. [38] revealed a significant positive effect of ICT on the growth of BRICS countries in the long run. At the same time, Ref. [35] concluded that implementing E-governance can reduce corruption and improve overall efficiency.

ICT can also reduce environmental emissions by making businesses more sustainable. For instance, Ref. [22] explored the effect of ICT on the sustainable development of 140 countries across the globe from 2000 to 2019. The findings reveal a significant positive impact of ICT on economic development prospects. The intensity of this positive impact varies across the geographical locations and income group categories. At the same time, the finding of [39] reveals a significant negative impact of ICT on carbon mission in a sample of Asian countries. Furthermore, Ref. [40] investigated the effect of information and digitization on development and environmental governance in China by using difference-in-difference (DID) estimation. The findings reveal that adopting information and digitalization improves economic development and environmental governance.

2.3. Corruption and Domestic Investment

The resource-rich countries witness high corruption levels that influence domestic investment and growth dynamics. It is an ancient practice, and every nation and firm usually encounters corruption of varying intensity and nature [41,42]. As far as the effect of corruption on the economic growth of countries and firms is concerned, some studies suggest that corruption enhances growth activities. At the same time, others believe that corruption hinders growth. Therefore, two important theories concerning the impact of corruption are the sanding wheel hypothesis and the greasing wheel proposition. The sanding wheal proposition urges that corruption levels deteriorate growth and development. For instance, Ref. [43] concludes that higher corruption level hinders the investment behavior of firms.

Similarly, Ref. [44] urge that the corruption level deteriorates investment by enhancing uncertainty and operation cost. Whereas the greasing the wheel hypothesis argues that an increase of corruption can be beneficial for firms and countries. For instance, the preliminary work of [45] reveals that corruption can enhance efficiency when governing authorities of any country are inefficient. Similarly, in more recent literature [46], higher corruption levels are shown to lead to greater capital expenditure, while corruption positively impacts innovation in advanced countries.

The empirical literature on corruption in investment in resource-rich countries also reveals contradictory findings. For instance, Ref. [1] investigated the impact of governance characteristics on private investment in MENA. The findings urge control of corruption, quality of bureaucracy, political stability, and law and order to enhance private investment. While Ref. [24] examines the effect of corruption on the investment and economic growth of countries in GCC from 2003 to 2016. The findings of causality analysis reveal that corruption

does not granger cause investment and economic growth in the short run. In contrast, there is strong unidirectional causality from corruption to domestic investment and economic growth in the long run. Furthermore, the fully modified ordinary least square estimation technique reveals that corruption distorts growth and enhances domestic investment.

2.4. The Gap in the Literature

The crowding-out of domestic investment due to excessive dependence on natural resources can be a major reason for the prevailing high dependence on some resource-intensive manufacturing sectors. The current study does not find any empirical investigation that explores the effect of natural resources on domestic investment. Therefore, this aspect of natural resources warrants a comprehensive economic inquiry. Moreover, the recent advancement in ICT has provided many investment opportunities in small and large-scale service industries [17]. The literature on ICT has not found any study concerning its impact on domestic investment. Based on above discussed literature review, this study formulated following five testable hypotheses:

H1. *Non-oil GDP has significant effect on domestic investment.*

H2. *Natural resource can have significant influence domestic investment.*

H3. *ICT can enhance domestic investment activities.*

H4. *Increase of corruption can deteriorate domestic investment.*

H5. *Trade openness can enhance domestic investment.*

3. Methodology

This section discusses the methodological framework used to explore the effect of non-oil GDP, natural resources, ICT, and corruption, along with trade openness, on domestic investment in 12 Middle Eastern and Central Asian countries from 2000 to 2019.

3.1. Model Specification

This study employs accelerator theory to explore the impact of ICT and natural resources on domestic investment in the sampled countries for two reasons. First, resource-dependent countries are highly controlled, where the interest rate is exogenously determined. Second, unavailability of interest rate data for all the selected countries. The acceleratory theory urges that an increase of aggregate demand explains domestic investment. Following Refs. [28,29,47], the augmented accelerator theory of investment is reported as follows:

$$INV_{it} = \beta_0 + \beta_1 NOGDPG_{it} + \beta_2 RES_{it} + \beta_3 ICT_{it} + \beta_4 CORR_{it} + \beta_5 TOPEN_{it} + u_{it} \quad (1)$$

where u_{it} is a white noise error term, β_0 and β_i reveal the intercept and slope coefficients of the selected variables.

The detailed description of the selected variables, along with the data source and descriptive statistics, are reported in Table 1.

The empirical literature mostly considered the growth rate of gross domestic product, which is mostly explained by natural resources in sampled countries. This study used a non-oil GDP growth rate to reduce multicollinearity among explanatory variables. The increase of non-oil income can increase domestic investment by inducing aggregate demand. Moreover, the previous empirical studies reported a significant positive impact of the increase of domestic income, and domestic investment activities also reveal a significant positive impact [28,29].

Table 1. Variables, definition, source, and description.

Variables	Definition	Source	Mean	Max	Standard Deviation
INV	Gross fixed capital formation, % of GDP.	World Bank, [8]	27.623	57.99	8.996
NOGDPG	Non-oil GDP * growth, constant prices, percentage change	IMF, [48]	5.897	38.72	4.867
RES	Natural resources rent, % of GDP	World Bank, [8]	24.813	58.983	14.375
ICT	Information communication and technology (Fixed broadband subscriptions per 100 people	QoG, [49]	17.149	90.2	12.201
CORR	Political corruption index	QoG, [49]	0.428	0.628	0.263
TOPEN	Trade openness index	World Bank, [8]	0.899	1.918	0.336

Source: Authors' calculations; * The non-oil GDP is gross domestic product by exclusion of oil contribution to the GDP.

This study has not found any empirical investigation concerning the effect of resources on domestic investment. To observe preliminary insight into the nature of the relationship in sampled countries, this study employs two-way quadratic prediction plots with CIs. Figure 2 shows that natural resources have a non-linear, inverted cub-shaped impact on domestic investment in sampled countries. This implies that investment increases in countries with lower dependence on natural resources, whereas highly resource-dependent countries witness distortion in domestic investment.

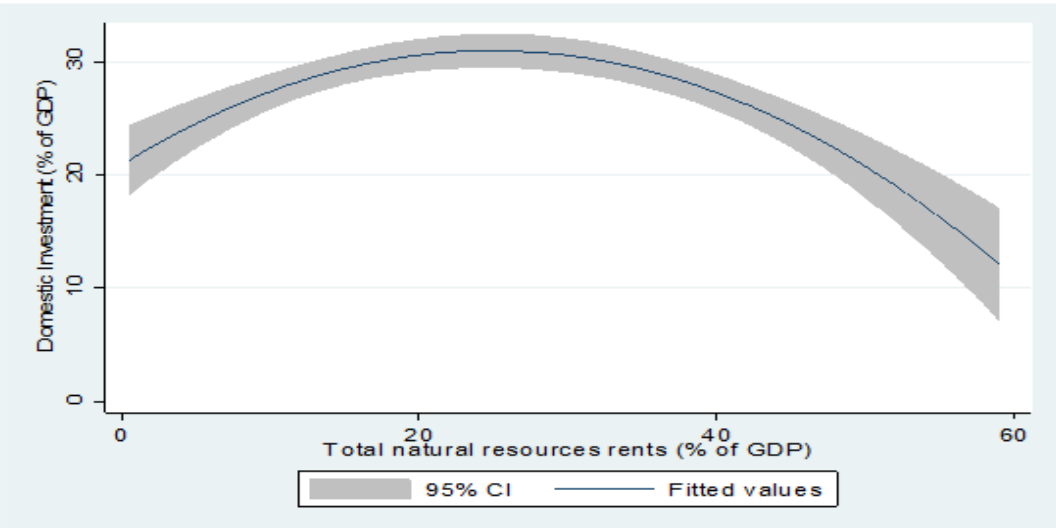

Figure 2. Natural resource and domestic investment nexus. Source: Authors' estimation.

The advancements in information communication and technology have transformed social and economic dynamics through user-friendly e-commerce, turning remote areas into new markets, reducing the cost of business, and making the production process more efficient. The literature concerning the impact of ICT on domestic investment is relatively scant. The available literature mostly focused on economic growth and reported a significant positive impact [20–22]. Similarly, literature on corruption also focused on its economic cost. There are two popular propositions, i.e., greasing the wheels and sanding the wheels. Among them, the greasing the wheels hypothesis urges that corruption increases growth by circumventing inefficient regulation.

In contrast, the 'sand the wheels' proposition considers that corruption prevents efficient production and distorts economic growth [50]. Concerning corruption in resource-rich nations, Refs. [51,52] concluded that high corruption perception is responsible for inefficient utilization of resource rent for developing other industries or economies. At the same time, trade liberalization can enhance domestic investment through technology spillovers and

provide greater investment incentives to exporting industries or sectors. However, this positive effect on investment can be offset in case of excess import discourages domestic production [46,53].

3.2. Estimation Strategy

3.2.1. Cross-Sectional Dependence

Recent advancements in econometrics reveal that panel data usually encounter cross-sectional dependence problems that can lead to biased estimates if not addressed. Therefore, the second generation of panel econometrics starts with the estimation of cross-sectional dependence. There are several variants of the cross-sectional dependence test, such as the test proposed by [54–56]. Among them, this study employed a cross-sectional dependence test of [56], which can be reported as:

$$\tilde{\Delta} = \sqrt{N}\left(\frac{\hat{S} - P}{2P}\right) \tag{2}$$

where $\hat{S}$ is:

$$\hat{S} = \sum_{i=1}^{N} \left(\hat{\beta}_{i.FE} - \hat{\beta}_{WFE}\right)' \left(\frac{X_i{}' M_1 X_i}{\hat{\sigma}_1^2}\right) \left(\hat{\beta}_{i.FE} - \hat{\beta}_{WFE}\right) \tag{3}$$

The null hypothesis of this test is homogeneity in cross-sectional coefficients, whereas the alternative hypothesis indicates slope heterogeneities.

3.2.2. Unit Root Analysis and Slop Homogeneity

The existence of slope heterogeneities urges the use of the second generation of panel unit analysis as traditional first-generation can lead to a biased conclusion, as it does not allow cross-sectional characteristics to be dependent. Therefore, this study used the recently advanced panel unit root analysis recommended by [57] to examine stationarity level and order of integration. This test is popularly known as CIPS unit root analysis. This test can be presented as:

$$\Delta y_{it} = \alpha_i + b_i y_{i,t-1} + c_i \overline{y}_{t-1} + d_i \overline{\Delta y}_t \tag{4}$$

where $\overline{y}_{t-1}$ is the lagged value from the mean value, and $\overline{\Delta y}_t$ also shows the mean in the first difference form. Pesaran (2007) [57] recommended the addition of mean value in equation 4 to address the cross-sectional dependence issue, which can be presented as:

$$CIPS\ (N,T) = N^{-1} \sum_{t=1}^{N} t_i(N,T) \tag{5}$$

This test is followed by an investigation of slope heterogeneities, which is performed using the test proposed by the [58].

3.2.3. CS-ARDL Model

The recently advanced cross-sectional dependence auto-regressive distributed lag (CS-ARDL) model proposed by [59] addresses the existence of strong cross-sectional dependence along with heterogeneities in slope coefficients. The advantage of the CS-ARDL approach over alternatives is that it can allow controlling for unobservable common components and slope heterogeneities in the short-run and long-run coefficients. The structure of standard CS-ARDL employed in this study is reported as follows:

$$\begin{aligned}\Delta INV_{i,t} = \alpha_i + \varnothing_i\left(\Delta INV_{i,\,t-1} - \varphi_i\, X_{i,\,t-1} - \rho_{1i}\overline{INV}_{t-1} - \rho_{2i}\overline{X}_{t-1}\right) + \sum_{a=\mathrm{i}}^{t-1} \vartheta_{1a}^{i}\, \Delta INV_{i,\,t-\mathrm{j}} + \sum_{a=0}^{u-1} \gamma_{1a}^{i}\, \Delta \mathrm{X}_{i,\,t-\mathrm{j}} \\ + \psi_{1i}\Delta\overline{INV}_t + \psi_{2i}\Delta\overline{X}_t + \varepsilon_{i,t}\end{aligned} \tag{6}$$

where $\Delta INV_{i\ t}$ is the vector of the dependent variable. Xit is the vector of explanatory variables such as NOGDP, RES, ICT, CORR, and TOPEN. $\overline{INV}_{t-1}$ is the expected value of

the dependent variable for the long run; $\overline{X}_{t-1}$ indicates long-run parameters for explanatory variables; $\Delta INV_{i,\ t-j}$ shows the dependent variable in the short run; $\Delta X_{i,\ t-j}$ is short-run estimates of explanatory variables; $\Delta\overline{INV}_t$ is the expected value of the dependent variable in the short run; $\Delta\overline{X}_t$ indicates expected values of explanatory variables in the short run; $\varepsilon_{i,t}$ is the stochastic term. ϑ^i_{1a} and γ^i_{1a} depict the short-run coefficients of the regressands and the regressors in the model. Furthermore, ψ_{1i} and ψ_{2i} are the short-run coefficients of the mean value of regressands and the regressors.

3.2.4. Panel Quantile Regression

The descriptive statistics in Table 1 and Figure 2 reveal the asymmetric nature of the relationship between natural resources and domestic investment, along with the existence of outliers. Therefore, this study employed quantile-quantile plots to examine the effectiveness of panel quantile regression in addressing these issues. The quantile-quantile plots in Figure 3 reveal that panel quantile regression can be an efficient tool to address asymmetries and outliers. Therefore, this study employed panel quantile regression proposed by [60] to address the asymmetric nature of relationships and outliers in the model. Moreover, the finding of this test can validate the robustness and explain the results obtained from the CS-ARDL model.

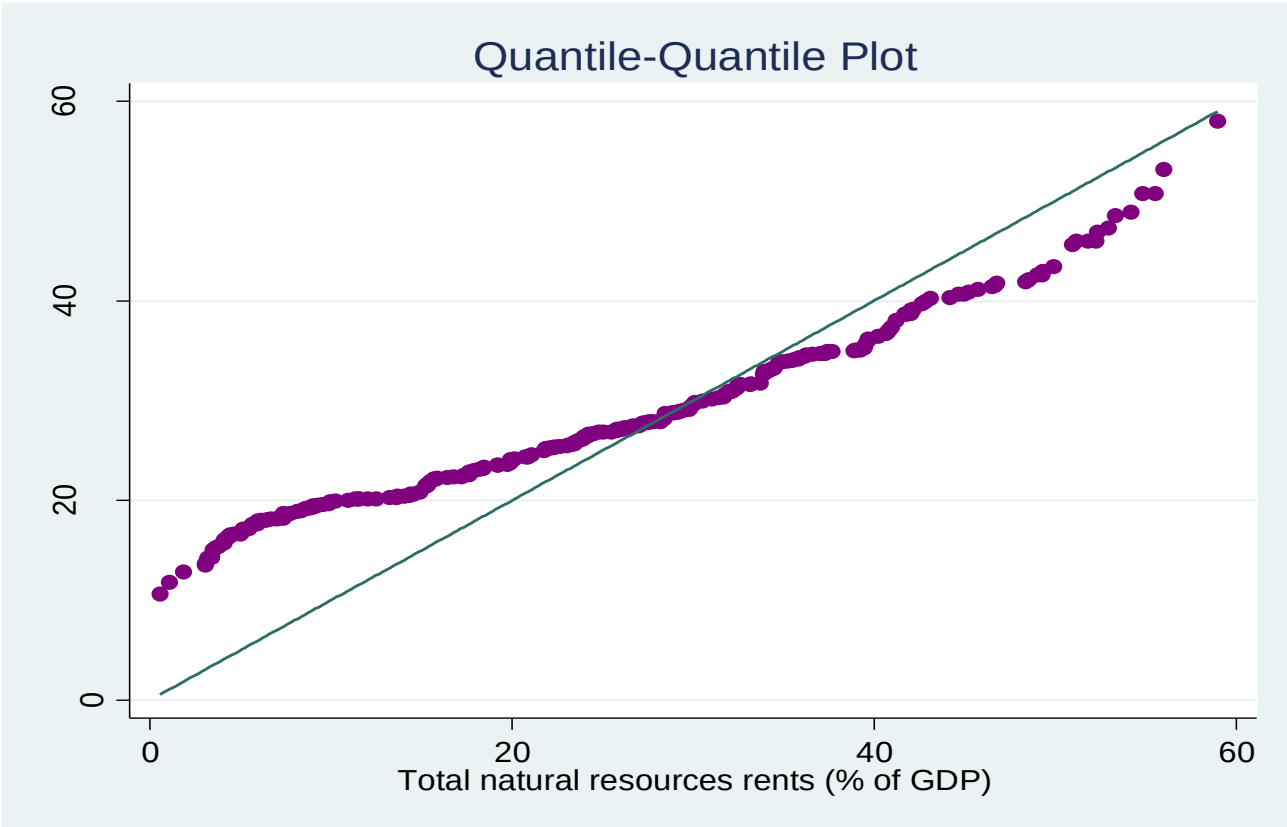

Figure 3. Quantile plot between domestic investment and natural resources. Source: Authors' estimations.

4. Results and Discussion

This section discusses the preliminary analysis and findings of CS-ARDL and MM-QR, which were employed to establish the short-term and long-term impact of natural resources, ICT, and other explanatory variables on domestic investment in selected Middle Eastern and Central Asian countries.

4.1. Pre-Diagnostic Test

Table 2 provides the result of the correlation among the model parameters. The result shows that domestic investment strongly correlates with its determinants, such as non-oil GDP growth, natural resources rent, information and communication technology, political corruption, and trade openness. The nature of correlation among the variables is in accordance with the expectations of this study. Moreover, little correlation is observed among the explanatory variables.

Table 2. Correlation among model parameters.

	INV	NOGDPG	RES	ICT	CORR	TOPEN
INV	1					
NOGDP	0.3687	1				
	0.000					
RES	−0.1903	0.0308	1			
	0.0197	0.063				
ICT	0.55	0.1183	0.3751	1		
	0.041	0.0821	0.089			
CORR	−0.4404	−0.2354	−0.183	0.4516	1	
	0.05	0.045	0.071	0.125		
TOPEN	0.369	0.1775	−0.1767	0.2262	0.056	1
	0.00	0.000	0.124	0.000	0.312	

Source: Authors' estimation. *p*-values are within parentheses.

After estimating correlation among variables, the selected variables are tested to examine cross-sectional dependence and explore stationarity. The CD and corresponding unit root test results, as shown in Table 3, reveal that the selected variables are cross-sectionally dependent. This implies that individual-specific cross-sectional characteristics can influence the behavior of a sampled variable. The estimated result of the panel unit root test in the second panel of Table 3 revealed that some variables are stationary at level, while others become stationary at first difference. For instance, non-oil GDPG, natural resource rent, and ICT are stationary at the level with an order of integration $I(0)$. In contrast, domestic investment, corruption, and trade openness become stationary at only the first difference, indicating the integration order of $I(1)$.

Table 3. Cross-sectional dependence panel unit root test.

Cross-Sectional Dependency			Unit Root Test	
Variables	**CD Test**	**Correlation**	**CIPS *I*(0)**	**CIPS *I*(1)**
INV	7.42 ***	0.204	−1.867	−4.205 ***
NOGDPG	11.75 ***	0.323	−3.267 ***	−5.256 ***
RES	24.29 ***	0.668	−2.326 **	−3.511 ***
ICT	11.21 ***	0.309	−2.976 ***	−4.922 ***
CORR	4.82 ***	0.133	−1.401	−3.782 ***
TOPEN	5.32 ***	−0.146	1.941	−4.410 ***

Source: Author's estimation. Note that *** $p < 0.01$, ** $p < 0.05$, Notes: Under the null hypothesis of cross-section independence, CD ~ N(0, 1).

After establishing the cross-sectional dependence along with an order of integration, the next stage is to explore the slope heterogeneities of selected variables. Thus, the slope homogeneity test recommended by [57] is used, as reported in Table 4. The findings of the slope homogeneity test reveal that slope coefficients are heterogenous.

Table 4. Result of slope heterogeneity test.

	Test Statistics	Probability
Delta	−2.315	0.010
Delta adjusted	−4.102	0.000

Source: Authors' estimation.

4.2. Analysis of Major Findings

The estimated results of the preliminary analysis are that the relationship between core variables is non-linear and variables in the model are cross-sectionally dependent. The slope of model parameters is heterogeneous, and variables have a mixed order of integration. To address these issues, this study employs two recently advanced panel econometrics. First, the CS-ARDL model can provide short-run and long-run estimates by addressing potential cross-sectional dependence and slope heterogeneities. The estimated results are reported in Table 5. Second, the panel quantile regression (QR) methods can address potential endogeneity, cross-sectional dependency, and asymmetric nature of the relationship. Table 6 reports the result of QR regression, while Figure 4 shows corresponding quantile plots.

Table 5. Estimated result of CS-ARDL model. Dependent variable: ΔINV_{it}.

	Model 1 (CD in SR)	Model 2 (CD in LR)	Model 3 (CD in SR & LR)
Long run			
NOGDPG	1.745 *	1.194 ***	1.122 ***
	(1.85)	(8.48)	(27.07)
RES	−1.337 ***	−0.712 ***	−0.791 ***
	(3.03)	(−9.91)	(−5.54)
ICT	1.059 *	0.215 ***	0.338 ***
	(1.79)	(4.47)	(3.25)
CORR	−1.582 *	−1.190	−3.296 **
	(−1.86)	(−0.71)	(−2.30)
TOPEN	1.382	3.961	2.215
	(1.46) *	(7.71)	(7.48)
Short run			
ΔNOGDPG	0.146	2.57 ***	2.242 **
	(1.18)	(2.80)	(2.45)
ΔRES	−0.434	−0.516 ***	−0.536 ***
	−1.21	(−4.88)	(−4.44)
ΔICT	0.790	0.605	0.655
	(0.99)	(1.08)	(1.07)
ΔCORR	2.843	−13.070	3.227
	(0.65)	(−0.38)	(1.52)
ΔTOPEN	1.685	1.609 ***	1.916
	(1.48)	(2.82)	(0.07)
Error correction	−0.033 *	−0.274 ***	−0.285 **
	(−1.74)	(−3.37)	(−2.47)
constant	−6.172	2.894 **	1.468 **
	(−0.74)	(2.05)	(3.13)

Source: Author's calculation. Note that *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table 6. Result of Quantile Regression estimates. Dependent variable: INV_{it}.

	Quantile 20	Quantile 40	Quantile 60	Quantile 80
NOGDPG	0.231 *	0.281 ***	0.352 ***	0.407 ***
	(1.73)	(5.68)	(3.32)	(2.80)
RES	−0.3.5 ***	−0.62 ***	−0.443 ***	−0.506 ***
	(−3.66)	(−5.65)	(−6.60)	(5.58)
ICT	0.591	0.185 *	0.364 *	0.506 **
	(1.09)	(1.69)	(1.76)	(2.22)
CORR	−1.729	−2.958 *	−1.424 *	−2.57 *
	(−0.66)	(−1.79)	(−1.71)	(−1.81)
TOPEN	2.185 ***	3.753 ***	3.919 ***	4.624 ***
	(3.36)	(4.98)	(5.51)	(4.46)

Source: Author's calculation. Note that z score values are presented inside () and *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

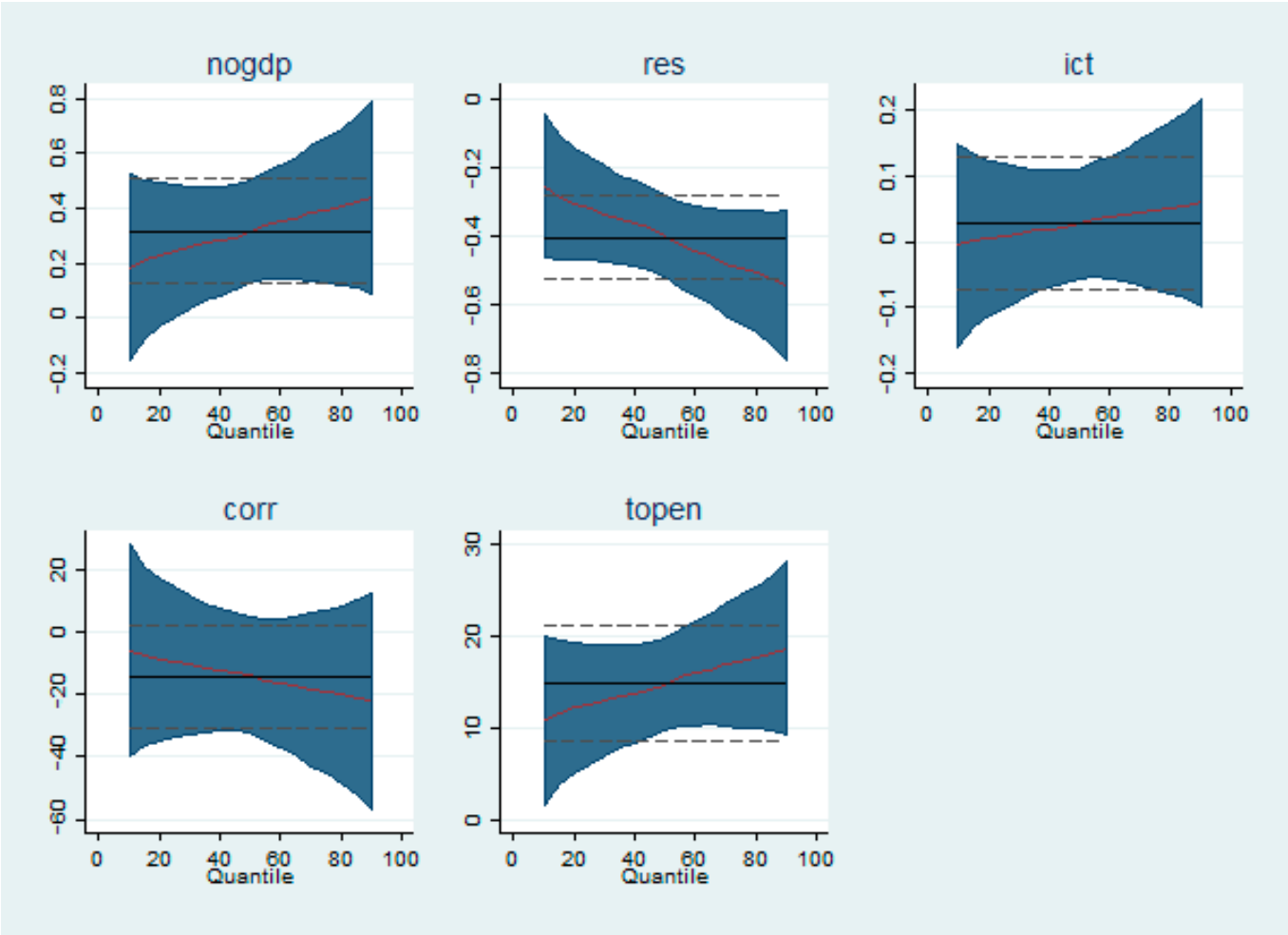

Figure 4. Quantile plots of the model. Source: Authors' estimation.

The CS-ARDL model provides short-run and long-run estimates and dynamic adjustment of short-term disturbances by addressing cross-sectional dependencies and slope heterogeneities. The estimated results of CS-ARDL, reported in Table 5, reveal that an increase of non-oil GDP growth has a significant positive impact on domestic investment in both the short run and long run. The findings, thus, validated hypothesis H1 and the

accelerator theory of investment in sampled countries in both the short and long run, which implies that an increase of non-oil production growth can considerably enhance domestic investment in the sampled countries. Moreover, the findings of methods of movements in quantile regression reveal a significant positive impact of NOGDP on domestic investment in all quantiles. Furthermore, quantile plots in Figure 4 also validate our proposition. The findings, thus, validated robust positive and validated the accelerator theory of investment. This positive impact is consistent with the findings of [28]. The major problem with the domestic product of selected resource-dependent countries is their reliance only on the natural resources sector. Therefore, an increase of production activities in the non-resource sector provides a good opportunity for the domestic investment and capital formation required to achieve sustainable development aspirations by reducing dependence on natural resources.

The CS-ARDL estimates of natural resources reveal a significant negative impact in the short and long run. The long-run coeffect reveals that an increase of natural resource rent by 1% of GDP deteriorates domestic capital formation by more than 0.70% in the long run. Similarly, it deteriorates more than 0.50 percent of domestic investment in the short run. Similarly, the quantile regression result in Table 6 reveals a significant negative impact on selected quantiles. Furthermore, the quantile plot also shows a significant negative association. The estimated results, thus, show the robust negative impact of natural resource rent on domestic investment activities in sampled resource-dependent countries and validate the prevalence of the resource curse. The findings validate that hypothesis H2 is consistent with the studies that reported a negative impact of resources on economic growth. This implies that the major problem with sampled countries is sluggish or deterioration in domestic investment activities. Their resource wealth is deteriorating their domestic investment activities instead of increasing them, which is a grave concern. These resource-rich countries are striving for economic diversification, which is impossible without adopting policies that can encourage domestic investment. The major reason for this resource curse is reliance on imports for inputs used in the resources sector and the processing of outputs abroad [11]. Therefore, these countries should reduce these barriers.

The advent of information and communication technology (ICT) has revolutionized the scope and nature of business by providing user-friendly e-commerce opportunities. The estimated result of ICT shows a significant positive effect on the domestic investment of sampled countries. The quantile plot reveals this positive impact from quantile 40 onward. It implies that increased ICT usage can provide opportunities for the domestic investor to enhance investment in user-friendly e-commerce opportunities, reduce barriers, and enhance market size. The significant positive impact of ICT validated testable hypothesis H3 is consistent with the findings of [20–22].

The long-run estimates of political corruption significantly distort domestic investment activities in the long run, whereas no significant effect is observed in the short run. The long-run estimates are consistent with hypothesis H4. The quantile regression analysis revealed a significant negative impact of the political corruption index on domestic investment at higher quantiles, i.e., quantile > 20. The quantile plots also validated this robust negative association between political corruption and domestic investment in sampled countries. These findings, thus, validated the 'sand the wheel' proposition concerning corruption. Moreover, Refs. [51,52] concluded that high corruption in oil-rich countries is responsible for inefficient utilization of resource rent to develop other industries or economies. Therefore, sustainable economic growth aspirations cannot be achieved by controlling the high corruption of the political elite and institutions.

Trade openness can enhance domestic production and investment activities through technology spillovers, as well as provide greater investment incentives to the exporting industries or sectors. However, this positive effect on investment can be offset if excess imports discourage domestic production [29,52,61]. The estimated results of the CS-ARDL model reveal a significant positive effect of trade openness on domestic investment in sampled resource-rich countries in both the short and long run. The findings, thus, validated testable hypothesis H5. Similarly, the MM-QR results validated the positive impact in

all quantiles at a 1 percent significance level. Moreover, the quantile plots also reveal a significant positive association. This implies that trade openness is creating new investment opportunities for the sampled countries.

5. Conclusions

Resource-dependent Middle Eastern and Central Asian countries face veracious resource curse phenomena and are still heavily dependent on depleting natural resources. These economies strive for ways to diversify their economy through the development of other manufacturing and services industries. The traditional and new growth theories and short-term business cycle theories stress domestic private investment for sustainable economic prosperity. Furthermore, the recent innovations in information and communication technology (ICT) transformed societal behavior and created new business opportunities. Previous studies had overlooked the impact of natural resources and ICT on domestic investment.

This study's primary research questions are to verify the accelerator principle, investigate the crowding-out and crowding-in effects of natural resources, and investigate the impact of ICT, corruption, and globalization on domestic investment in the selected economies. Therefore, this study modeled the impact on natural resources and ICT domestic investment in a sample of 12 highly resource-dependent countries in the Middle East and Central Asia from 2000 to 2019 by augmenting the accelerator theory of investment.

The model parameters are estimated using the recently advanced cross-sectional dependent auto-regressive distributed lag (CS-ARDL) model and panel quantile regression. The estimated results validate the accelerator theory of investment in the short and long run, as non-oil GDP growth can considerably enhance domestic investment activities, while natural resource dependence considerably deteriorates domestic capital formation in the long run. The estimated result of ICT reveals that it positively influences domestic investment in the long run by creating new opportunities through user-friendly and lower-cost e-commerce. Furthermore, the major problem with resource-abundant countries is the prevalence of high political corruption, which is a major constraint on domestic investment. In contrast, the openness of the domestic market can significantly create new investment opportunities through knowledge spillover, and provide higher incentives to exporting industries.

Our findings do have significant practical implications for policymakers. The present study finds significant relation of non-oil GDP growth and ICT with domestic investment, which will support governments and decision-makers, particularly in the adoption of the efficient mechanism in economic expansion modelling. For the purpose of enhancing the efficiency of domestic investment, we advocate that these countries focus special attention on promoting and broadening access to ICT services. They should invest more in ICT services.

The small sample size constrains the scope of this study; therefore, future research can expand our findings by comparative analysis of resource-abundant and resource-dependent samples of countries, since these resource-dependent countries strive for economic diversification. Therefore, future research can also analyze the competitive strength of industries that provide inputs to the resources sector and the industries involved in processing raw materials. Furthermore, the scope of this study can be expanded by augmenting the model with the inclusion of other potential economic and policy variables.

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