Wilfried-Guth-Stiftungsprofessur für Ordnungs- und Wettbewerbspolitik

Diskussionsbeiträge / Discussion Paper Series

No. 2017-04

The Response of Income Inequality to Positive Oil Rents Shocks in Iran: Implications for the Post-Sanction Period

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August 2017

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The response of income inequality to positive oil rents shocks in Iran: Implications for the post-sanction period

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This version: August 10, 2017

Abstract

We study the short and long run responses of income inequality to the positive oil and gas rents per capita shocks in Iran from 1973 to 2012. Using vector autoregression (VAR)-based impulse response functions, we find a positive and statistically significant response of income inequality to oil rents booms within 4 years after the shock. The Autoregressive-Distributed Lag (ARDL) results show that a 10 percent increase in oil and gas rents per capita leads to 1.1 percent increase in income inequality in the long run. The results are robust after controlling for income-distribution channels in Iran. Our analysis can help policy makers to evaluate and accommodate the possible positive or negative effects of lifting sanctions on inequalities in Iran.

JEL Classification: Q33; Q38; D63
Keywords: oil rents; inequality; VAR; ARDL; sanctions; Iran

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1. Introduction

We study how the income gap between the rich and the poor in Iran is affected by oil and gas rents and how positive changes in the latter will shape the distribution of income in Iran in the future. The research question is motivated by the removal of energy and economic sanctions following the *Iran Nuclear Deal*, leading to higher oil rents in the Iranian economy.[1]

On January 16, 2016, the *International Atomic Energy Agency* (IAEA) confirmed that the *Islamic Republic of Iran* fully met its internationally agreed nuclear commitments. Accordingly, the EU lifted its sanctions on Iran's financial, banking and insurance, oil, gas and petrochemical sectors, on the transport, metals and software sectors, on persons, entities and bodies. The United States also ceased the application of sanctions on the financial and banking**,** insurance, energy and petrochemical sectors as well as shipping, port, metals and automotive sectors in Iran. According to some earlier estimates, the costs to Iran by US sanctions alone amounted to up $2.6 billion per year (Torbat, 2005). Additionally, different versions of the UN Security Council sanctions on Iran terminated, subject to re-imposition if Iran ceased cooperation**.**[2]

Lifting these sanctions allows Iran to re-enter the global economy as a full-fledged member, providing the country with the benefits of international labor division and the access to all relevant markets in the industrialized world. Most importantly, Iranian authorities aim to increase oil production and exports to pre-sanction levels. Iran's Oil Minister, Bijan Zanganeh, announced a plan to reclaim Iran's share of global crude oil and to encourage international oil companies to invest in Iranian oil projects.[3] Re-connection to international banking and access to the worldwide transaction network SWIFT will increase foreign exchange revenues. Already,

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[1] See http://www.bbc.com/news/world-middle-east-33521655

[2] More information at: https://www.lawfareblog.com/comprehensive-timeline-iran-deal.

[3] See http://www.ft.com/cms/s/0/ea34e566-7641-11e5-933d-efcdc3c11c89.html#axzz40w9izt4B. According to the U.S. Energy Information Administration (EIA, 2017), total petroleum and other liquids production in Iran reduced from 4,215,000 barrels per day in 2011 (before oil embargo of 2012) to 3,194,000 barrels per day in 2013. Following lifting of sanctions in Jan 2016, the Iranian oil production has reached its earlier levels of production (4,138,000 barrels per day).

Iran has access to approximately 100 billion euros in assets, previously frozen under the international sanctions.[4] The IMF (2015: 82) adds to this list as a fourth area possibly providing benefits to the country: the sale, supply of parts, and transfer of goods and services to the automotive and air-transportation sectors, and associated foreign investment.

Lifting the sanctions should therefore have three main economic effects (IMF, 2015): first, a positive external demand shock, both for oil and non-oil exports; second, a positive terms-of-trade shock from a dramatic decline in the cost of external trade and financial transactions (mainly through a lowering of the price of imports and an increase in the price of exports); third, a wealth effect through restored access to foreign assets and higher oil exports. Therefore, the IMF (2015: 82) predicts that "these three shocks are likely to create a significant improvement in the outlook for the Iranian economy in the years ahead, outweighing the adverse effects from the sharp decline in global oil prices over the past year."

Despite this promising outlook, one should not underestimate the potential detrimental effects that these shocks could bring about. The positive economic shocks may have political repercussions that could turn out to be highly problematic. In our paper, we will take a closer look at the development of the income gap between the rich and the poor in Iran. Income inequality, especially when it rises (quickly), has been shown to have a destabilizing effect on societies and political regimes. For instance, following Ted Gurr's (1970) seminal book there is a large literature showing that relative deprivation, as one of the most important occurrences of both perceived and actual inequality, may indeed trigger internal conflict.[5] Whether this conflict occurs as a direct or an indirect effect of inequality is open to debate, but in any case, suddenly increasing inequality needs to be accommodated in a society to avoid negative effects.

[4] http://www.euronews.com/2016/02/01/swift-return-to-international-bank-transfers-for-iran-s-banks/.

[5] Relative deprivation theory posits that members of a society evaluate their economic position relative to reference groups (Gurr, 1970; Yitzhaki, 1979). It argues further that members of society develop feelings of discontent and frustration when their economic position compares unfavorably to a reference group (i.e., when they are relatively deprived). Finally, the theory postulates that these feelings matter strongly to the genesis of (political) violence (cf. Krieger and Meierrieks, 2016a).

Why is it important to raise this issue and to investigate whether the – otherwise positive – shock of lifting sanctions of the Iranian economy also raises inequality? It is precisely because of the negative repercussions that might endanger the stability of the country. Not only is Iran an important regional military power, but it is also one of the main players in a highly instable world region with many ongoing conflicts. While Iranian politics can be criticized on various grounds, severe internal conflicts caused by an unequal distribution of newly arising oil rents in Iran will certainly not improve the fragile situation in the region.

In this paper, we investigate the extent to which the positive shock in Iranian oil rents affects the income gap between the rich and the poor. We will ask whether lower income groups experience benefits from increased foreign trade in their daily lives or whether the gap between the rich and the rest of society will widen. We do so by using historical information on past positive oil shocks to simulate the response of income inequality following such shocks. Our exercise will allow us to predict the conflict potential resulting – through direct and indirect channels – from increased inequality in the Iranian society.

Our analysis proceeds as follows. After a thorough review of the related literature and a derivation of our hypotheses in Section 2, we will turn to methodological and data issues in Section 3. Section 4 presents our empirical findings, followed by a discussion of these results and some concluding remarks in Section 5.

2. Review of literature

As our introduction showed, three distinct effects of lifting the sanctions can be expected (IMF, 2015): a positive external demand shock; a positive terms-of-trade shock; and a positive wealth effect. In the following, we will first investigate how these effects may affect income – and, in fact, wealth – inequality, before turning to a brief discussion of the potential effects of rising inequality on the Iranian society.

At first glance, lifting sanctions should not overly affect – perceived or actual (i.e., measured)[6] – income inequality in Iran. If we expect a growth dividend to occur from re-gaining access to the world market and if the domestic macroeconomic policy response is appropriate to achieve national economic policy goals (such as low inflation, steady growth and a competitive exchange rate), we could expect economic benefits across all groups in society, i.e., an *inclusive* growth (IMF, 2015: 83). Even if the oil-producing sector is the forerunner in terms of experiencing additional rents, we would expect either trickle-down effects benefitting the rest of society after a while through, for instance, oil workers' additional demand for commodities from other sectors, or an intersectoral mobility of workers towards the oil industry. The consequent adjustment of the capital-labor ratio in the affected sectors should lead to higher wages also outside the oil sector, thereby adjusting income inequalities.

Economic theory shows, however, that things are typically not as simple as that. As a resource-rich country, Iran is a prime candidate to experience the Dutch disease (Gregory, 1976; Corden and Neary, 1982). The increase in global demand for Iranian oil after lifting sanctions and the likely subsequent rise in oil prices triggers a sharp rise in oil exports, just as hoped for by the Iranian government. This will cause an appreciation in the Iranian real exchange rate which in turn will harm competitiveness of other tradable sectors, like agriculture and

[6] The distinction between perceived and measured inequality has recently attracted some attention in the literature, see, e.g., Gimpelson and Treisman (2015). In our analysis, we will referred to measured or actual inequality as we rely on official statistics rather than on survey data.

manufacturing. As a result, employment in agriculture and manufacturing might decline following the boom in the Iranian oil sector (cf. Bhattacharyya and Williamson, 2015). This development may be so strong that it will increase inequality significantly at least in the short run, the reason being that neither trickle-down effects nor intersectoral labor mobility is sufficiently able to counter the emerging income inequality. Only in the medium or long run, these market processes may restore the previous equilibrium, if at all.

Interestingly, Bhattacharyya and Williamson (2015: 223-4) find that "surprisingly little is known about [resource booms'] distributional impact (…) and the empirical literature on this topic is surprisingly thin". It is indeed surprising that, while the Dutch disease suggests clear employment effects, its distributional effects attract relatively little attention despite their importance in resource-rich countries, of whom many are not known for having particularly sound institutions. Rather, these countries suffer from weak institutions[7] which originate from, e.g., earlier colonization policies following the model of "extractive states"[8] (Acemoglu et al., 2001). Even in countries without a colonial history (such as Iran) we may observe corruption,[9] rent-seeking activities by large companies (such as state oil companies) and political instability as signs of deeply rooted institutional dysfunction and which are at least partly related to resource abundance, as Mehlum et al. (2006) show.[10] Often, weak institutional settings in a country correlate with high levels of inequality (Krieger and Meierrieks, 2016b).

Acemoglu et al. (2005) and Acemoglu and Robinson (2006) provide convincing explanations for this observation. They argue that the arrangement of economic institutions is

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[7] The catch-all-phrase "weak institutions" includes, among others, a high risk of government expropriation as well as a lack of independent judiciary, property rights enforcement, and institutions providing equal access to education and ensuring civil liberties. Together, these characteristics lead to weak incentives for investment and ultimately low economic growth and development (Acemoglu et al., 2001).

[8] The main purpose of an "extractive state" was to transfer as much of the resources of the colony to the colonizer (Acemoglu et al., 2001).

[9] Iran is ranked 131th out of 176 countries on Transparency International's Corruption Perception Index (Transparency International 2017).

[10] Interestingly, Mehlum et al. (2006) differ explicitly from other influential works on the resource curse by Sachs and Warner (1995, 1997, 2001). While Mehlum et al. find the deterioration of institutions an important driver of weak development, Sachs and Warner argue instead that Dutch-disease effects are responsible.

determined by the exercise of political power by different societal groups, where groups with more power are more likely to shape economic institutions in their favor. Acemoglu et al. (2005) differentiate between *de facto* and *de jure* political power. De jure political power stems from the design of a country's political institutions. De facto power refers to political power that individuals exercise thanks to their economic might.[11] It is rooted in a society's distribution of resources. Past resource rents have shaped the initial conditions of a society’s wealth distribution and economic power and influenced in turn the political institutions until today, supporting income and wealth inequality in the long-run future (Acemoglu and Robinson, 2006). In Iran, elites with close ties to the oil sector accumulated economic and political clout in the past and remained in a prominent position until today. Any new and sudden rents following the lifting of sanctions strengthens their position further, as most of these resources will be appropriated by these elites. Inequality is likely to rise further. Unless threatened by the possibility of losing these rents due to a revolution (such as the Iranian revolution of 1979), trickle-down effects to the rest of society will remain negligible.[12]

While the Iranian society might have lived with a certain level of inequality during the times when the sanctions were applied, lifting them changed the situation significantly. Arguing that economic downturn and, possibly, a certain level of inequality were in fact a results of the sanctions seem to have convinced the poorer parts of society, especially when elites claimed that all problems were caused by the country’s foreign enemies. With Iran re-entering the global economy and with newly increasing oil rents, however, this argument is less convincing to the population, and inequality, especially in terms of relative deprivation, is felt more directly.

[11] The economic elite always has the most to offer (the biggest bribes, the largest political contributions etc.) to politicians, bureaucrats and other public officials acting as selfish maximizers of their own (rather than social) utility (Holcombe, 2015; Acemoglu et al., 2005). These circumstances can be described as “political capitalism” (Holcombe, 2015: 41), “captured democracy” (e.g., Acemoglu and Robinson, 2008: 283) or “economic-elite domination” (Gilens and Page, 2014: 566).

[12] Note that there might even be detrimental effect to economic activity when economic elites (“industrial incumbents”) actively oppose more liberal economic policies because such policies would threaten the incumbents’ market position (cf. Rajan and Zingales, 2003; Sokoloff and Engerman, 2000).

Inequality, in turn, has been shown to induce frustration and anger, which provokes an aggressive response to vent one's frustration (e.g., Muller and Weede, 1994). Gurr (1970) calls this relationship the "frustration-aggression mechanism".[13]

As shown by Krieger and Meierrieks (2016a), relative deprivation theory as a specific representation of the inequality problem in a society has been used to explain diverse phenomena of social deviance, protest and political violence such as crime (e.g., Kawachi et al., 1999; Wilkinson and Pickett, 2007), support for revolutions (MacCulloch, 2005), riots (e.g., Chandra and Williams Foster, 2005), terrorism (e.g., Krieger and Meierrieks, 2016a; Piazza, 2006) as well as civil wars and rebellions (e.g., Gurr, 1970; Muller and Weede, 1994).[14]

Whether or not these negative effects on the Iranian society will occur, depends, first of all, on the question whether increasing oil rents after lifting sanctions will indeed lead to higher inequality. As we stated above, according to Bhattacharyya and Williamson (2015) there is little empirical literature on this issue so far, and it is the prime goal of our analysis to provide additional new insights into the distributional effects of a sudden increase oil rents in a specific oil-rich country, namely Iran. Let us summarize the existing empirical findings on the nexus between resource rents and income inequality in the following. Overall, this literature provides mixed results.

Carmignani (2013) uses cross-sectional data from 1970 to 2010 of approximately 84 countries. He finds that resource abundance *increases* the inequality of incomes in a country, while reducing human development at the same time. The latter effect is likely to introduce further inequalities at the socio-economic level, thereby directly feeding back to feelings of being relatively deprived. Similarly, Bhattacharyya and Williamson (2015) show that all top

[13] The direct link between the genesis of organized political violence and the frustration and discontent due to relative deprivation is explicitly stated by Gurr (1970: 12-13): "The primary causal sequence in political violence is first the development of discontent, second the politicization of that discontent, and finally its actualization in violent action against political objects and actors. Discontent arising from the perception of relative deprivation is the basic, instigating condition for participants in collective violence."

[14] A more general discussion of the socio-economic impacts of income inequality can be found in Thorbecke and Charumilind (2002).

income groups in Australia benefit from resource booms in the short and long term. They conclude therefore that resource booms tend to *exacerbate* inequality in Australia.

These results can, however, not be confirmed in other contexts. Davis and Vásquez Cordano (2013) used income growth data by quintile in 57 developed and developing countries. They do not find evidence for either positive or negative effects of extraction-led growth on the poor, i.e., neither do the poor catch up to the rich nor do they fall back further. Inequality remains *unaffected*.

Quite the opposite has been observed in Kazakhstan in a study by Howie and Atakhanova (2014). They examine the effect of resource booms on income inequality in using panel data at regional, urban and rural levels. They find that resource booms had a *decreasing* effect on inequality within the country Kazakhstan and suggested that the results can be linked to a larger non-tradable sector following a resource boom and a higher share of unskilled labor in the sector. Goderis and Malone (2011) examine the relatively unskilled labor-intensive non-traded sector in 90 countries between 1965 and 1999 and find that inequality *falls in the short term* but *eventually increases* over time following oil and mineral booms. Finally, Fum and Hodler (2010) show in a cross-country analysis that resource rents *increase* inequality in countries with high ethnical fractionalization and *reduce* inequality in ethnically homogenous societies.

3. Data and Methodology

3.1 The unrestricted VAR model

We use the *unrestricted VAR model* to estimate the interconnections between our main variables, oil rents and inequality, in order to investigate the effects of oil booms on the income gap between the rich and the poor in Iran as a major oil exporting country. The VAR approach has previously been employed by Farzanegan and Markwardt (2009) and Farzanegan (2011) to examine macroeconomic indicators (industrial production, imports, inflation, the real effective exchange rate, and government spending behavior) in Iran after oil shocks.

Within a multivariate framework, the VAR model relates changes in a particular variable (e.g., income inequality) to changes in its own lags and to changes in (the lags of) other variables (e.g., oil rents):

$$y_t = A_1 y_{t-1} + \cdots + A_p y_{t-p} + B x_t + \varepsilon_t$$

where y_t is a vector of k endogenous variables, x_t is a vector of d exogenous variables, $A_1, \cdots, A_p$ and B are matrices of coefficients, and ε_t is a vector of innovations that may be contemporaneously correlated but are uncorrelated both with their own lagged values and with all of the right-hand side variables. The optimum lag of one year is based on the Schwarz information (SC) and the Hannan-Quinn information (HQ) criterion (see Table A1 in Appendix A). All main variables are endogenous in our VAR framework.

We use the following variables in our VAR system: the logarithm of oil and gas rents per capita, military spending as a percentage of total government spending, education spending as a percentage of total government spending, tax revenues as a percentage of total government revenues, the logarithm of real GDP per capita, the logarithm of the Gini index, and the logarithm of a weighted measure of conflict. We control for Iran's eight years of war with Iraq (1980-1988) and include constant term (exogenous variables).

The ADF test (Dickey and Fuller, 1979) and Phillips-Perron test (Phillips and Perron, 1988) show that all of the endogenous variables (except for the conflict data) are integrated of first order (I(1)). To answer the question whether there is a long-run relationship among I(1) variables, we employ Johansen's (1991, 1995) VAR-based cointegration tests and include the exogenous war dummy variable, while setting the optimum lag length to one. The results (available upon request) show that there is at least one cointegrated relationship among our variables. In this case, differencing will lead to the loss of useful long-run information in our data. Sims (1980) and Sims et al. (1990) have argued against differencing of cointegerated variables—suggesting the use of a VAR model in levels. We follow other related studies such as Farzanegan and Markwardt (2009), Farzanegan (2011), Farzanegan and Raeisian Parvari (2014), and Dizaji et al. (2016) and apply the unrestricted VAR model in the level of variables. After all, we are interested in applying tools such as impulse-response analysis rather than aiming at interpreting each coefficient of the VAR model.

3.2 The ARDL model

In addition to the VAR estimation, we also apply the *Autoregressive Distributed Lag (ARDL) model* (Pesaran and Shin, 1999). An ARDL is a least squares regression including lags of the dependent and explanatory variables. We use the ARLD method to estimate the long term response of income inequality to a positive change in oil rents per capita in Iran, controlling for other drivers of inequality. The ARDL model has certain advantages over other cointegration regression models such as Fully Modified OLS and Dynamic OLS. The latter models require either all variables to be I(1) or prior knowledge and specification of which variables are I(0) and which ones are I(1) (IHS, 2016). ARDL eliminates this problem, as it allows the variables in the cointegrated relationship to be either I(0) or I(1), i.e., there is no need to pre-specify which variables are I(0) or I(1). According to Pesaran and Shin (1999), the ARDL also does not require symmetry in lag lengths, i.e., each variable can have a different number of lag terms.

In summary, we compare both short term results from the VAR models and the long-term response of income inequality to positive changes in oil rents based on ARDL approach.

3.3 Data

To measure income inequality, we use the GINI index[15] (ranging from 0 to 1, higher values indicating higher income inequality) from the Annual Household Income and Expenditure

[15] As shown by Yitzhaki (1979), higher levels of income inequality measured by the GINI coefficient mean higher levels of relative deprivation.

Surveys from the Central Bank of Iran. As an alternative to the GINI index, we also employ the ratio of expenditures of the 10th decile relative to that of the 1st decile, indicating the intensity and the dynamic of the income gap between the rich and the poor. The minimum level of GINI index in our dataset of 0.37 was observed in the year 2011, the highest level of 0.50 occurred in 1975, at a time of significant positive oil revenue shocks in Iran.

We use the logarithm of the value added of different oil groups (crude petroleum, gas, and refined products) in constant prices divided by total population as a proxy for oil and gas rents per capita. The value added of oil is the difference between the output value of the oil groups and their intermediate consumption. These data are available from the Iran Annual National Accounts published by the Central Bank.[16] Farzanegan (2011) and Dizaji et al. (2015) have also used this variable as a proxy for oil rents. As argued by Ross (2012), the value of the oil production (in our case, we subtract also costs of production) is a better proxy for size of oil rents than measures such as oil exports, which do not take into account the value of domestically consumed oil products. Ignoring this consumption would be problematic, as there is a high level of subsidization of domestic consumption of different energy carriers in Iran. In 2007, for example, Iran was the largest fossil-fuel subsidizing country in the world with subsidies amounting to $56 billion per year (Farzanegan and Markwardt, 2012).

Besides oil rents and income inequality which are our key variables of interests, we need also to control for some important transmission channels running potentially from oil rents to the income of households. One of these channels relates to government spending. Obviously, higher oil rents may increase state revenues from, e.g., taxing oil firms, thereby allowing to provide more public goods (including the military) or to redistribute to poorer people. Therefore, we control for military and education spending as a share of total government spending. Farzanegan (2014) provides a comprehensive review of the nexus between economic

[16] http://www.cbi.ir/simplelist/5796.aspx.

growth and military spending in Iran, showing that the military budget Granger-causes the economic growth. He also shows that the response of income growth to shocks in the military budget is positive and statistically significant. However, different from spending on education, military spending may not benefit the majority of population (Dizaji et al, 2016). Government spending on education can provide educational coverage and build up an educational infrastructure, thus contributing to human capital formation. The latter is critical to increasing the skills of the labor force and to reducing the income gap between high and low skilled labor.

We also control for the share of tax revenues in total government revenues which is another channel of redistributing oil rents across society. The overall state of economic development, measured by the logarithm of real GDP per capita, is also controlled in our estimations.[17] Finally, our sample includes a couple of political changes such as the transition from monarchy to an Islamic republic and different governments in the post-revolution period.

Factionalism in Iranian post-revolution politics and its destructive effects on economic growth under increasing oil rents has been investigated by Bjorvatn et al. (2013). We follow this approach and control for different forms of political instabilities and conflicts by using the logarithm of a weighted measure of conflict drawn from the Cross-National Time-Series Data Archive (CNTS) of Databanks International (Banks and Wilson, 2015). The conflict measure covers assassinations, strikes, guerrilla warfare, government crises, purges, riots, revolutions, and anti-government demonstrations. Finally, the eight-year war period with Iraq is controlled for by using a dummy variable equaling one for 1980-1988. Except for the conflict measure, all other variables are taken from CBI (2017).

To trace back the response of income inequality in Iran to positive shocks in oil and gas rents per capita, we apply the generalized impulse-response function (IRF) on the basis of our estimated unrestricted VAR model. The IRF shows the direction, size, and statistical

[17] The square of GDP per capita works better for a cross-section of countries in a given year than for inequality within countries over time (Li et al., 1998).

significance of responses following an initial shock to oil rents. Before investigating the IRF, we need to check the stability of the estimated VAR model. According to Lütkepohl (1991), an estimated VAR model is stable (stationary) if its root reciprocals are less than one, that is, when they are located in the unit circle. If the VAR is not stable, the impulse-response standard errors are not valid (IHS, 2016, p. 646). Table 1 shows that our estimated VAR is stable, i.e., the influence of a shock on all variables will decrease over time.

Table 1. Stability of the VAR model

Roots of the Characteristic Polynomial	
Endogenous variables: oil rents per capita; military spending; education spending; taxation; GDP per capita; GINI; conflict	
Exogenous variables: constant; Iran-Iraq war dummy (1980-88)	
Lag specification: 1 1	
Root	Modulus
0.959671	0.960
0.901557	0.902
0.533507 - 0.173379i	0.561
0.533507 + 0.173379i	0.561
0.340821	0.341
0.098056	0.098
0.002762	0.003
No root lies outside the unit circle.	
VAR satisfies the stability condition.	

In addition to the stability condition test, we need to examine the properties of the residuals from our estimated VAR model. For this purpose, we use the autocorrelation LM Test which reports the multivariate LM test statistics for residual serial correlation up to the specified order (i.e., up to 4 years in our case). The test statistic for lag order $h = 4$ is calculated by estimating an auxiliary regression of the residuals u_t on the original right-hand regressors and the lagged residual u_{t-h} , where the missing first h values of u_{t-h} are filled with zeros (for more details, see Johansen, 1995). The null hypothesis under the autocorrelation LM Test is "*no serial* *correlation of order h*". Table 2 shows that our estimated VAR model is also immune against serial correlation in residuals up to the order of 4 years.

Table 2. Autocorrelation LM Test

VAR Residual Serial Correlation LM Tests		
Null Hypothesis: no serial correlation at lag order *h*		
Sample: 1959-2014		
Included observations: 42		
Lags	LM-Stat.	Prob.
1	63.841	0.076
2	54.703	0.267
3	48.872	0.478
4	50.535	0.413
Probs. from chi-square with 49 degree of freedoms		

Another issue in VAR modelling and the subsequent IRF analysis is the ordering of variables in the VAR system. The first variable in the ordering is the most exogenous one which can affect other variables in the system instantly, but gets affected by them with some time lag. The last variable in the ordering is the most endogenous variable. At best, economic theory should guide us in selecting the ordering of variables. When theory is not conclusive about the ordering, we need to show that the IRF results are at least robust to different orderings of variables.[18] In our analysis, we use the generalized impulse response[19] introduced by Pesaran and Shin (1998) for this purpose and report in the following section the derived confidence bands at the 95 percent confidence intervals for impulse responses.[20]

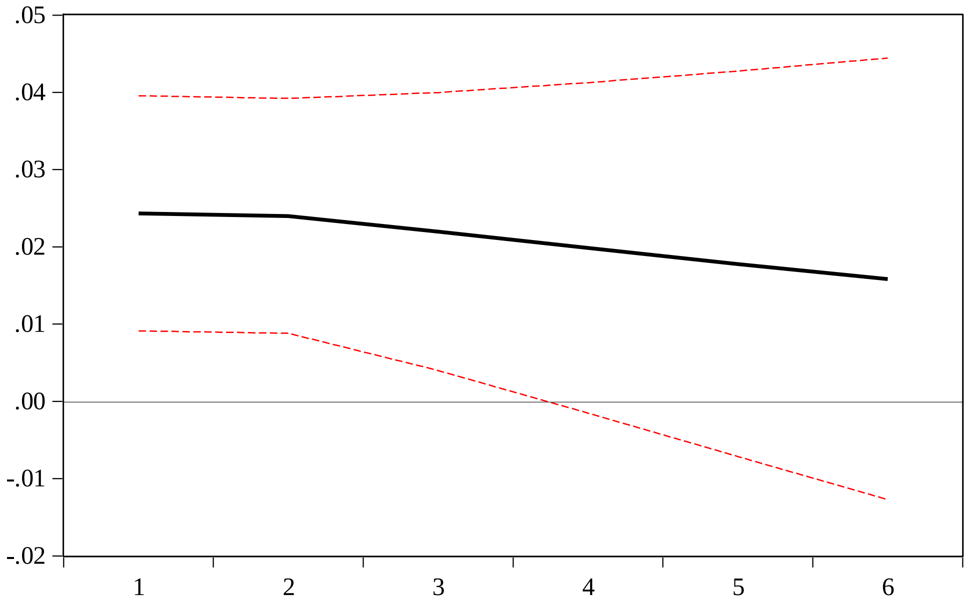
[18] One of the strategies to select the ordering of variables in the VAR system is to use the Granger causality test results (see Farzanegan and Markwardt, 2009, for a similar approach). Table A2 in the Appendix shows the results for the VAR Granger causality / Block exogeneity Wald test.
[19] The generalized IRF constructs an orthogonal set of innovations that does not depend on the VAR ordering.
[20] These intervals are built using 1,000 Monte Carlo simulations.

4. Results

Figure 1 shows the impulse response of income inequality to a positive shock in oil and gas rents per capita. It shows that after an unexpected positive shock in oil and gas rents per capita in Iran, income inequality increases. The increase is statistically significant for the first four years following initial shock. The peak positive response of income inequality is seen within the first two years after the shock. These results are obtained by controlling for other channels connecting oil rents and inequality, such as spending on education and the military, a measure of conflict and political instability, the relative share of tax revenues in the government budget, and GDP per capita as well as times of war with Iraq.

Our results differ from Goderis and Malone (2011), who suggest the short-term fall of inequality following oil booms, but they are perfectly in line with the findings by Fum and Hodler (2010) and Bhattacharyya and Williamson (2015). Recall that Fum and Holder (2010) argue that increasing oil rents can increase inequality when a country has a relatively high ethnolinguistic diversity. According to Montalvo and Reynal-Querol's (2005) indicator of ethnic fractionalization and polarization, Iran is among the most fractionalized countries worldwide. It has a score of 0.60 in ethnic polarization and 0.76 in ethnic fractionalization (the scale ranging from 0 to 1). As we theorized above, one of the dangers of a sudden resource boom is that it may trigger conflict induced by higher relative deprivation. Often, inequality runs along urban-rural divide or ethnic lines with ethnic minorities living particularly deprived, which may increase ethnic tensions. Combining Fum and Hodler's (2010) and our findings indicates a potential vicious circle in Iran: The expected boom following the lifting of sanctions occurs in a highly fractionalized country, which is particularly prone to increasing inequality. The increase in inequality results in an even greater economic division of ethnic groups, making any future booms even more dangerous as relative deprivation will increase further. Arguably, at some sufficiently high level of relative deprivation (or intergroup income inequality) political instability and conflict may result, if Iran's institutional setting will not improve in the meantime to accommodate these potential conflicts.

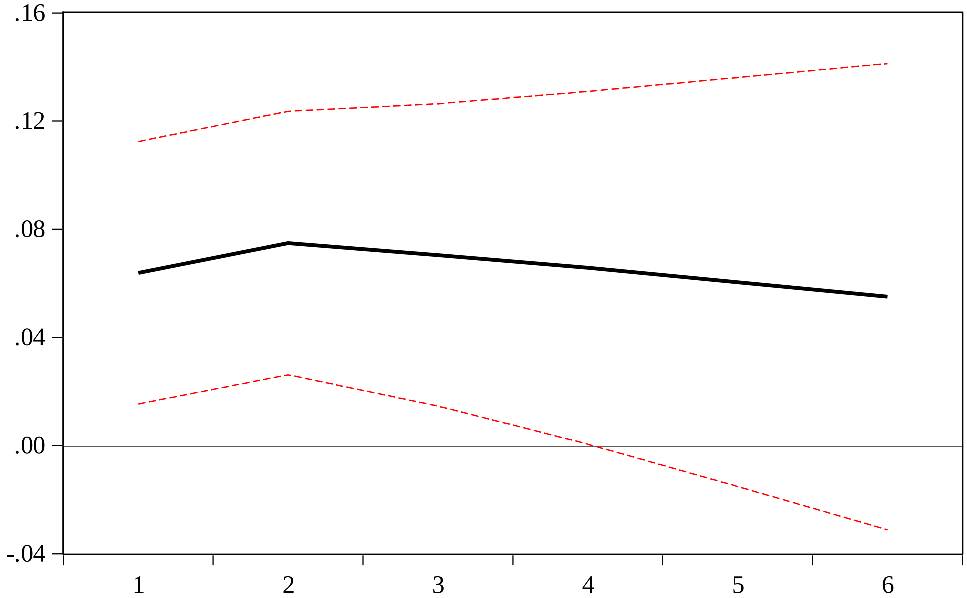
Figure 1. Response of inequality to a shock in oil and gas rents per capita



Note: The graph shows the generalized impulse responses of income inequality (log of GINI) to a one-standard-deviation shock in the log of oil and gas rents per capita. One SD of the log of oil and gas rents per capita in our sample is 0.53 (minimum of 14.79 and maximum of 16.84). The dotted lines represent ±2 standard deviations (95% CI). The deviation from the baseline scenario of no shocks is on the vertical axis; the periods (years) after the shock are on the horizontal axis. The vertical axis shows the magnitude of the responses.

Figure 2 shows the response of the ratio of expenditures of the 10th decile to the 1st decile (i.e., the gap between the rich and the poor) to a positive shock in oil and gas rents per capita. This simulation is based on a VAR model with optimal lag length of one year, controlling for the same variables as in the case of Figure 1. Both stability and residual serial autocorrelation tests are satisfactory. The figure reconfirms the previous findings (Figure 1). The income gap between the richest 10 percent to the poorest 10 percent increases after an unexpected positive shock in oil rents per capita in Iran. It reaches its peak in the second year after the shock and remains statistically significant for the first four years following the initial oil rents shock.

Figure 2. Response of the gap between the rich and the poor to a shock in oil and gas rents per capita



Note: The graph shows the generalized impulse responses of income gap between the richest and the poorest (in log) to a one-standard-deviation shock in the log of oil and gas rents per capita. One SD of the log of oil and gas rents per capita in our sample is 0.53 (minimum of 14.79 and maximum of 16.84). The dotted lines represent ±2 standard deviations (95% CI). The deviation from the baseline scenario of no shocks is on the vertical axis; the periods (years) after the shock are on the horizontal axis. The vertical axis shows the magnitude of the responses.

How much of the variance in income inequality (measured by GINI index) is explained by shocks in oil and gas rents per capita, and how much is explained by shocks in other variables? The variance decomposition (VDC) results in Table 3 show the variance of income inequality from each source of shock. The first vertical column indicates the number of years following a shock to which the decomposition applies, and the row figures give the fraction of variance explained by the shock source.

Table 3 shows that in the first year after the shock approximately 50 percent of the changes in income inequality are explained by its own past lags. The shocks in oil and gas rents explain about 30 percent of the variance of inequality in the first year following the shock. The relative importance of oil rents shocks in explaining the fluctuation of income inequality increases constantly over the time, reaching its maximum of 45 percent in the 6th year after the initial shock.

Table 3. Variance decomposition of GINI index

Period	oil and gas rents per capita	conflict	military spending	tax revenues	GDP per capita	education spending	GINI
1	31	5	3	2	0	6	53
2	38	8	2	2	0	9	41
3	41	8	2	1	0	11	36
4	43	8	2	1	1	13	32
5	44	8	3	1	1	14	29
6	45	8	3	1	2	14	28
7	45	7	3	1	2	15	26
8	45	7	4	1	3	15	25
9	45	7	4	1	3	15	24
10	45	7	4	1	4	16	24

Cholesky Ordering: oil and gas rents per capita; conflict; military spending; tax revenues; GDP per capita; education spending; GINI

The next important variable in explaining the variance of inequality is the share of government spending on education in total government spending. It explains about 15 percent of the inequality fluctuations in the middle and long term. Finally, the conflict and instability measures explain approximately 7 percent of the variation of inequality in Iran.

Let us now analyze the long run response of inequality to a positive change in oil and gas rents per capita, controlling for the other mentioned variables. As explained above, we use the ARDL approach which is particularly useful for this purpose. It explains income inequality in terms of past values of inequality, as well as the current and past values of other variables in the model including oil and gas rents per capita. We set the maximum number of lags for the dependent (GINI) and independent variables to 4. The lag length (which can be different for each variable in ARDL) that minimizes the model's AIC (Akaike information criterion) will be selected. We include a linear trend and a constant as fixed regressors in our ARDL specification and report heteroskedasticity and autocorrelation consistent (HAC) standard errors. Among

62,500 evaluated models, we select ARDL (4,4,4,4,3,2,4).[21] The effective sample period is 1973-2012.

It is important that the errors of this model are serially independent. Otherwise, the parameter estimates will not be consistent. Table A3 in the Appendix shows correlograms of residuals. Overall, the results are satisfactory, implying that errors are serially independent.

Estimating an ARDL model provides a basis for using Bound test which examines the existence of long run relationship among variables of interest (Pesaran et al., 2001). The null hypothesis under the Bounds Test is that there is no long-run relationship between the variables under consideration. Table A4 in the Appendix shows the results of Bounds test. We see that the F statistic for the Bounds test is 4.92 which exceeds even the 1-percent critical value for the upper bound (4.39). Thus, we can strongly reject the null hypothesis of "no long-run relationship" among our variables.

Finally, we estimate the long run response of income inequality to a positive change in oil and gas rents and other variables. The results are shown in Table 4. We can see that a 10 percent change in the oil and gas rents per capita will result in a long-run change of 1.1 percent in the income inequality as measured by GINI index. This long run effect is statistically significant at 99 percent CI. It confirms our earlier findings from the VAR model. If we remove the trend variable from the ARDL estimation, our main results regarding the positive long run response of inequality to a change in oil rents even increases and at the same time the effect of other variables becomes statistically significant. We have reported this result in Table A5 of the Appendix for comparison.

[21] We can also see how well some of the other specifications perform in terms of minimizing AIC. See Figure A1 in Appendix A.

Table 4. Long run response of income inequality to positive changes in oil rents; ARDL results

Dep. Variable:	log (GINI)		
	Coefficient	t-Statistic	Prob.
log (oil and gas rents per capita)	0.118	4.54	0.00
log (conflict)	0.005	1.53	0.17
military spending	-0.001	-0.34	0.74
tax revenues	0.001	0.60	0.57
log (GDP per capita)	-0.094	-1.54	0.17
education spending	-0.005	-0.91	0.39
Trend variable	-0.001	-0.86	0.42

5. Conclusion

Iran is about to become a full-fledged member of the global economy again, after most sanctions related to the country's nuclear weapons program have been lifted. At the same time, Iran is one of the most important political and economic players in a highly instable world region. There are many reasons to criticize the Iranian governments for their role in the region. However, a pragmatic approach to Middle-East politics would suggest that yet another destabilized country in the region would probably do more harm than good. Hence, it is important to analyze closely how the expected economic boom after the lifting of sanctions will affect the stability of the country. Will Iran become more stable and become an even more powerful player in the region (which may or may not be beneficial to the region)? Or will increasing oil wealth destabilize the country, making it another dangerous player, suffering from internal conflict, which might ultimately harm regional and – possibly – even world peace. The literature on the inequality-conflict nexus, including Ted Gurr's (1970) seminal book "Why men rebel", cautions us that quickly rising income inequality, especially in the form of relative deprivation along ethnic lines, is an important trigger for internal conflict. Hence, our paper tried to predict the effect of the end of sanctions and the expected subsequent rise of income and wealth from oil rents on income inequality. More specifically, we studied the short and long run responses of income inequality to a positive change in oil and gas rents per capita from 1973 to 2012 in Iran.

We find that oil booms worsen the income distribution in Iran, i.e., incomes become more unequally distributed once additional rents are available. Based on an impulse response as well as a variance decomposition analysis, we show that the response of income inequality to positive oil and gas rents per capita shocks is positive for the first four years following a shock and is statistically significant at a 95-percent confidence level.

Additionally, we show that approximately 45 percent of the variance of inequality is explained by shocks to per capita oil and gas rents in Iran in the middle and long run. The ARDL estimations indicate a significant long run response of income inequality to a positive change in oil rents per capita. A 10-percent increase in oil and gas rents per capita leads to 1.1-percent increase in income inequality. Our results are robust while controlling for other possible channels affecting the income distribution in Iran, such as government spending on education and the military, income per capita, a measure of conflict and political instability and the share of tax revenues in the government budget.

Our predictions augur significant threats to the Middle-East region. As the oil boom is likely to result in an increasing inequality caused by, e.g., elite-domination in the distribution of new oil income, and as Iran is prone to inequality-induced conflict, there is the real danger to see internal conflict in Iran, which may spread to other countries in the region. The task of the Iranian government (also in its very own self-interest to stay in power) will be to accommodate the increase of inequality. Redistributive policies, also toward rural regions or across ethnic lines, could be one strategy to avoid future conflict. Whether an elite-dominated government will be able to choose this strategy is a different matter. Any country interested in a peaceful development of the Middle-East region should at least keep an eye on the development of inequality in Iran.

References

Acemoglu, D., Johnson, S., Robinson, J.A., 2001. The colonial origins of comparative development: An empirical investigation. American Economic Review 91, 1369–401.

Acemoglu, D., Johnson, S., Robinson, J.A., 2005. Institutions as a fundamental cause of long-run growth. In: Aghion, P., Durlauf, S. (Eds.), Handbook of Economic Growth. Elsevier, Amsterdam, 386–472.

Acemoglu, D., Robinson, J.A., 2006. De facto political power and institutional persistence. American Economic Review 96, 325–330.

Acemoglu, D., Robinson, J.A., 2008. Persistence of power, elites, and institutions. American Economic Review 98, 267–293.

Banks, A. S., Wilson, K. A. 2015. Cross-National Time-Series Data Archive. Databanks International. Jerusalem, Israel (http://www.cntsdata.com/).

Bhattacharyya, S., Williamson, J.G., 2015. Distributional consequences of commodity price shocks: Australia over a century. Review of Income and Wealth. 10.1111/roiw.12167

Bjorvatn, K., Farzanegan, M.R., Schneider, F., 2013. Resource curse and power balance: evidence from Iran. Review of Middle East Economics and Finance 9, 133–158.

Carmignani, F., 2013. Development outcomes, resource abundance, and the transmission through inequality. Resource and Energy Economics 35, 412–428.

CBI, 2017. Economic Time Series Database. Central Bank of Iran. Available at: http://tsd.cbi.ir/.

Chandra, S., Williams Foster, A., 2005. The "revolution of rising expectations," relative deprivation, and the urban social disorders of the 1960s: Evidence from state-level data. Social Science History 29, 299–332.

Corden, W.M., Neary, J.P., 1982. Booming Sector and De-Industrialization in a Small Open Economy. Economic Journal 92, 825–48.

Davis, G.A., Vásquez Cordano, A.L., 2013. The fate of the poor in growing mineral and energy economies. Resources Policy 38, 138–151.

Dickey, D.A., Fuller, W.A., 1979. Distribution of the estimators for autoregressive time series with a unit root. Journal of the American Statistical Association 74, 427–431.

Dizaji, S.F., Farzanegan, M.R., Naghavi, A. 2016. Political institutions and government spending behavior: theory and evidence from Iran. International Tax and Public Finance 23, 522–549.

EIA, 2017. International Energy Statistics. U.S. Energy Information Administration. Available at: https://www.eia.gov/beta/international/

Farzanegan, M.R., 2014. Military spending and economic growth: The case of Iran. Defence and Peace Economics 25, 247-269.

Farzanegan, M.R., 2011. Oil revenues shocks and government spending behavior in Iran. Energy Economics 33, 1055–1069.

Farzanegan, M.R., Markwardt, G., 2009. The effects of oil price shocks on the Iranian economy. Energy Economics 31, 134–151.

Farzanegan, M.R., Markwardt, G., 2012. Pollution, economic development and democracy: evidence from the MENA countries. MAGKS Paper No. 27-2012, Marburg.

Farzanegan, M.R, Raeisian Parvari, M., 2014. Iranian-Oil-Free Zone and international oil prices. Energy Economics 45, 364–372.

Fum, R.M., Hodler, R., 2010. Natural resources and income inequality: The role of ethnic divisions. Economics Letters 107, 360–363.

Gilens, M., Page, B.I., 2014. Testing theories of American politics: Elites, interest groups, and average citizens. Perspectives on Politics 149, 564–581.

Gimpelson, V., Treisman, D., 2015. Misperceiving inequality. NBER Working Paper No. 21174.

Goderis, B., Malone S.W., 2011. Natural resource booms and inequality: theory and evidence. Scandinavian Journal of Economics 113, 388–417.

Gregory, R., 1976. Some Implications of the Growth of the Mining Sector. Australian Journal of Agricultural Economics 20, 71–91.

Gurr, T.R., 1970. Why Men Rebel. Princeton University Press: Princeton, NJ.

Holcombe, R.G., 2015. Political capitalism. Cato Journal 35, 41-66.

Howie, P., Atakhanova, Z., 2014. Resource boom and inequality: Kazakhstan as a case study. Resources Policy 39, 71–79.

IHS, 2016. EViews 9 User's Guide II. Irvine CA.

International Monetary Fund (IMF), 2015. Regional economic outlook. Middle East and Central Asia. Chapter 5: Economic Implications of Agreement with the Islamic Republic of Iran. Washington, D.C., 81–88.

Johansen, S., 1991. Estimation and hypothesis testing of cointegration vectors in Gaussian vector autoregressive models. Econometrica 59, 1551–1580.

Johansen, S., 1995. Likelihood-based Inference in Cointegrated Vector Autoregressive Models, Oxford University Press, Oxford.

Kawachi, I. Kennedy, B.P., Wilkinson, R.G., 1999. Crime: Social disorganization and relative deprivation. Social Science & Medicine 48, 719–731.

Krieger, T., Meierrieks, D., 2016a. Does Income Inequality Lead to Terrorism? CESifo Working Paper No. 5821.

Krieger, T., Meierrieks. D., 2016b. Political capitalism: The interaction between income inequality, economic freedom and democracy. European Journal of Political Economy 45, 115–132.

Li, H., Squire, L., Zou, H., 1998. Explaining international and intertemporal variations in income inequality. The Economic Journal 108, 26–43.

Lütkepohl, H., 1991. Introduction to Multiple Time Series Analysis. Springer-Verlag, New York.

MacCulloch, R., 2005. Income inequality and the taste for revolution. Journal of Law and Economics 48, 93–123.

Mehlum, H., Moene, K., Torvik, R., 2006. Institutions and the resource curse. The Economic Journal 116, 1–20.

Montalvo. J. G., Reynal-Querol, M., 2005. Ethnic diversity and economic development. Journal of Development Economics 76, 293– 323.

Muller, E.N., Weede, E., 1994. Theories of rebellion: Relative deprivation and power contention. Rationality and Society 6, 40–57.

Pesaran, M.H., Shin, Y., 1998. Generalised impulse response analysis in linear multivariate models. Economics Letters 58, 17–29.

Pesaran, M.H., Shin, Y. 1999. An Autoregressive Distributed Lag Modelling Approach to Cointegration Analysis. Econometrics and Economic Theory in the 20th Century: The Ragnar Frisch Centennial Symposium, Strom, S. (ed.) Cambridge University Press.

Pesaran, M.H., Shin, Y., Smith, R., 2001. Bounds testing approaches to the analysis of level relationships. Journal of Applied Econometrics 16, 289–326.

Phillips, P.C.B., Perron, P., 1988. Testing for a Unit Root in Time Series Regression. Biometrika 75, 335–346.

Piazza, J.A., 2006. Rooted in poverty? Terrorism, poor economic development, and social cleavages. Terrorism and Political Violence 18, 159–177.

Rajan, R.G., Zingales, L., 2003. The great reversals: The politics of financial development in the twentieth century. Journal of Financial Economics 69, 5–50.

Ross, M.L., 2012. The oil curse: how petroleum wealth shapes the development of nations. Princeton University Press.

Sachs, J.D., Warner, A.M., 1995. Natural resource abundance and economic growth. NBER Working Paper No. 5398.

Sachs, J.D., Warner, A.M., 1997. Sources of slow growth in African economies. Journal of African Economies 6, 335–76.

Sachs, J.D., Warner, A.M., 2001. The curse of natural resources. European Economic Review 45, 827–38.

Sims, C. A., 1980. Macroeconomics and reality. Econometrica, 48, 1–48.

Sims, C. A., Stock, J., Watson, M., 1990. Inference in linear time series models with some unit roots. Econometrica, 58, 113–144.

Sokoloff, K.L., Engerman, S.L., 2000. History lessons: Institutions, factors endowments, and paths of development in the New World. Journal of Economic Perspectives 14, 217–232.

Thorbecke, E., Charumilind, C., 2002. Economic inequality and its socioeconomic impact. World Development 30, 1477–1495.

Torbat, A.E., 2005. Impacts of the US Trade and Financial Sanctions on Iran. The World Economy 28, 407–434.

Transparency International, 2017. Corruption Perception Index. Available at: http://www.transparency.org/news/feature/corruption_perceptions_index_2016.

Wilkinson, R.G., Pickett, K.E., 2007. The problems of relative deprivation: Why some societies do better than others. Social Science & Medicine 65, 1965–1978.

Yitzhaki, S., 1979. Relative deprivation and the Gini coefficient. Quarterly Journal of Economics 93, 321–324.

Appendix A

Table A1. VAR Lag Order Selection Criteria for the VAR model

Endogenous variables: oil and gas rents per capita; conflict; military spending; tax revenues; GDP per capita; education spending; income inequality

Exogenous variables: constant; war dummy

Sample: 1959 2014

Included observations: 41

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-416.2059	NA	3.06809	20.98565	21.57077	21.19872
1	-276.6304	217.8739	0.038892	16.56734	19.20039*	17.52615*
2	-215.8739	74.09326*	0.028284*	15.99385*	20.67483	17.6984

* 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

Table A2. VAR Granger Causality/Block Exogeneity Wald Tests

Sample: 1959 2014

Included observations: 42

Dependent variable: oil and gas rents per capita				*Dependent variable: conflict*			
Excluded	Chi-sq	d	Prob	Excluded	Chi-sq	d	Prob
conflict	0.01	1	0.92	oil and gas rents per capita	1.68	1	0.19
military spending	0.51	1	0.47	military spending	0.02	1	0.90
tax revenues	1.40	1	0.24	tax revenues	0.22	1	0.64
GDP per capita	2.90	1	0.09	GDP per capita	8.87	1	0.00
education spending	2.01	1	0.16	education spending	2.67	1	0.10
GINI	2.43	1	0.12	GINI	0.79	1	0.37
All	13.96	6	0.03	All	12.63	6	0.05
Dependent variable: military spending				*Dependent variable: tax revenues*			
Excluded	Chi-sq	d	Prob	Excluded	Chi-sq	d	Prob
oil and gas rents per capita	5.48	1	0.02	oil and gas rents per capita	0.02	1	0.89
conflict	2.07	1	0.15	conflict	0.18	1	0.67
tax revenues	0.14	1	0.71	military spending	2.32	1	0.13
GDP per capita	5.46	1	0.02	GDP per capita	0.83	1	0.36
education spending	0.11	1	0.74	education spending	0.93	1	0.33
GINI	3.10	1	0.08	GINI	5.04	1	0.02
All	12.14	6	0.06	All	11.46	6	0.08

Dependent variable: GDP per capita				*Dependent variable: education spending*			
Excluded	Chi-sq	d	Prob	Excluded	Chi-sq	d	Prob
oil and gas rents per capita	4.94	1	0.03	oil and gas rents per capita	0.92	1	0.34
conflict	0.02	1	0.89	conflict	2.31	1	0.13
military spending	0.24	1	0.63	military spending	0.00	1	0.94
tax revenues	2.36	1	0.12	tax revenues	0.14	1	0.71
education spending	0.95	1	0.33	GDP per capita	1.16	1	0.28
GINI	5.28	1	0.02	GINI	0.22	1	0.64
All	10.48	6	0.11	All	5.31	6	0.51
Dependent variable: GINI							
Excluded	Chi-sq	d	Prob				
oil and gas rents per capita	1.83	1	0.18				
conflict	0.52	1	0.47				
military spending	0.05	1	0.82				
tax revenues	0.00	1	0.99				
GDP per capita	1.20	1	0.27				
education spending	1.14	1	0.29				
All	3.73	6	0.71				

Table A3. Correlogram of residuals of estimated ARDL

Sample: 1959 2014
Included observations: 40
Q-statistic probabilities adjusted for 4 dynamic regressors

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob*
		1	-0.338	-0.338	4.9168	0.027
		2	-0.097	-0.239	5.3362	0.069
		3	0.032	-0.107	5.3830	0.146
		4	-0.214	-0.319	7.5237	0.111
		5	0.171	-0.069	8.9286	0.112
		6	-0.071	-0.160	9.1770	0.164
		7	-0.008	-0.126	9.1801	0.240
		8	0.103	-0.038	9.7338	0.284
		9	-0.046	-0.010	9.8490	0.363
		10	0.036	0.009	9.9206	0.447
		11	-0.135	-0.149	10.980	0.445
		12	0.060	-0.031	11.194	0.512
		13	-0.025	-0.117	11.232	0.591
		14	-0.025	-0.121	11.273	0.664
		15	0.147	0.012	12.733	0.623
		16	-0.088	-0.037	13.274	0.653
		17	0.001	-0.065	13.274	0.718
		18	0.076	0.053	13.717	0.747
		19	-0.217	-0.171	17.491	0.557
		20	0.149	-0.041	19.344	0.500

*Probabilities may not be valid for this equation specification.

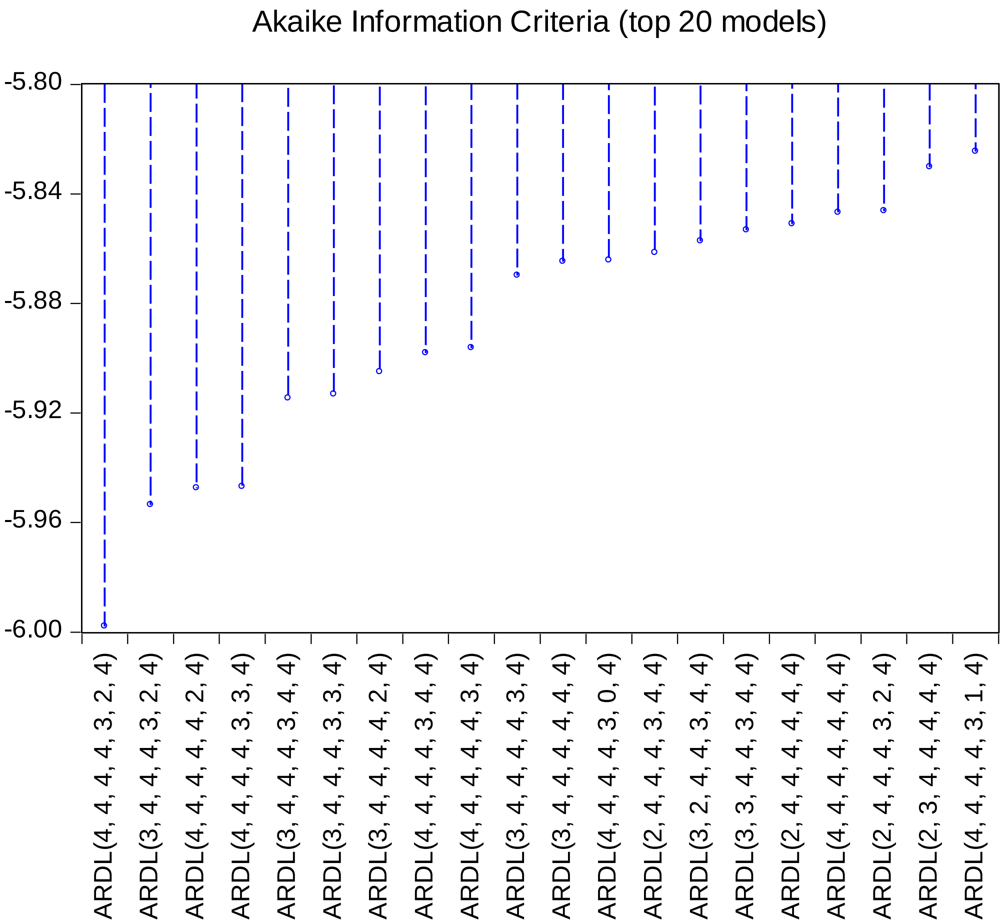
Table A4. Bounds Test

F-Bounds Test		Null Hypothesis: No levels relationship		
Test Statistic	Value	Significance	I(0)	I(1)
F-statistic	4.92	10%	2.33	3.25
k	6	5%	2.63	3.62
		2.50%	2.9	3.94
		1%	3.27	4.39

Table A5. Long run effects in ARDL (without trend)

Dep. Variable:	log (GINI)		
	Coefficient	t-Statistic	Prob.
log (oil and gas rents per capita)	0.12	8.22	0.000
log (conflict)	0.01	8.09	0.000
military spending	0.00	6.18	0.000
tax revenues	0.00	-1.18	0.271
log (GDP per capita)	-0.15	-7.81	0.000
education spending	-0.01	-2.29	0.051
constant term	-1.28	-5.13	0.001

Figure A1. ARDL model selection summary



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