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Does oil corrupt? Evidence from a multivariate VAR in Iran

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Does oil corrupt? Evidence from a multivariate VAR in Iran

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Abstract

We examine the response of the news-based Corruption Reflection Index (CRI) to positive shocks in oil revenues in Iran. Using annual data from 1962 to 2019, we employ the Vector Autoregressive (VAR) model and analyze impulse response functions. Our findings reveal a positive and significant response of corruption to oil shocks. The key channels through which this relationship operates include inflation, military spending, and the degradation of democratic institutions. Moreover, we provide a case study of clientelism in public investment projects in Iran from 2002 to 2012 and their impact on the public budget.

Keywords: Corruption; Oil rents, Resource curse; Conflict; Iran; VAR model

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1. Introduction

We aim to examine the response of a newly developed corruption reflection index, based on news coverage in Iran (Farzanegan and Zamani 2022), to positive shocks in oil rents. Additionally, we seek to explore the mechanisms through which oil rent shocks influence corruption in Iranian society. Understanding the nexus between corruption and oil rents will provide insights into the resource curse phenomenon in Iran, thereby shedding light on potential policies to mitigate its impact.¹

Oil rents have been a crucial source of foreign exchange revenues in Iran since 1960. According to OPEC (2023) data, the share of oil exports in Iran's total export revenues was approximately 92% before the Islamic revolution (1960-1978). Although this ratio declined after the revolution, it remains high, averaging around 71% from 1979 to 2021.

Corruption has emerged as a growing institutional challenge in Iran. The estimated control of corruption score for Iran, which reflects perceptions of both petty and grand corruption, has been consistently negative since 1996 (the earliest available data from the World Bank 2023). In recent years, corruption levels have increased. This leads us to the frequently asked question: What is the contribution of oil rents to corruption in Iran? Surprisingly, a long-term analysis examining the dynamic relationship between oil rents and corruption in a resource-rich country like Iran is missing. Given the significant role of high levels of corruption coupled with a young demographic structure as a driver of political instability (Farzanegan and Witthuhn 2017), the urgency to investigate this relationship becomes more evident.

Generally, scholars argue that in natural resource-poor countries, governments need to tax economic agents and individuals, thereby increasing pressure for accountability and transparency (Ross 2012). This heightened risk of corruption detection arises due to the reliance on taxation and associated accountability. However, in natural resource-rich countries, governments can finance their expenditures through the rents generated from natural resources. This reduces the need for taxation and the urgency to improve formal institutions. Moreover, research has shown that in natural resource-rich countries, individuals tend to exhibit rent-seeking behavior, while governments support their clients through redistributive policies such as public employment, subsidies, and public investment projects (Torvik 2002).

We make several contributions to the literature on the resource curse phenomenon. Firstly, we utilize a comprehensive and long time series dataset of the corruption reflection index spanning from 1963 to 2019. This index is based on the coverage of corruption-related cases in a prominent Iranian newspaper, enabling us to investigate the dynamic relationship with the development of oil rents. Secondly, we address the simultaneous relationship between corruption and oil rents. We acknowledge that higher levels of oil rents can increase the risk of corruption through the weakening of democratic institutions

¹ For a recent survey of resource curse literature see Majumder, Raghavan, and Vespignani (2020).

or the strengthening of autocracy, among other factors. Higher public corruption can incentivize the maximization of resource extraction for personal gain, thus neglecting necessary economic and political reforms and diversification efforts. To analyze this relationship, we employ a vector autoregressive (VAR) model, treating all variables as endogenous. We further employ impulse response functions to simulate the response of corruption to a positive shock in oil rents. Thirdly, we investigate and provide empirical evidence for the various channels through which oil rents may influence corruption. By examining these channels, we aim to gain a better understanding of the mechanisms at play. Finally, we study clientelism in public investment projects in Iran, elucidating its drivers and showcasing how this type of clientelism has contributed to increased costs in public investment projects.

Our results demonstrate a positive and statistically significant response of the corruption reflection index to a positive shock in oil rents, even after controlling for factors such as economic growth rate, inflation rate, military spending, and democracy. Additionally, our findings reveal that several key channels connect oil rents to corruption, including economic growth, inflation, government budget, and political institutions.

The rest of the paper is organized as follows: In the next section, we provide a theoretical background on the resource curse and its connection to corruption, along with a comprehensive literature review. Within this section, we also delve into the case study of Iran, examining and comparing the effects of oil price shocks in the 1970s and 2000s on corruption levels, as well as the economic and political responses of the government to these shocks. Furthermore, we discuss the opportunity cost of white elephant projects in Iran during the 2000s, serving as illustrative examples of clientelism in a resource-rich country. In the third section, we delve into the methodology and data employed in our study. We provide details on the analytical approach utilized to explore the relationship between oil rents and corruption. In the subsequent section, we present and interpret our results, shedding light on the findings obtained from our analysis. Finally, we conclude the paper in the last section, summarizing the main insights derived from our study and discussing their implications for policy and future research.

2. Theoretical literature and background in the case of Iran

2.1. Natural resources and corruption

Initial studies on the resource curse focus on the effects of natural resources on the economic growth rate, showing that resource-rich countries, on average and in the long term, grow slower than resource-poor economies (Sachs and Warner 2001). Since then, a growing number of studies have focused on the transmission channels of the curse, such as the lower importance of education both in quantity and quality (Gylfason 2001 and Farzanegan and Thum 2020), the quality of governance (Bhattacharyya and Hodler 2010; Abman and Longbrake 2023), a higher risk of conflict and violence especially in ethnically and politically fractionalized countries as well as in centralized administrations (Farzanegan, Lessmann, and Markwardt 2018; Fearon 2005; Bjorvatn, Farzanegan, and Schneider 2012; Bjorvatn and

Farzanegan 2015), Dutch disease, unemployment, inflation and distortion of the currency market (van Wijnbergen 1984), and rising inequality (Farzanegan and Krieger 2019).

Our focus in this study is to examine the corruption-oil rents nexus in Iran. There are various theoretical arguments that suggest higher levels of corruption can be expected following an increase in oil rents. We summarize these theoretical arguments and relevant empirical evidence below:

1. *Repression effect*: Scholars argue that in resource-rich countries, governments tend to suppress democracy and transparency. Additionally, due to the revenue generated from natural resources, the government discourages demands for political system reforms (Ross 2001). Increased repression and restricted access to information reduce the risk of engaging in corruption. An example of the repression effect can be observed in Iran during the pre-revolutionary period when the Iranian government established a single-party system (known as The Party of Resurrection of the Iranian Nation) and encouraged all citizens to join this political party (Farzanegan 2022). Through this political suppression, the government aimed to suppress democratic demands (Skocpol 1982; Pesaran 1982).

2. *Militarization effect*: During periods of repression, governments often prioritize bolstering military forces to maintain control over the political system. However, militarization tends to increase corruption (Gupta, de Mello, and Sharan 2001; Ali and Solarin 2020), creating barriers to reporting or supervising corrupt activities.

3. *Clientelism effect*: According to Robinson and Verdier (2013), politicians employ redistributive policies to address the political commitment problem and signal to voters that they are acting in their best interests. This form of distributive politics is known as "patronage" or "clientelism," wherein patrons (i.e., politicians) provide support to their clients. Examples of clientelism include the distribution of public jobs or positions. However, patronage policies tend to result in lower efficiency, as politicians distribute rents to secure or prolong their power. In this context, ideology often outweighs economic efficiency and inequality increases the likelihood of clientelism (Robinson and Verdier 2013).

Moreover, scholars argue that the likelihood of clientelism is particularly high in oil-rich countries. Titeca and Edmond (2019) found that oil resources can serve as a significant source of patronage and rent extraction. With rent extraction from oil production and redistributive policies supported by oil revenues, the government can exert control over the process of wealth creation and political influence (Titeca and Edmond 2019). A higher level of clientelism in the public sector increases the probability of the resource curse (Robinson, Torvik, and Verdier 2006) and corruption.

Another example of clientelism is the "white elephant" problem, which refers to public investments that lack social benefits (Robinson and Torvik 2005). The main characteristic of white elephant projects is the ignorance of cost-benefit analysis. Many of these projects commence without proper feasibility studies or transparent tendering processes. Some public investment projects are politically driven and economically detrimental. Additionally, the choice of land and location for public projects often depends

on the influence of politicians. The white elephant problem also exacerbates corruption by promoting the misallocation of public resources.

4. *Research and development (R&D) and diversification effect*: Resource dependence hampers the potential of the industrial sector, leading to a decrease in R&D levels in resource-dependent countries (Wen and Jia 2022). This is because governments can fulfill their technological needs by relying on international companies, using the revenues generated from natural resources. Additionally, governments often focus solely on industries related to natural resources, resulting in limited exports to natural resources and related commodities. As a consequence, there is a low level of diversification in the export of goods and services. Achieving a diversified economy requires companies to operate within a competitive economic structure, which necessitates robust regulations and low corruption. Consequently, resource-dependent countries, with their low levels of R&D and diversification, face less pressure to be competitive and transparent. This further emphasizes the barrier to diversification caused by higher oil rents in MENA countries (Matallah 2022).

5. *Rentier effect*: Mahdavy (1970) conducted a study on the patterns and challenges of economic development in Iran as a rentier state. Since then, several scholars have shed light on the rentier effect on economic performance in resource-rich countries. Ross (2001) identifies various channels through which the rentier state negatively impacts the quality of institutions, including corruption. Torvik (2002) argues that natural resources amplify rent-seeking behavior, while Caselli and Cunningham (2009) contend that substantial oil revenues support rent-seeking activities. Furthermore, some researchers have focused on the role of larger oil companies and their involvement in rent-seeking activities (Mahdavy 1970; Amuzegar and Fekrat 1971; Pesaran 1982), which can include corruption (Mauro 1995).

6. *Political instability and conflict effect*: The effect of political instability and conflict is closely tied to the wealth generated by natural resources, such as ore and oil. Studies by Collier and Hoeffler (2004) indicate that the abundance of natural resources can provide financial support to rebel groups, thereby increasing the likelihood of violent conflicts (Collier and Hoeffler 2005; Farzanegan and Zamani 2022). Additionally, Serra (2006) points out that corruption tends to be more prevalent in regions where political instability is a major concern. Moreover, the revenue derived from natural resources has the potential to exacerbate the fragmentation of national interests, leading to internal conflicts and political instability (Shaxson 2007; Bjorvatn and Farzanegan 2015).

7. *Competition effect*: According to Ades and Di Tella (1999), there is a correlation between higher competition and lower levels of corruption. Additionally, they find that political rights, which serve as a proxy for political competition, have a negative impact on corruption. However, their research reveals that countries rich in natural resources hinder both political and economic competition, resulting in higher levels of corruption. To examine competition in economic markets, they use market dominance as a measure and propose the hypothesis that "natural rents, such as those derived from oil, and rents

resulting from the absence of production market competition, contribute to the prevalence of corruption."

2.2. Oil rents and corruption: background from Iran

Figure 1 demonstrates a sharp increase in corruption levels from 1974 to 1977 in Iran. This period coincided with an oil price shock that began in 1973 and continued until 1977, resulting in a significant rise in oil revenue per capita (refer to Figure 2). This positive correlation aligns with the existing literature on natural resources and corruption. A similar pattern occurred in the 2000s, with a sharp increase in oil prices from 2006 to 2010. During this period, both the Corruption Reflection Index (CRI) and oil export income per capita experienced significant growth (Figures 1 and 2).

The second phase of a substantial increase in CRI can be observed during the years 1992-1995, reaching its highest point since 1962. Figure 4 illustrates a significant rise in inflation during this period, soaring from approximately 20 percent in 1992 to about 50 percent in 1995. Notably, the 50 percent inflation rate in 1995 represents the highest level of inflation between 1962 and 2020. This positive correlation between inflation and corruption suggests that inflation serves as one of the channels through which corruption may increase in Iran.

Furthermore, Figure 6 shows a gradual and positive change in the level of the Liberal Democracy Index from 1963 to 1972. However, this positive trend reversed in 1973 and persisted until 1978 due to the oil price shock of the 1970s. Consequently, a negative correlation emerged between the quality of institutions and oil revenue (as well as corruption), which is in line with the theoretical background. In the following sections, we will delve into these issues in detail. For now, we will focus on two specific aspects to shed light on the effect of oil revenues on corruption in Iran.

First, we emphasize the strength of the resource curse drivers of corruption, which can persist even with a change in the political system. To illustrate this point, we compare the economic and political conditions in Iran during the 1970s and the 2000s, two periods marked by significant oil shocks and distinct political systems. Second, we analyze the drivers and costs of white elephant projects in Iran during the 2000s, drawing insights from national budget bills. This analysis aims to demonstrate that the cost of white elephant projects, which is a form of clientelism, is high and leads to the squandering of oil revenues, leading to more corruption.

2.2.1. Oil price shocks in the 1970s and 2000s: similar outcomes in two different political systems

Following the oil price shock in 1973, which resulted in a significant increase in the average annual OPEC crude oil price from \$1.82 per barrel in 1972 to \$2.7 in 1973 and \$11 in 1974, the Iranian government responded by establishing a new political party called the Rastakhiz party. This party was created with the intention of consolidating power and loyalty to the government². Meanwhile, the influx of oil dollars had adverse effects on the crucial institutions necessary for development. The sharp increase in oil revenues led to a surge in the number of public investment projects. However, the

² <https://www.nytimes.com/1975/03/03/archives/shah-decrees-iran-a-oneparty-nation.html>

Organization of Budgeting and Planning, responsible for allocating funds to these projects, became an obstacle for the Shah (the king) to finance them. The organization had implemented criteria, including feasibility studies, to assess the eligibility of public project financing. These conditions slowed the rapid allocation of oil revenues. Consequently, the Shah took measures to limit the power of this organization in the process of financing public investments. This was done to bypass hindrances and expedite the allocation of oil revenues into the projects.

Since its establishment in 1948, the aforementioned organization played a crucial role in enhancing the decision-making process in Iran. It took on the responsibility of medium-term planning, contributing to the improvement of economic policies. Additionally, its collaboration with other newly created organizations, including the central bank established in 1959, further strengthened the level of economic policy-making in the country. These efforts resulted in higher levels of economic growth and lower inflation rates during the 1960s, suggesting that Iran had achieved a stable macroeconomic environment. However, the oil price shock disrupted the progress that was made over the course of two decades. The institutions that had been painstakingly built were dismantled, posing significant challenges to the economic stability and policymaking capabilities of the country.

Within two to three years following the oil shock, inflation levels soared to 12 percent, a significant increase compared to the previous levels of around 5 percent or even lower prior to the oil price shock. This sudden surge in inflation was accompanied by the dismantling of economic institutions, the rise of authoritarianism, and a worsening of civil conflicts within the country.

As opposition to the government grew, certain political groups initiated armed struggles, resulting in a daily increase in the people opposing the government. Political instability was evident even in the tenure of prime ministers. Amir-Abbas Hoveyda, Iran's longest-serving prime minister, held the position from 1965 until 1977. However, subsequent prime ministers had significantly shorter tenures, with the next prime minister serving only one year and 20 days, and each subsequent prime minister lasting approximately two months. The final prime minister before the revolution in 1979 held the position for a mere month. This rapid turnover in prime ministers indicated the anticipation of a complete political regime change, leading governors to exploit public resources for personal gain (Campante, Chor, and Do 2009). Consequently, corruption levels sharply increased, as depicted in Figure 1. Moreover, the heightened level of corruption demonstrated a direct correlation with increased internal conflicts (Farzanegan and Zamani 2022).

Another oil price shock occurred in the 2000s, with the average annual OPEC crude oil price rising from \$28.1 per barrel in 2003 to \$50.59 in 2005 and \$94.1 in 2008. Although it experienced a decline in 2009 to \$60, prices sharply increased again, reaching around \$100 or more from 2011 to 2014. Similar to the oil price shock in the 1970s, this had detrimental effects on the economic and political institutions in Iran, leading to declines in their quality.

Once again, the Organization of Budgeting and Planning was entrusted with the task of financing public investment projects. However, during Ahmadinejad's presidency (2005-2013), his administration was

dissatisfied with the decision-making process of the organization, particularly regarding the assessments of the feasibility studies for these projects. As a result, they restructured the organization, appointing one of Ahmadinejad's deputies to exert complete control and bypass the rules and procedures that were perceived as barriers to the government's allocation of oil rents.

Consequently, there was a significant increase in public investment projects, some of which remain unfinished. One notable example is the *Maskan Mehr* project, initiated during Ahmadinejad's government with the aim of providing housing for various segments of society. However, being a mega project, it was unable to be completed within his tenure. The subsequent president, Rohani, and his team did not prioritize the project for eight years. Only in 2021 did the new government resume funding for the project, which still requires a significant amount of time to reach the operational phase. The *Maskan Mehr* project was launched in major cities across Iran, consuming a significant portion of oil revenues, and serves as a prime example of a white elephant project. It is important to note that projects like *Maskan Mehr* were designed to cater to the government's clients and support their interests. This highlights the clientelistic nature of such initiatives.

Similar to the oil price shock in the 1970s, the level of political stability declined once again. This instability even affected the longevity of ministers. For instance, Ahmadinejad dismissed his foreign affairs minister while the minister was in an official meeting in another country³. He also openly challenged the supreme leader by refusing to accept the individual recommended by the supreme leader to be the minister of intelligence⁴. It is worth noting that previous presidents, such as Khatami and Rafsanjani, did not possess the same capacity to challenge the supreme leader.

From a clientelism perspective, Ahmadinejad implemented a redistributive policy that involved providing monthly financial support to approximately 90% of the Iranian population⁵. This policy continues to this day and proves challenging for subsequent presidents to dismantle. Additionally, he introduced *Saham Edalat* (Justice Shares), which involved distributing shares of state-owned companies to the public. However, due to the lack of transparency in the selection of board members for *Saham Edalat*, those appointed to the boards were often Ahmadinejad's political clients⁶.

As discussed in the previous section, the similarities between the phases of the Dutch disease and the situation in Iran are apparent. Inflation levels increased, political instability heightened, and there was a significant threat to political rights. Additionally, the decline in institutional quality and the erosion of democracy further contributed to the rise in corruption. Figure 1 illustrates that the highest level of corruption in our sample, spanning over half a century, occurred during Ahmadinejad's presidency in 2012.

³ <https://www.nytimes.com/2010/12/14/world/middleeast/14iran.html>

⁴ <https://www.reuters.com/article/us-iran-ahmadinejad-parliament-idUSBRE82D0NK20120314>

⁵ For an analysis of effects of such cash payments on inequality and poverty measures in Iran see Farzanegan and Habibpour (2017)

⁶ For a review of *Saham Edalat* see Farzanegan and Alaedini (2016).

The response of both Ahmadinejad in the post-revolutionary period and the Shah in the pre-revolutionary period is strikingly similar (see Table 1). Both periods in Iran were characterized by the Dutch disease, high inflation, deindustrialization, institutional degradation, dependent capitalism, authoritarianism, nepotism, clientelism, and political instability. These factors collectively contributed to the increase in corruption. Unfortunately, neither the Shah nor Ahmadinejad paid sufficient attention to the long-term consequences of the oil price shocks. Instead, they prioritized short-term gains and attempted to compensate for Iran's historical backward development. However, in their pursuit of immediate benefits, they inadvertently undermined the sound economic institutions that are crucial for sustainable long-term economic development.

The literature review reveals that countries facing the resource curse often exhibit short-term horizons. This characteristic was particularly evident during Ahmadinejad's lengthy presidency. While Khatami implemented measures such as the establishment of a stabilization fund for oil revenue as part of the Fourth Five-Year Development Plan, Ahmadinejad and his administration disregarded these rules following the oil price shock. This highlights the challenge of implementing international solutions to address the issues posed by the resource curse in resource-rich countries. Appendix A presents clientelism in public investment projects in Iran.

Table 1. Similar economic and political conditions of Iran in the 1970s and 2000s when it faced oil price shocks

Indicators	Period		Notes
	1970s	2000s	
Oil price shock	✓	✓	<ul style="list-style-type: none"> The average annual OPEC crude oil price increased from \$1.82 per barrel in 1972 to \$2.70 in 1973 and \$11.00 in 1974. The average annual OPEC crude oil price increased from \$28.10 per barrel in 2003 to \$50.59 in 2005 and \$94.10 in 2008.
Suppression of main economic institutions	✓	✓	<ul style="list-style-type: none"> Both the Shah and Ahmadinejad undermined the accumulated experience of governance in major economic institutions, including the Organization of Budgeting and Management and the Central Bank.
Authoritarianism	✓	✓	<ul style="list-style-type: none"> Both the Shah and Ahmadinejad removed independent experts from senior-level management positions. Subsequently, ministers and their top managers endorsed the decisions of political power, despite being aware of their flawed nature.
Clientelism in public sector	✓	✓	<ul style="list-style-type: none"> In both periods, the number of public employees increased.
Clientelism in public investment (white elephant)	✓	✓	<ul style="list-style-type: none"> The cost of white elephant projects in the 2000s amounted to approximately \$60 billion (see next part). The national project of Maskan Mehr started during Ahmadinejad's tenure, but has not been completed. Similarly, in the 1970s, numerous white elephant projects existed as all ministries undertook various public projects that could not be completed due to financing issues and difficulties in importing technology.
Clientelism in import	✓	✓	<ul style="list-style-type: none"> In both periods, the government granted import privileges to individuals who were supporters of the government.
Militarism	✓	✓	<ul style="list-style-type: none"> Due to increasing political instability and a growing number of opponents, both governments relied more heavily on militias. In the 1970s, a senior militia member, General Gholam Reza Azhari, even became the prime minister. During Ahmadinejad's presidency, we observed an increasing influence of the revolutionary guard in political system.
Suppression of opponents	✓	✓	<ul style="list-style-type: none"> In the 1970s, a one-party system was established, and the government gave people two options: either join the party or leave the country. Similarly, in the 2000s, Ahmadinejad referred to opponents during the 2009 presidential election as "dust and trash."
Political instability	✓	✓	<ul style="list-style-type: none"> Political instability in the 1970s eventually culminated in the revolution of 1979. Similarly, in the 2000s, the level of political instability also witnessed an increase.
Inflation	✓	✓	<ul style="list-style-type: none"> Inflation increased in both periods: from 6.4 percent in 1971 to 27.3 percent in 1976, and from 10 percent in 2006 to 25.4 percent in 2008.
Direct distributive policy	✓	✓	<ul style="list-style-type: none"> Ahmadinejad introduced Saham Edalat, which aimed to allocate shares of state-owned enterprises to the public, and this policy continues. In the 1970s, the government also implemented a food subsidy program in schools.
Procyclicality of fiscal policy	✓	✓	<ul style="list-style-type: none"> In both periods (1970s and 2000s), government expenditures increased during economic booms and decreased during stagnation.
Procyclicality of monetary policy	✓	✓	<ul style="list-style-type: none"> In both periods (1970s and 2000s), the money supply increased during economic booms.
Dutch disease	✓	✓	<ul style="list-style-type: none"> In both periods, Iran experienced the Dutch disease and its consequences.
Sharp increase in Corruption	✓	✓	<ul style="list-style-type: none"> The highest levels of corruption in both the pre- and post-revolutionary periods occurred in the 1970s and 2000s.

3. Methodology and Data

3.1. Methodology

To examine how the corruption reflection index responds to a positive shock in oil rents, we employ a vector autoregressive (VAR) model. Sims (1986) explains the advantages of the VAR approach in policymaking when the variables are endogenous.

We utilize the Ordinary Least Squares (OLS) method to estimate the reduced form:

$$Y_t = g_0 + G_1 Y_{t-1} + G_2 Y_{t-2} + \dots + G_p Y_{t-p} + e_1 \quad (1)$$

where Y_t , which is a vector of endogenous variables, depends on its own lags and the lags of other endogenous variables. Given that the variable ordering can impact post-VAR estimations for the impulse response analysis (IRF), we adopt the generalized IRF (GIRF) approach introduced by Pesaran and Shin (1998). This allows us to present generalized IRFs that remain unaffected by the variable ordering within the VAR model.

Below, we explain the endogenous variables included in the VAR estimation. Our primary variables of interest are the corruption reflection index and oil rents. However, we have also accounted for other potential channels through which the impact of an oil rents shock can be transmitted to corruption in Iran.

Our key hypothesis suggests that, *ceteris paribus*, the response of corruption to a positive shock in oil rents per capita is expected to be positive and statistically significant.

3.2. Data

Corruption reflection index (CRI): The CRI is a news-based index developed by Farzanegan and Zamani (2022) to measure the reflection of corruption. It encompasses keywords related to corruption, such as 'bribe,' 'embezzlement,' and 'fraud' in Persian. The index tracks the prevalence of corruption, including its various forms, in *Ettelā'āt*, a prominent newspaper in Iran. *Ettelā'āt* is widely recognized as a moderate source that covers a range of political, social, and economic events in Iran, appealing to a broad readership. Figure 1 shows development of CRI from 1962 to 2019 in Iran. For interpretability, we employ its logarithmic transformation in the analysis.



Figure 1. Corruption Reflection Index in Iran

Oil revenues per capita: This variable represents the value of petroleum exports divided by the total population and is measured in US dollars. The data for this variable is sourced from the Organization of the Petroleum Exporting Countries Annual Statistical Bulletin (OPEC 2023). Figure 2 shows development of this variable in our period of analysis.

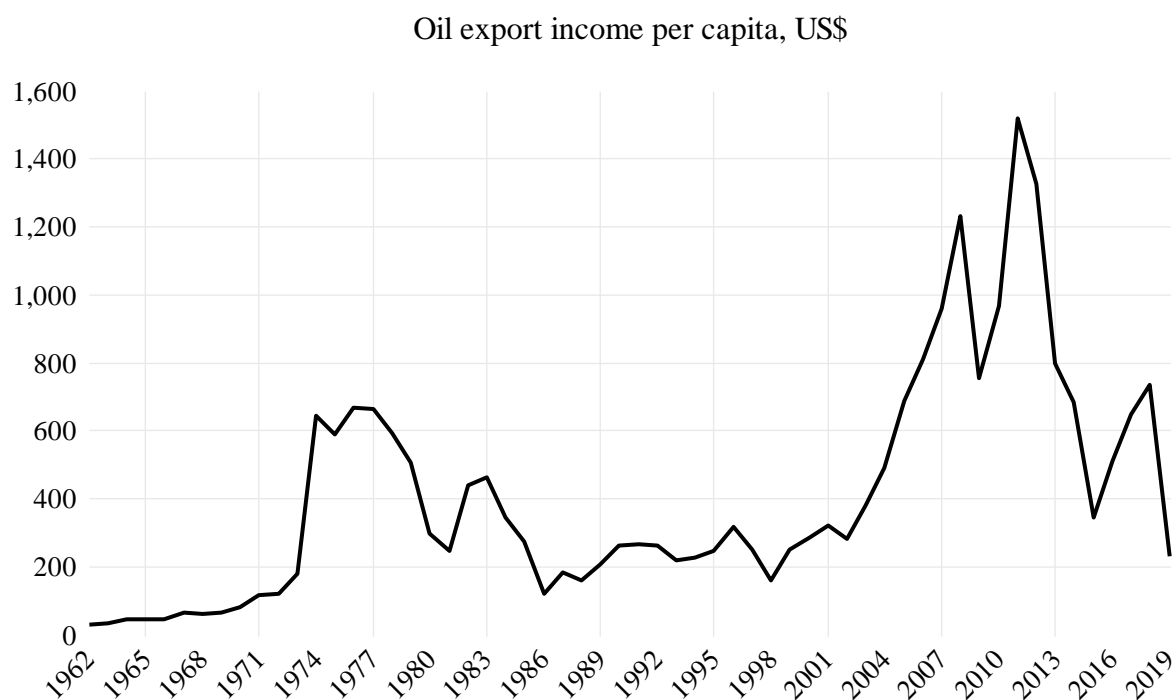


Figure 2. Oil export income per capita in Iran

GDP growth rate: This variable represents the real GDP growth rates based on purchasing power parity (PPP) weights and is expressed as a percentage. The data for this variable is sourced from OPEC (2023). The aggregates are compiled by OPEC using GDP weights from 2017 and purchasing power parities from 2017. Figure 3 depicts the trend of this variable since 1962.

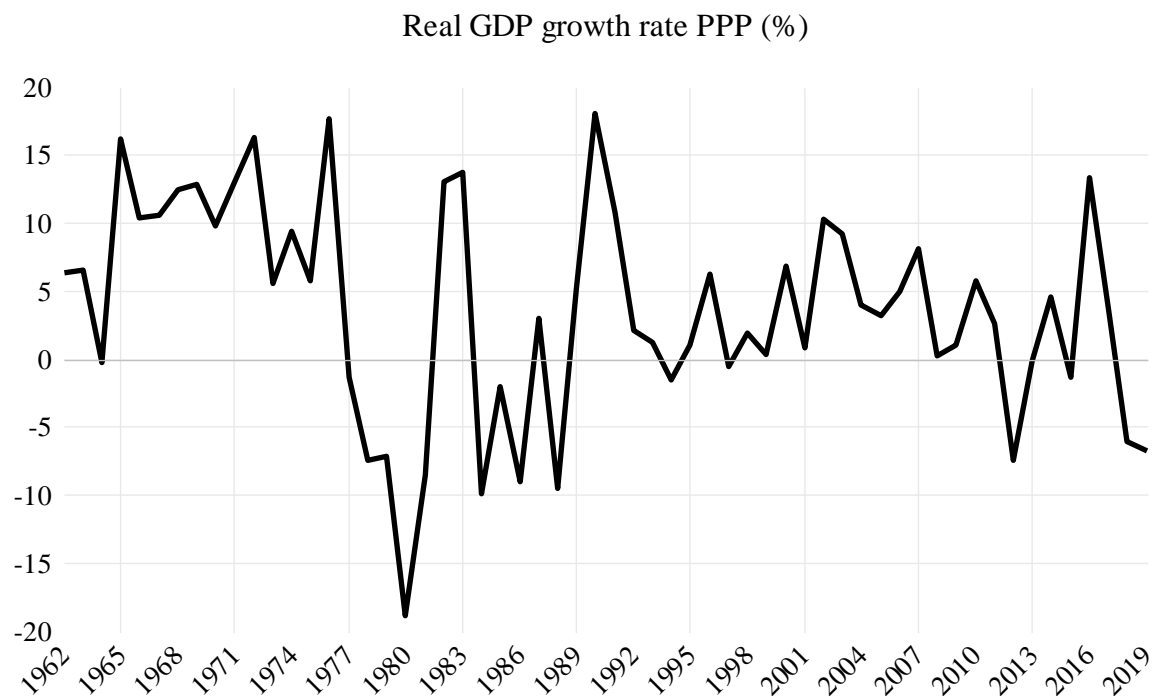


Figure 3. Real GDP growth rate in Iran

Inflation rate (%): Inflation, as measured by the consumer price index (CPI), represents the annual percentage change in the cost of a basket of goods and services typically purchased by the average consumer. This basket may contain both fixed and variable items, with specified intervals for revision, such as on a yearly basis. The data for this variable is sourced from the World Bank (2023). Figure 4 shows its development.

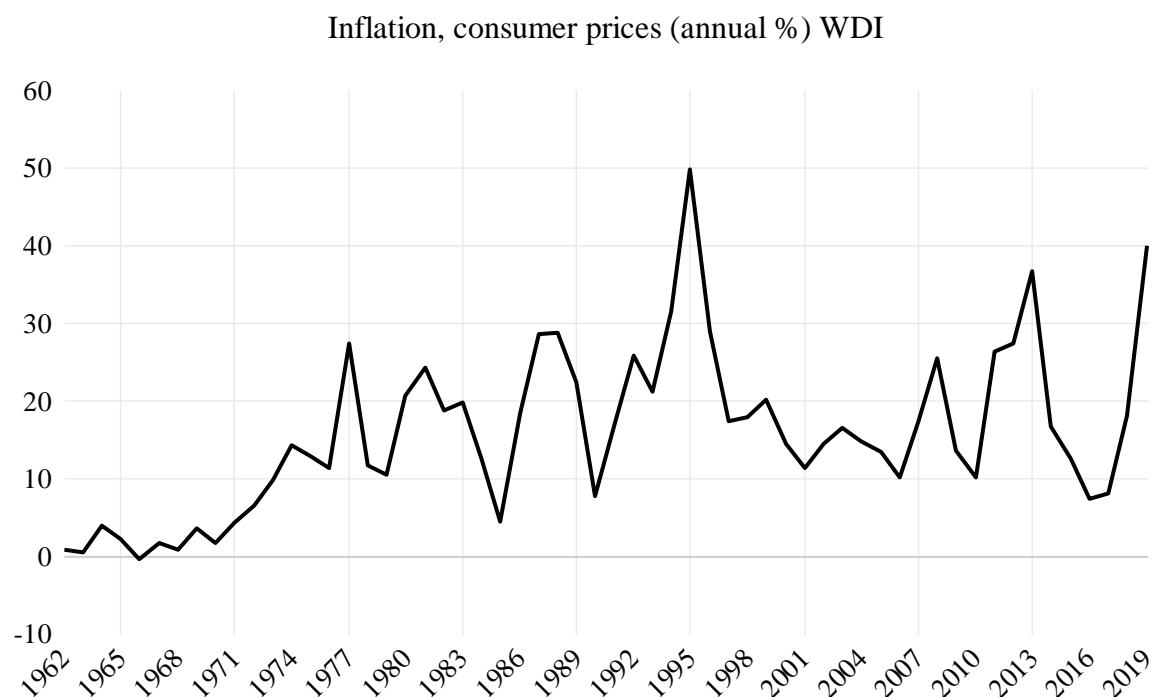


Figure 4. Inflation in Iran

Military spending (as % of GDP): Military expenditure data from the Stockholm International Peace Research Institute (SIPRI) is obtained based on the definition provided by the North Atlantic Treaty Organization (NATO). This definition encompasses current and capital expenditures on armed forces, including peacekeeping forces, defense ministries, government agencies involved in defense projects, paramilitary forces if they are deemed trained and equipped for military operations, and military space activities. The data for this variable is sourced from the World Bank (2023). Figure 5 illustrates its evolution since 1962.



Figure 5. Military expenditure (percent of GDP) in Iran

Political institutions: We utilize a measure of democratic institutions obtained from the V-Dem Dataset, which is published by the V-Dem Institute at the University of Gothenburg. The dataset encompasses various indicators reflecting the quality of democratic institutions. In our main estimation, we focus on the Liberal Democracy Index. According to V-Dem, this index emphasizes the importance of safeguarding individual and minority rights against both state and majority tyranny. The liberal model adopts a "negative" perspective on political power by evaluating the quality of democracy based on the constraints imposed on the government. This is achieved through constitutionally protected civil liberties, a robust rule of law, an independent judiciary, and effective checks and balances that limit executive authority. To capture the measure of liberal democracy, the index also considers the level of electoral democracy. For more detailed information, please refer to (Coppedge et al. 2022). Figure 6 illustrates the development of this index in Iran.

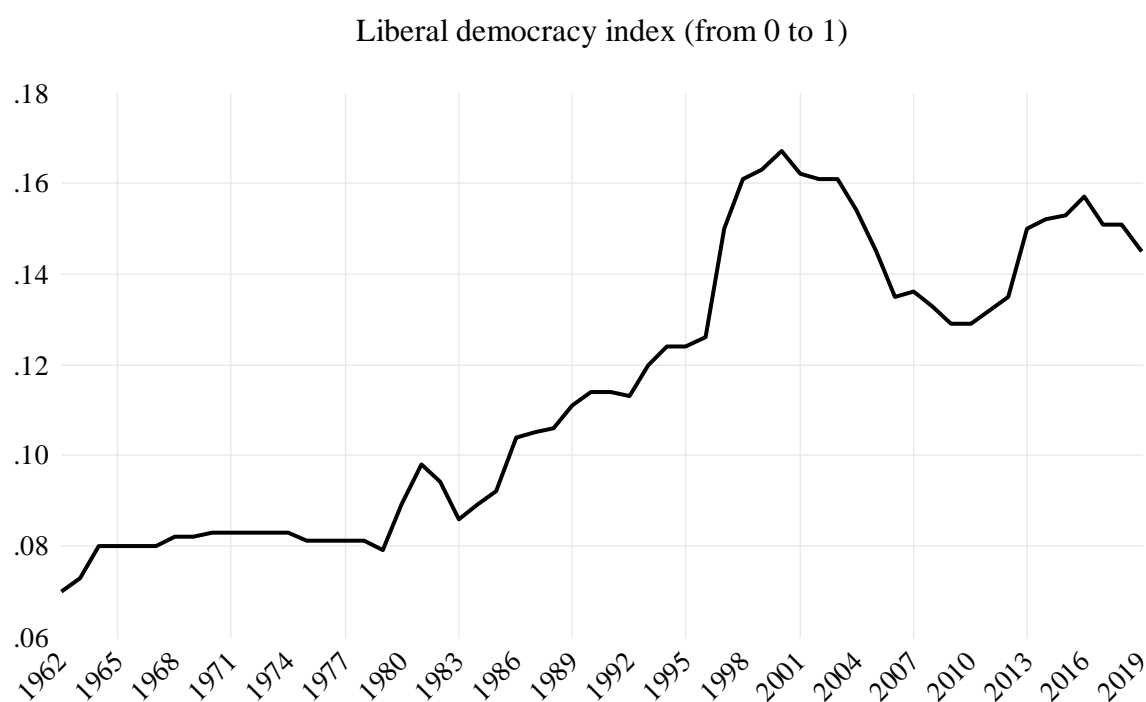


Figure 6. Liberal Democracy Index in Iran and its summary statistics

4. Results

4.1. Response of corruption to oil rents shocks

In order to estimate the VAR model, several steps need to be taken. First, the optimal lag length must be determined. Next, the stationarity of the estimated VAR model needs to be checked and it must be confirmed that the estimated VAR model does not exhibit residual autocorrelation at the chosen lag lengths. The results of the lag length selection are presented in Table 2. Based on different statistical criteria, a lag length of 1 is selected to estimate the VAR model.

Table 2. VAR Lag Order Selection Criteria

Endogenous variables: Log(oil revenues per capita), military spending as % of GDP, GDP per capita growth rate, inflation rate, Log(CRI), Log(liberal democracy)

Exogenous variables: Constant term

Sample: 1962 2019

Included observations: 53

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-581.7367	NA	172.6920	22.17874	22.40180	22.26452
1	-387.0237	337.9925*	0.436758*	16.18957	17.75094*	16.79000*
2	-356.4742	46.11244	0.565099	16.39525	19.29493	17.51033
3	-319.4588	47.49138	0.624766	16.35694	20.59492	17.98666
4	-289.3277	31.83664	1.038515	16.57841	22.15470	18.72278
5	-237.4733	43.04894	0.973012	15.98013*	22.89474	18.63915

* indicates lag order selected by the criterion

LR: sequential modified LR test statistic (each test at 5% level)

FPE: Final prediction error

AIC: Akaike information criterion

SC: Schwarz information criterion

HQ: Hannan-Quinn information criterion

Ensuring the stability (stationarity) of the estimated VAR model is crucial, as it determines the validity of critical results, such as estimated confidence intervals for impulse responses (IHS Markit 2020). According to Lütkepohl (2007), the overall stationarity condition of a VAR model holds greater significance than the stationarity of individual series. Consistent with prior research, we estimate our VAR model using the levels of variables, as the stability condition confirms the stationarity and stability of the entire model (see Figure 7, showing that no roots lie outside of circle). Previous studies have also employed variable levels, particularly when the emphasis is on interpreting impulse responses (Sims, Stock, and Watson 1990; Sims 1992; Farzanegan and Markwardt 2009; Farzanegan and Zamani 2022; Dizaji, Farzanegan, and Naghavi 2016).

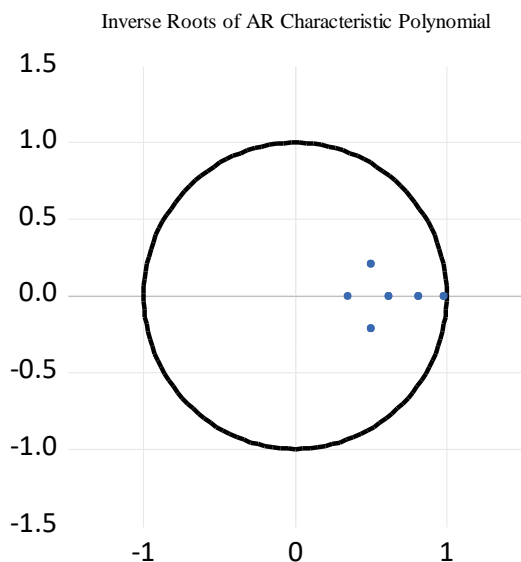


Figure 7. VAR stability condition

Furthermore, the estimated VAR model exhibits no residual correlation at the chosen lag length of one. This is confirmed by the Lagrange Multiplier (LM) test for autocorrelation, as shown in Table 3. The p-value of 0.12 suggests that we cannot reject the null hypothesis of no residual autocorrelation at the lag of one.

Table 3. VAR Residual Serial Correlation LM Tests

Sample: 1962 2019

Included observations: 57

Null hypothesis: No serial correlation at lag h

Lag	LRE* stat	df	Prob.	Rao F-stat	df	Prob.
1	45.97167	36	0.1233	1.315271	(36, 174.0)	0.1264
2	25.95055	36	0.8918	0.703394	(36, 174.0)	0.8936

Null hypothesis: No serial correlation at lags 1 to h

Lag	LRE* stat	df	Prob.	Rao F-stat	df	Prob.
1	45.97167	36	0.1233	1.315271	(36, 174.0)	0.1264
2	88.38343	72	0.0921	1.270353	(72, 185.3)	0.1029

*Edgeworth expansion corrected likelihood ratio statistic.

Since there are no concerns regarding the stability and specification of the estimated VAR model, we proceed to calculate the generalized impulse response functions. The shock variable in our analysis is the logarithm of oil rents per capita, while our primary response variable is the logarithm of the corruption reflection index (while controlling for other relevant variables).

To determine the response standard errors, we employ Killian's unbiased confidence interval method (Killian 1998). This approach effectively addresses the bias and skewness inherent in the impulse response estimator due to limited observations. Following the methodologies outlined by Sims and Zha (1999) and Stock and Watson (2001), we present error bands in the generalized impulse response functions (GIRFs) that correspond to one standard deviation (representing 68% confidence intervals).

Response of Log(CRI) to Log(Oil income per capita) Generalized One S.D. Innovation
68% CI using Kilian's unbiased bootstrap with 999 bootstrap repetitions and fast double bootstrap approx.

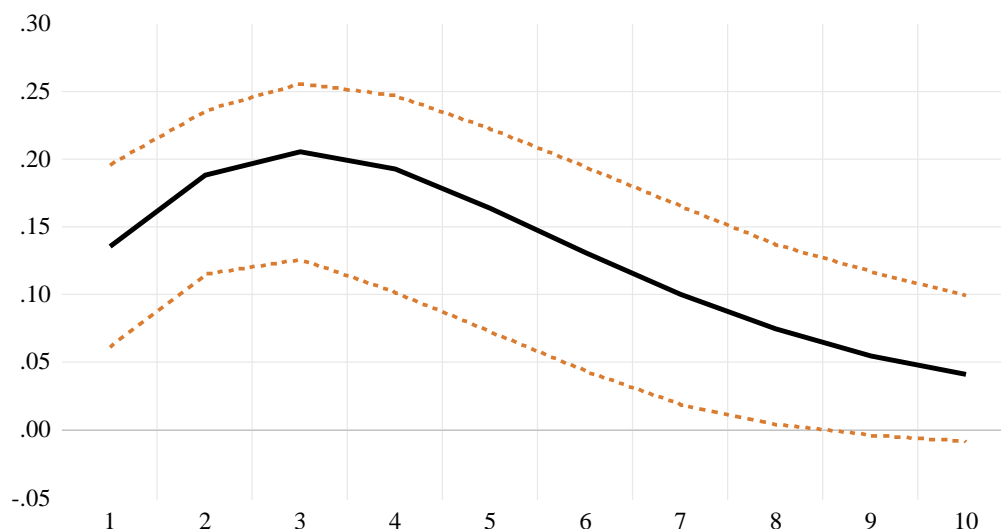


Figure 8. Response of Log (CRI) to Log (oil income per capita) shock

Figure 8 demonstrates that the corruption reflection index displays a positive response to a positive shock in oil rents in Iran. An unexpected increase in oil rents, such as through positive oil price shocks or increased oil production or exports following the lifting of oil sanctions, leads to elevated levels of corruption, as reflected in one of Iran's main media outlets. The peak of corruption responses is observed during the second and third year following the oil shock. The positive and statistically significant impact of oil shocks on corruption persists for up to seven years after the initial shock. Oil booms serve as a conducive environment for corruption to thrive in Iran.

4.2. Potential mechanisms: What are the possible mechanisms for increasing corruption following oil booms?

A) Inflation

One potential mechanism through which positive oil income shocks can contribute to an increase in corruption is through the inflation rate. The concept of the Dutch disease hypothesis helps to elucidate the inflationary environment that arises because of unexpected positive changes in oil rents. As oil rents increase, the government tends to allocate more spending towards both tradable and non-tradable goods. However, due to supply constraints, this leads to higher prices in the non-tradable sector. Do we have

evidence for a positive response of inflation to positive oil shocks in Iran, based on history of data from 1962 to 2019?

Response of Inflation rate (%) to Log(Oil income per capita) Generalized One S.D. Innovation
68% CI using Kilian's unbiased bootstrap with 999 bootstrap repetitions and fast double bootstrap approx.

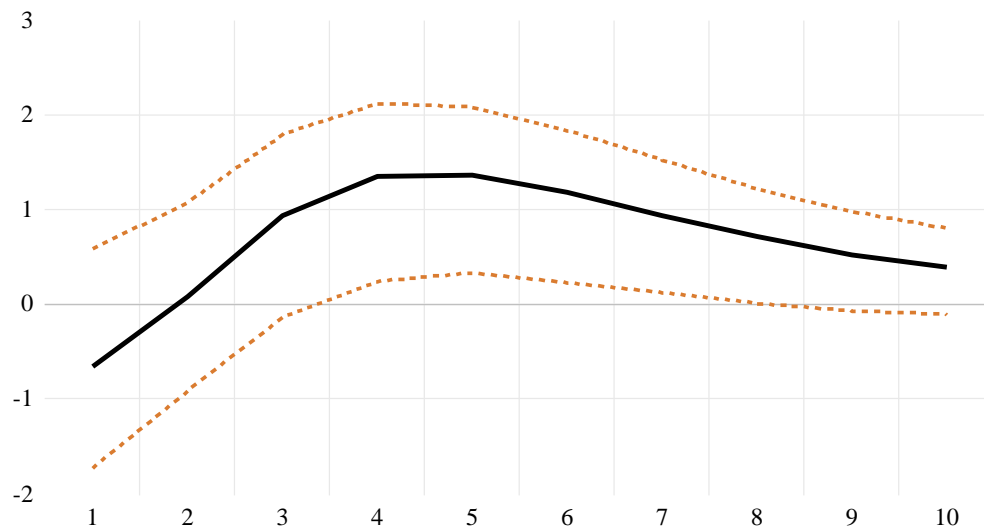


Figure 9. Response of inflation to Log (Oil income per capita)

In Figure 9, we observe a positive response of the inflation rate to a positive shock in oil income per capita. The response reaches its peak approximately by the fourth year after the shock. Additionally, the positive response remains statistically significant between the fourth and seventh year after the shock. How does corruption respond to a positive change in inflation following oil booms?

Response of Log(CRI) to Inflation rate Generalized One S.D. Innovation
68% CI using Kilian's unbiased bootstrap with 999 bootstrap repetitions and fast double bootstrap approx.

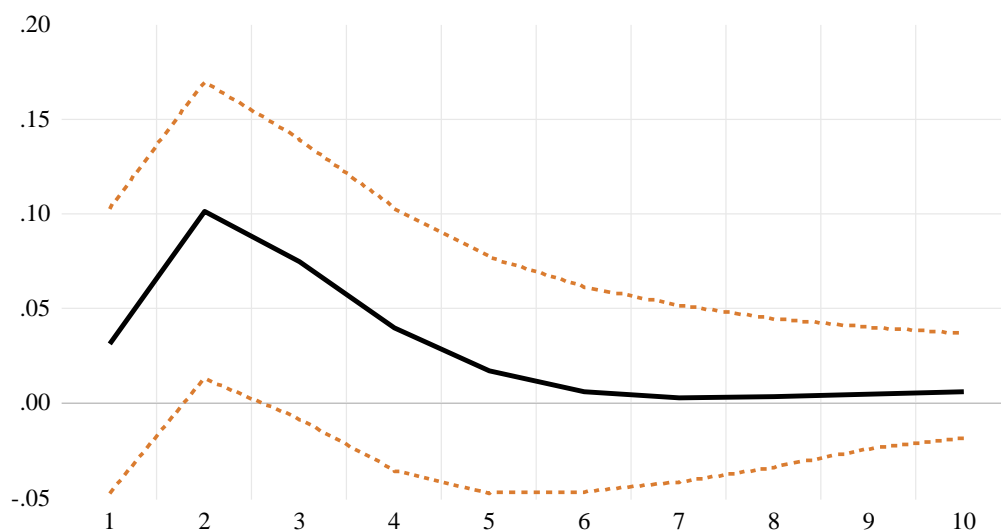


Figure 10. Response of Log (CRI) to inflation rate shock

The response of corruption to a positive shock in the inflation rate, as depicted in Figure 10, is positive and statistically significant in the second year following the shock. This implies that an inflationary environment resulting from a potential oil boom leads to an increase in reported cases of corruption, even when controlling for other variables in the estimation. Inflation can distort transparency in the pricing of goods and services and may incentivize the manipulation of invoices to generate higher profits in trade (Farzanegan 2009). Additionally, higher inflation diminishes individuals' purchasing power, increasing the incentives for engaging in corrupt practices, such as accepting bribes in business interactions. The inflationary environment may also reduce the time horizon of individuals and policymakers, thereby diminishing incentives to consider the long-term detrimental consequences of corruption on development.

B) Military spending

In autocratic countries, government spending tends to prioritize sectors that can protect the ruling establishment during times of crisis. The military sector often benefits from increased oil export revenues, sometimes at the expense of the public education and health sectors, which have a wider impact on the population. However, in autocratic systems where the role of elections is weaker, the interests of the broader population become less significant. Instead, the interests of the military elite may take precedence over those of the rest of society (see Dizaji, Farzanegan, and Naghavi 2016).

How does military spending in Iran respond to a positive shock in oil rents?

Response of Military spending (% GDP) to Log(Oil income per capita) Generalized One S.D. Innovation 68% CI using Kilian's unbiased bootstrap with 999 bootstrap repetitions and fast double bootstrap approx.

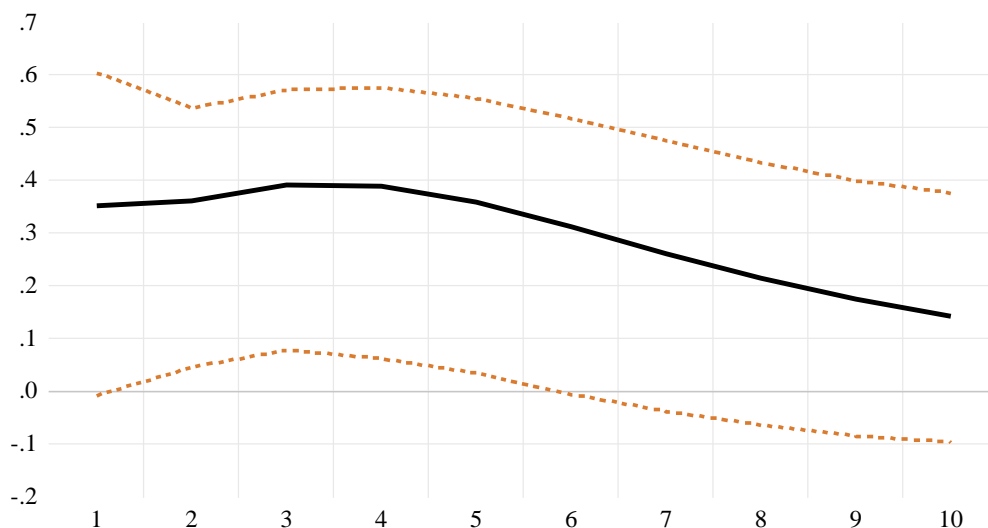


Figure 11. Response of Military spending (% of GDP) to Log (Oil income per capita) shock

Figure 11 illustrates that in response to an oil boom, military spending exhibits a positive and significant trend for the initial five years after the shock. How does corruption respond to a positive shock in military spending?

The military sector and its associated transactions are often characterized by a lack of transparency, creating a setting conducive to corrupt activities. The risk of detection is low and the public has limited access to the contracts and agreements within the military sector. Additionally, the likelihood of misinvoicing trade documents, particularly for technologically advanced and capital-intensive equipment, is high. These factors contribute to an environment where corruption can thrive within the military sector.

Response of Log(CRI) to Military spending (% GDP) Generalized One S.D. Innovation
68% CI using Kilian's unbiased bootstrap with 999 bootstrap repetitions and fast double bootstrap approx.

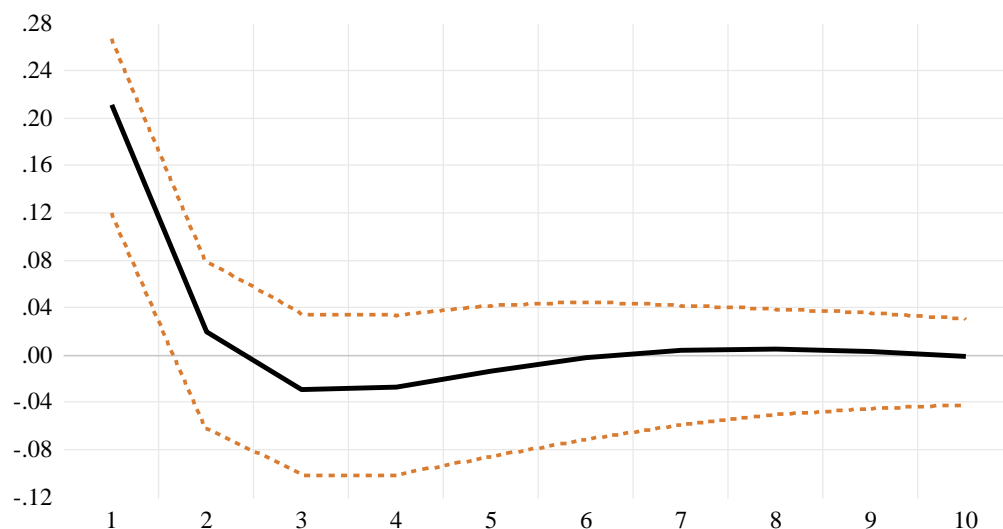


Figure 12. Response of Log(CRI) to military spending (% of GDP) shock

As anticipated, the response of the corruption reflection index to a positive shock in military spending is positive and statistically significant within the first year after the shock (see Figure 12). However, the response tends to approach zero after the second year. It is possible that there are limitations in reporting corruption cases through the public media in Iran following a surge in militarization, which could contribute to the insignificant response of corruption reflection beyond the second year.

C) Economic growth

The resource curse hypothesis pertains to the long-term adverse effects of resource dependency, particularly on point resources like oil, on the economic development of countries. In the short term, an oil boom may lead to increased investment and production. However, the management of oil rent distribution within the government budget, particularly in ethnically fractionalized countries, can exacerbate inequality (Farzanegan and Krieger 2019), amplify corruption and raise the risk of internal and external conflicts (Farzanegan, Lessmann, and Markwardt 2018). In our analysis, we initially explore the response of the real GDP growth rate to a positive shock in oil rents, considering history of data spanning approximately 60 years. By examining the dynamic relationship between our variables, we aim to gain insights into the impact of oil rents on economic growth.

Response of real GDP growth rate (%) to Log(Oil income per capita) Generalized One S.D. Innovation
68% CI using Kilian's unbiased bootstrap with 999 bootstrap repetitions and fast double bootstrap approx.

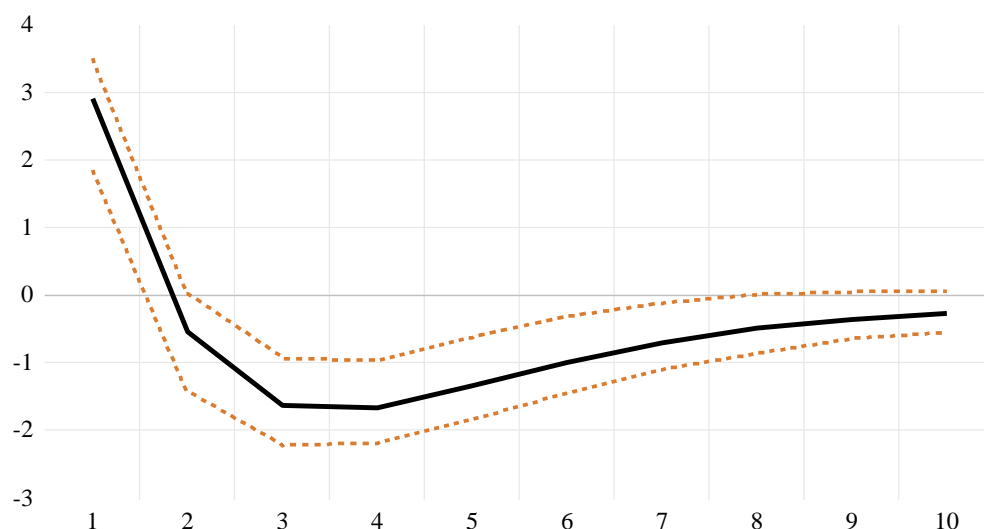


Figure 13, Response of real GDP growth rate (%) to Log (Oil income per capita) shock

According to Figure 13, we can observe an immediate positive response in the real GDP growth rate following a positive shock in oil export revenues in Iran. This initial response is statistically significant. However, the positive response gradually declines and becomes negative and statistically significant between the second and seventh year after the initial shock. This negative development in the real economy following an oil boom can be partly explained by the distortions outlined in the Dutch disease hypothesis. What is the relationship between real economic growth and corruption in Iran? How does corruption respond to a positive shock real economic growth? Do we see an improvement in the control of corruption because of higher state capacity in a growing economy and higher opportunity costs to engage in corruption in a booming economy? Or does a booming economy in an oil-based country open new rent-seeking opportunities and thus amplifies corruption in the presence of weak quality of institutions?

Response of Log(CRI) to real GDP growth rate (%) Generalized One S.D. Innovation
68% CI using Kilian's unbiased bootstrap with 999 bootstrap repetitions and fast double bootstrap approx.

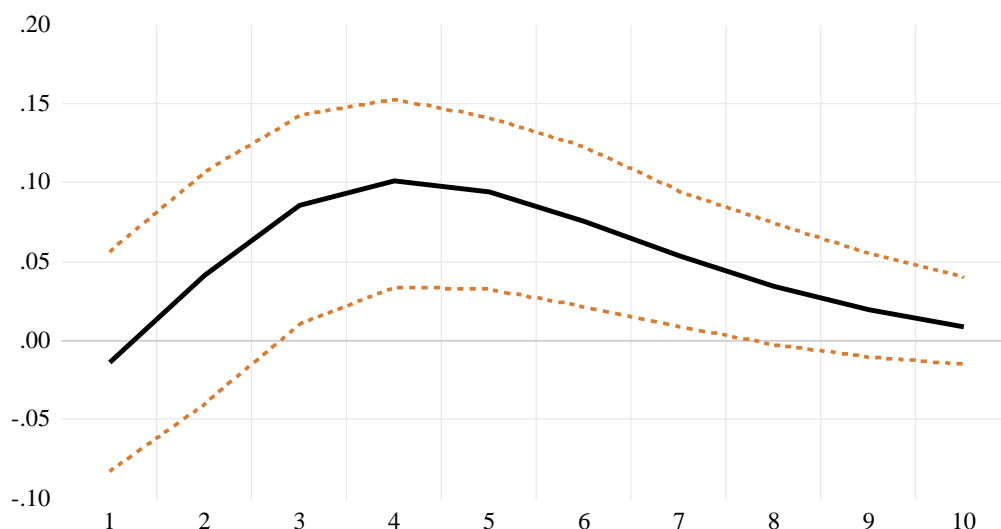


Figure 14. Response of Log (CRI) to real GDP growth rate (%) shock

Based on Figure 14, we can observe that the response of our news-based corruption reflection index to a positive shock in real GDP growth is initially negative, although statistically insignificant. This weak evidence suggests that in an oil-based economy like Iran, a booming economy may lead to lower instances of corruption. This can be attributed to factors such as the higher opportunity cost for economic agents to engage in corruption and an increased state capacity to control corruption.

However, in contrast to the initial negative response, we observe a subsequent positive response in corruption reflection in the media. This positive response becomes statistically significant between the third and seventh year after the positive shock in real GDP growth rate. This finding aligns with arguments that suggest that in countries with low-quality institutions, economic growth may create new opportunities for rent-seekers and consequently lead to an increase in corruption cases.

Part of the overall positive response of corruption to a positive shock in oil rents can be attributed to the short-term booming effect of oil rents on economic growth in Iran, which has been shown to be positively associated with corruption cases. This finding is in line with the research conducted by Farzanegan and Krieger (2019), who also demonstrate that oil booms, along with short-term economic growth, lead to higher income inequality in Iran. Based on their findings, we can argue that the opportunity cost of engaging in corrupt transactions decreases and ethical considerations regarding involvement in fraud, bribery, and embezzlement diminish as the gap between the rich and the poor widens. This can contribute to the observed increase in corruption following an oil boom.

D) Quality of institutions

Increasing oil rents and an economic system's dependence on them can have detrimental effects on the financial independence of the state from the contributions of its citizens, such as taxes. This can potentially weaken democratic institutions. Strong democratic institutions play a crucial role in controlling corruption, as they promote a free media, the active participation of the people in the political

process, and access to information and transparency. In the absence of robust democratic institutions, the risk of detecting corruption is low.

Oil booms may also contribute to the expansion of the middle class, as demonstrated by Farzanegan et al. (2021). The growth of the middle class is often associated with an increased demand for political openness and reforms. However, as argued by Farzanegan et al. (2021), the middle class in Iran is financially dependent on the transfer of oil rents in various forms, such as through subsidies and public employment. Therefore, even with an expanded middle class, the likelihood of significant democratic openness and reforms may be limited. We examine the response of the quality of democratic institutions to a positive shock in oil rents.

Response of Log(liberal democracy index) to Log(Oil income per capita) Generalized One S.D. Innovation 68% CI using Kilian's unbiased bootstrap with 999 bootstrap repetitions and fast double bootstrap approx.

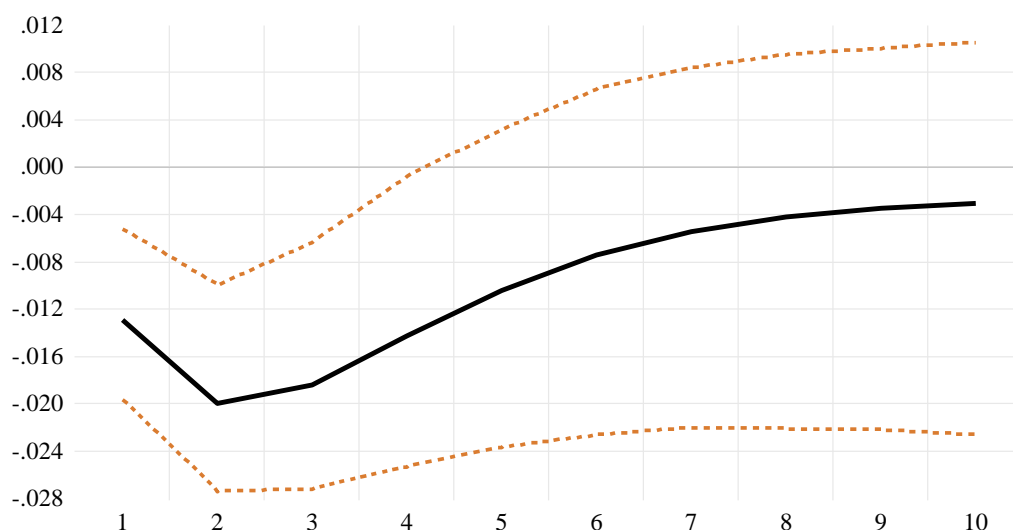


Figure 15. Response of Log (Liberal democracy) to Log (Oil income per capita) shock

As shown in Figure 15, the response of the liberal democracy index to a positive shock in oil rents is negative and statistically significant for the first four years after the shock. This finding aligns with our previous argument regarding the potential negative impact of increasing oil rents on democratic institutions.

How does the corruption reflection index respond to a positive shock in the quality of democratic institutions?

Response of Log(CRI) to Log(liberal democracy index) Generalized One S.D. Innovation
68% CI using Kilian's unbiased bootstrap with 999 bootstrap repetitions and fast double bootstrap approx.

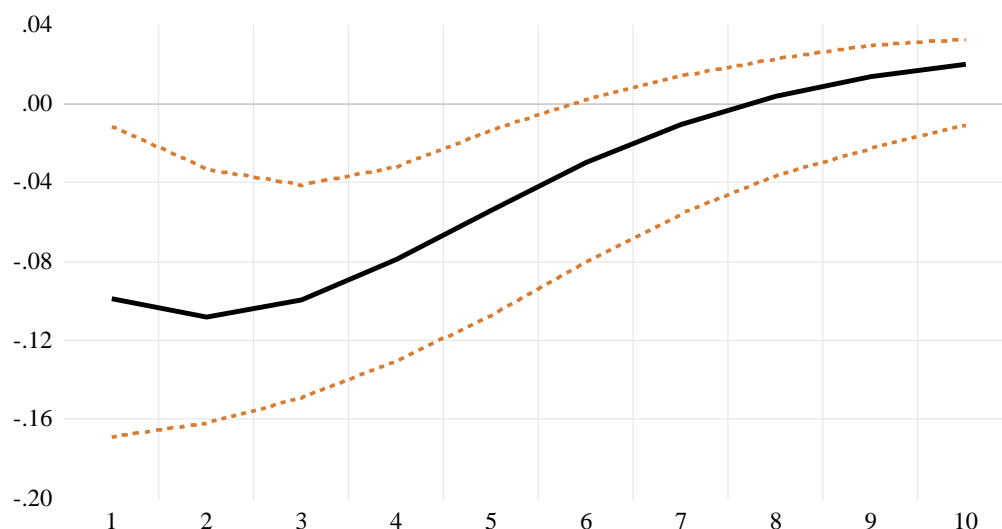


Figure 16. Response of Log (CRI) to Log (liberal democracy) shock

There is clear evidence of a negative response of corruption to a positive shock in the quality of democratic institutions, as shown in Figure 16. This negative response is statistically significant for the first five years after the shock. In particular, the decrease in corruption is most significant in the initial years after democratic openness in Iran.

Based on the results obtained, it can be concluded that oil booms negatively impacts the quality of democratic institutions and we demonstrate that the quality of democratic institutions is an important factor in reducing corruption. Therefore, one important transmission channel for the overall effect of an oil boom on corruption in Iran is through the quality of democratic institutions. Appendix B presents further robustness checks.

5. Conclusion

Our study examines the dynamic interactions between oil rents and corruption in Iran. Through the utilization of data spanning over the past half-century, we explore the co-movement of these two variables and examine the channels through which oil rent shocks may influence corruption. To accomplish this, we employ a news-based corruption reflection index introduced by Farzanegan and Zamani (2022) and apply a VAR model that treats all included variables as endogenous. We use a generalized impulse response function that is insensitive to the ordering of variables in the VAR model.

Our key finding reveals a positive and significant response of the corruption reflection index to a positive shock in oil income per capita in the years following the initial shock. This suggests that an oil boom exacerbates corruption in Iran. Furthermore, we explore the mechanisms through which the oil boom may contribute to increased corruption. Our analysis reveals that an oil boom in Iran can potentially lead to increased corruption levels through several channels. These channels include higher military

spending, the degradation of democratic institutions, elevated inflation rates, and a temporary economic boom. In conclusion, our study sheds light on the intricate relationship between oil rents and corruption in Iran. The evidence demonstrates that an oil boom not only fuels corruption but also highlights the various pathways through which this influence is exerted.

Appendix A

A review on clientelism in public investment projects in Iran

Clientelism is defined as “discretionary resource distribution by political actors” (Golden and Nazrullaeva 2023). Clientelism in public investment often results in the neglect of cost-benefit analyses (Robinson and Torvik 2005). This type of clientelism is particularly prevalent in oil-rich countries, as noted by Titeca and Edmond (2019) and Alamdari (2005). In the case of Iran, we examine drivers of clientelism and its associated costs.

According to the literature, political power significantly influences clientelism in public investment. In the context of Iran, both the government and the parliament play a role in this matter through the national budgeting process. Initially, the government prepares the national budget bill and submits it to parliament, usually in January or February of each year, for approval. The Organization of Budgeting and Planning assumes a central role in government budgeting and is responsible for presenting the final draft of the budget bill to parliament.

Parliament scrutinizes the budget through a three-step process. In the first step, members of expert commissions, such as those focused on industry or agriculture, concentrate on issues that are important to them and gather proposals to modify or justify the budget based on these issues. In the second step, each commission appoints representatives to the Budget Consolidation Commission. Within this commission, members reevaluate the proposals from all expert commissions and decide on whether to accept or reject them. The commission's president incorporates the accepted proposals into the budget bill and submits the final version to the speaker of the parliament. During the public sessions of parliament, all proposals from the Budget Consolidation Commission are reexamined, and parliament makes its final decisions. Ultimately, parliament approves the budget act, which becomes effective from April (Khezri, Ghasemi, and Lamei 2004). Parliament has the authority to modify the projected revenues and expenditures. It can also change or justify the names and expenditures of public investment projects. Government experts are required to attend parliament and its commissions to explain the main purposes and strategies outlined in the budget bill to the members of parliament. This process demonstrates that both the government and parliament can influence public investment projects. Members of parliament aim to convey to their constituents that they are advocating for their interests and attempting to secure more funding for their respective regions. Furthermore, ministries that perceive their projected expenditure or investment in the final draft of the budget bill to be relatively small strive to gain the support of parliament to increase their budget allocation.

The budgeting process in Iran highlights the significant influence of both parliament and the government on clientelism, where political lobbying is central to public investment projects. This type of budgeting process is characterized by limited transparency and gives rise to three drivers of clientelism in public investment:

A) Monopolistic power in budget allocation: Public investment projects in the budget are categorized as national, regional, exclusive⁷, or miscellaneous⁸. The Organization of Budgeting and Planning retains control over miscellaneous projects and has discretionary authority in allocating the budget for these projects (Zamani 2017). This discretionary power grants the organization a monopoly in manipulating the distribution of budget allocations among projects. Consequently, different projects receive varying levels of budget allocation, with some projects receiving 100% while others receive as low as 10%. In practice, the budget allocated to miscellaneous projects is substantial, accounting for approximately 40% to 55% of the total public investment budget. For instance, it constituted around 51% in the 2023 budget bill (Jalali and Seddighi 2023). Through this allocation mechanism, the government can exert influence over parliament, particularly among members who do not align with the government's agenda. This mechanism undermines parliamentary oversight, facilitates patronage practices, and ultimately contributes to increased corruption (Zamani 2017).

B) Defining new projects without feasibility studies and proportionate budgets: It is expected that each new public investment project undergoes a feasibility study and is allocated an appropriate budget to ensure its successful completion within a specified timeframe. However, in the case of Iran, both parliament and the government have incentives to introduce new projects without conducting proper feasibility studies. The government understands that if the total budget for public investment projects is excessively high, it may raise suspicions among parliament members regarding the feasibility of implementing the allocated budget. To address this concern, the government intentionally reduces the budgets for certain public projects, even though it knows that they are not realistic. On the other hand, parliament members may propose new projects to be included in the budget and are aware that these projects require additional sources of revenue for financing, which the government may disagree with. Consequently, they suggest new public projects with minimal budgets, recognizing that it is impossible to complete these projects under the proposed budget. However, they anticipate that in subsequent years, they can secure increased funding for these projects. This pattern can be observed in certain budget tables related to public investments where the government lists new projects with minimal budgets. Parliament members often overlook these projects due to their limited budgets, perceiving them as insignificant. However, in later years, the budgets allocated to these projects experience significant surges in the national budget bill. Consequently, the government introduces numerous new projects without conducting proper feasibility studies, resulting in substantial funds being allocated to projects with minimal social benefit. This process contributes to the proliferation of projects established solely

⁷These projects are financed exclusively using the organization's own generated funds.

⁸ It means projects which are not national, regional, or exclusive.

for the distribution of benefits among political clients. In some cases, parliament members actively support this inefficient process by lobbying to include the names of new public projects from their respective regions in the national budget bill, even if these projects lack feasibility studies and sufficient budgets. In their recent report, Jalali and Seddighi (2023) highlighted several concerning practices in the budget bills for public investment projects. In the 2021 budget bill, the parliament increased the budget for 300 public investment projects, introduced 88 new projects without proper feasibility studies, and altered the names of 66 projects without adjusting their budgets. Such questionable practices are not limited to the parliament; they also occur within the government. For instance, the budget bill for 2023 listed nine public investment projects that were not included in the 2022 budget bill and had previously been listed with zero budgets in past years (Jalali and Seddighi 2023).

Moreover, a closer examination of the 2022 budget bill revealed that 72 projects had budgets significantly lower than what they required. Both the government and the parliament were aware that the allocated budgets for these 72 projects were unrealistic, yet they still approved them. The examples cited pertain to the years 2021 and 2022, during which Iran faced economic sanctions and experienced constrained oil revenues. During periods of oil price shocks, like the 2000s, it can be anticipated that both the government and the parliament had even stronger motivations to introduce new projects without conducting feasibility studies, given the availability of more financial resources to expend (Zamani 2017). This practice further contributes to the levels of corruption, as illustrated in Figure 1.

C) Tender problems: Most public investment projects consist of several subprojects and the responsible organizations are required to select contractors for these subprojects through a tender process, as mandated by the "Law of Conducting Tenders."⁹ However, some ministries in Iran violate tender laws to circumvent the standard selection process and award projects to specific groups or individuals without proper merit. An example of this occurred in the 2009 budget bill, where the Ministry of Oil was granted exceptions to bypass tender laws, further contributing to corruption.

Overall, clientelism in public investment projects reduces transparency and increases corruption. Estimating the precise extent of corruption is challenging, but it is possible to assess the general cost of this type of clientelism in Iran using data from national budget bills. For the purposes of this discussion, we will focus on the 2000s, when Iran received significant petrodollars due to oil price shocks.

Under normal circumstances, a public investment project includes a feasibility study, a defined time duration (including start and end dates), and a total budget allocated for each year. These details are presented when the project is initially listed in the budget bill. While adjustments to the budget or project timeline may occur during implementation due to unforeseen issues, these adjustments should typically be less than 10%. For instance, in Norway during the 2000s, the performance budget deviation for public investment projects was approximately 7% (Abouhamzeh and Zamani 2016). However, in Iran during the 2000s, it reached about 132% (Jalali and Panahi 2012). This indicates that if a project was initially listed in the Iranian budget bill with a budget of \$10 million, it was expected to be completed with an

⁹ It has been approved in the parliament in 2004

actual cost of \$27.1 million. This represents the additional cost incurred for each project and can be estimated for all projects during the 2000s.

Using data from the Iranian national budget bill, Jalali & Panahi (2012) found that during the period of 2002-2012, an average of 503.4 public investment projects were expected to be completed each year. However, only 141.5 projects (28% of the total) were finished without any delays, while the remaining 72% experienced significant delays (see Table A1).

Table A1. Number of projects completed compared to forecast in the budget bill (2002-2012)

Issue		Total (2002 to 2012)	Average (each year)
Public projects predicted in budget bills to be finished on time	Number	5537	503.4
	Budget (billion rial)	292509	26591.7
	Budget (billion dollar)	29.2	2.65
Public projects finished on time	Number	1557	141.5
	Budget (billion rial)	44935	4085.0
	Budget (billion dollar)	4.49	0.4
Public projects that did not finish on time and require additional budget to be completed	Number	3980	361.8
	Extra Budget (billion rial)	633702	57609.3
	Budget (billion dollar)	63.37	5.76

Source: Jalali & Panahi (2012) and Abouhamzeh & Zamani (2016). Note: The exchange rate of the Iranian currency (rial) fluctuated from 7,000 to 30,000 per US dollar during the mentioned period (2002-2012). For the purposes of this discussion, we assume an average exchange rate of 10,000 rials per US dollar.

Moreover, as Table A1 indicates, \$29.2 billion in allocations was initially projected to complete 5,537 projects on time. However, in reality, the government allocated \$67.86 billion (= \$4.49 + \$63.37) to complete them. This demonstrates that the cost of clientelism in public investment during that period amounted to \$38.6 billion (= \$67.86 - \$29.2). However, this additional cost was also a result of project delays, rendering their feasibility studies somewhat meaningless as the demand for those projects had diminished (Jalali and Abedi 2020). Furthermore, when certain projects finally reached their final stages after prolonged delays, their feasibility studies became irrelevant (ibid). Additionally, Abouhamzeh & Zamani (2016) highlighted the negative environmental impacts of these projects and how they contribute to tensions between the banking system and contractors, further exacerbating the resource curse and corruption in Iran.

Appendix B

Robustness checks

Using the protests index instead of liberal democracy

We propose replacing the measurement of the quality of democratic institutions with the internal conflict index. Numerous studies have examined the impact of oil rents on internal conflict, particularly in countries characterized by high levels of ethnic fractionalization and institutional deficits, such as Iran (Farzanegan, Lessmann, and Markwardt 2018; Bjorvatn and Farzanegan 2015). Additionally, it is conceivable that an oil boom could enable the government to maintain stability by providing larger subsidies and increasing public employment (Bjorvatn and Farzanegan 2015). Over the long term, it is more likely that oil wealth leads to increased corruption, diminished quality of democratic institutions, and subsequently, heightened conflict and violence. A higher level of conflict and political instability can also reduce the time horizon of politicians in oil-rich economies, potentially intensifying their engagement in corrupt practices and self-enrichment (Campante, Chor, and Do 2009). Furthermore, heightened internal conflict and protests are associated with reduced trust in government and shortened time horizons among individuals. In a country with elevated levels of conflict and repression, corruption and rent-seeking can be perceived as justifiable means of accumulating wealth.

To measure protests, we rely on the Domestic Conflict Event dataset published by the Cross-National Time-Series (CNTS) Data Archive (Banks and Wilson 2021). The theoretical framework for defining conflict indicators within the CNTS dataset is provided by (Rummel 1966). This dataset encompasses various events, including assassinations, general strikes, terrorism/guerrilla warfare, major government crises, purges, riots, revolutions, and anti-government demonstrations. The events recorded in the CNTS dataset are primarily sourced from major international newspapers such as the New York Times. Following the approach outlined in Ishak and Farzanegan (2022) and Farzanegan and Zamani (2022), we use the CNTS news-based protest index spanning the years 1962 to 2019. This index is constructed by aggregating the number of events related to riots, strikes, and anti-government demonstrations. These specific types of events are more likely to occur in response to the (mis)management of oil rent distribution and institutional performance.

Re-estimating our VAR model with a one-year lag of the included variables, consistent with our main specification, we observe the response of the corruption reflection index to a positive shock in oil rents per capita. Similar to our main findings, the response of the corruption reflection index to positive oil rent shocks remains positive and statistically significant over a period of 10 years following the shock. The impact of the oil boom on corruption is particularly pronounced in the short term, reaching its peak within 3 years after the shock (see Figure B1). These results indicate a significant and lasting effect of oil booms on increasing corruption, with a stronger influence observed in the immediate aftermath of the shock.

Response of Log(CRI) to Log(Oil income per capita) Generalized One S.D. Innovation
68% CI using Kilian's unbiased bootstrap with 999 bootstrap repetitions and fast double bootstrap approx.

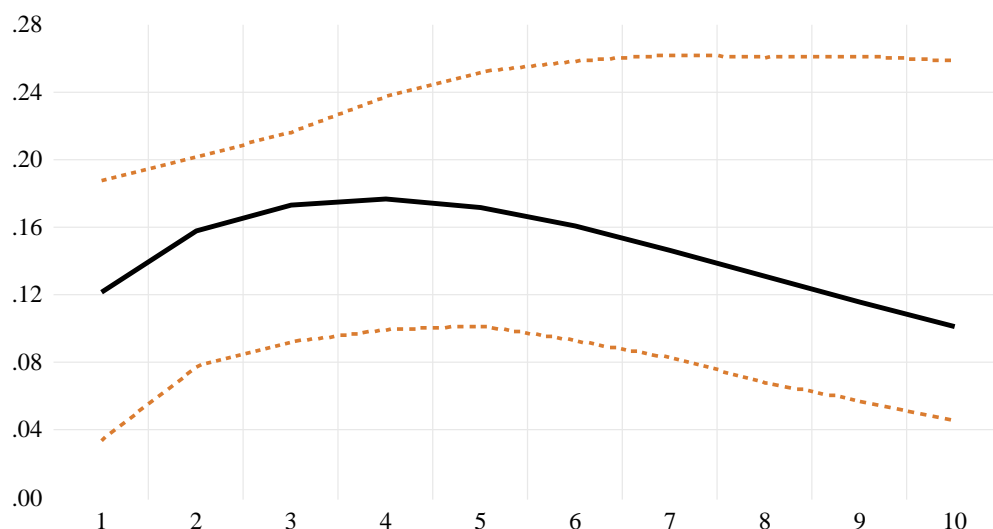


Figure B1. Response of corruption to oil income shocks (using internal conflict instead of democracy index in the model)

Our argument suggests that internal conflict and protests may increase following an oil boom, in part due to higher income inequality (Farzanegan and Krieger 2019). Can we observe such a positive response from internal conflict to a positive oil shock in Iran? Figure B2 demonstrates a positive and statistically significant response of the protest index to a positive oil shock, particularly after the third year following the initial shock. This finding supports the notion that the oil boom has a destructive effect, leading to increased inequality and corruption, which subsequently result in protests with a certain time lag. Consequently, we lack empirical evidence supporting the stabilizing effect of an oil boom in Iran.

Response of Log(protest) to Log(Oil income per capita) Generalized One S.D. Innovation
68% CI using Kilian's unbiased bootstrap with 999 bootstrap repetitions and fast double bootstrap approx.

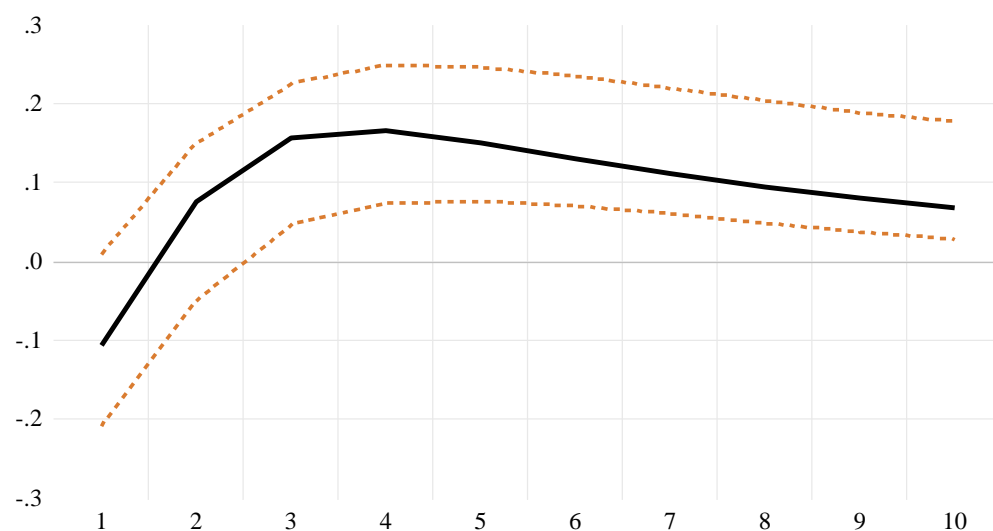


Figure B2. Response of internal conflict to a positive shock in oil income

How does the corruption reflection index respond to a positive shock in protests? Is there evidence indicating that corruption increases following unexpected shocks in internal conflict? Figure B3 reveals that the corruption reflection index exhibits an immediate positive and statistically significant response in the first year following an initial positive shock in protests. However, there is no evidence of a long-term positive response of corruption to a positive shock in protests. The escalation of internal protests is likely to result in increased media control by the Iranian government and higher levels of news censorship, particularly regarding corruption scandals. The coverage of these specific news items can further intensify protests, which is an outcome undesirable for the ruling system.¹⁰

Response of LOG(CRI) to LOG(protest) Generalized One S.D. Innovation
68% CI using Kilian's unbiased bootstrap with 999 bootstrap repetitions and fast double bootstrap approx.

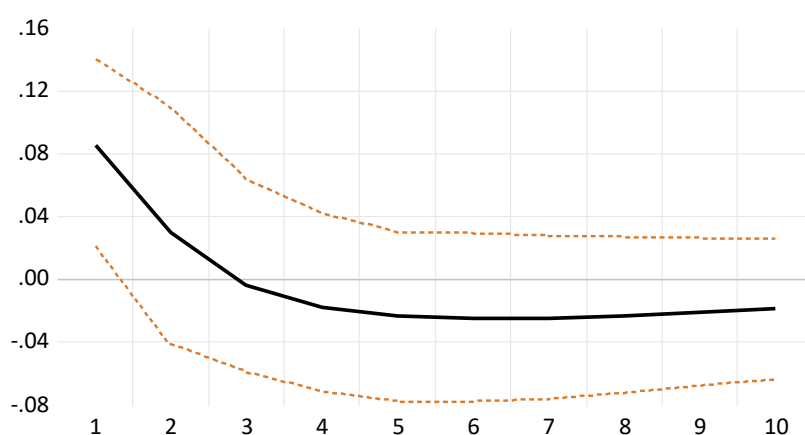


Figure B3. Response of corruption reflection index to a positive shock in protests

¹⁰ In 2011, during a public talk, the Iranian Supreme Leader, Ali Khamenei, referred to one of the largest banking scandals in Iran. He urged politicians and the media to avoid "making a fuss" over the \$2.6 billion banking scam, emphasizing that "Some people are seeking to use this as an excuse to bash the authorities." See <https://www.rferl.org/a/iranian-supreme-leader-calls-for-restraint-over-bank-scam/24347674.html/> (access 13 July 2023). For a brief background on this scandal see Harris (2011).

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