

Military Spending and Political Institutions: Lessons for the Iran's Sanctions

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Abstract

This study examines how quality of political institutions affects the distribution of government budget and how development of government spending in major sections shapes the political institutions in Iran. This question has become especially important due to recent international sanctions, aiming to change the political behavior of Iran. We use the impulse response functions (IRF) and variance decomposition analysis (VDC) on the basis of Vector Autoregressive (VAR) model with annual data from 1960 to 2006. Our results show the importance of political institutions in patronage (e.g., military) and public goods provision spending (e.g., education and health) in Iran. The results imply that a shock in positive changes of democratic quality of institutions leads to negative and statistically significant response of military spending and positive and statistically significant response of education expenditures in short term. If sanctions are successful to change the political behavior of Iran in short run (Dizaji and Bergeijk, 2013), then we can also expect to see a reduction in allocated budget for military in Iran.

JEL Classification: H11, H41, P16, O53, O43

Keywords: political institutions, military spending, Iran, VAR modelling, sanctions

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1- Introduction

Our goal in this study is to examine how quality of political institutions in Iran has shaped behavior of the state towards patronage (e.g., military spending) and public goods provision (e.g., education and health spending). Our approach to this nexus has been also additionally motivated by recent significant international sanctions to change the political behavior of Iranian government. In our study, we focus on the case of Iran to quantify the magnitude and significance of political institutions in government military and non-military spending behavior. We use Vector Autoregressive Model (VAR) and its applied tools, i.e. impulse response functions and variance decomposition analysis, examining the dynamic relationship between institutions and different categories of government spending in Iran from 1960 to 2006. This is the first empirical investigation of response of military and non-military spending to symmetric and asymmetric shocks in political institutions of Iran. In addition, we also analyze the response of political institutions to a shock in military and non-military spending.

Our main results show that a shock in positive changes of quality of political institutions leads to negative and statistically significant response of military spending, as a proxy of patronage in economics, and positive and statistically significant response of education expenditures, as an indicator of public goods provision, in short term. By contrast, shocks in negative changes of political institutions reflects itself in positive response of military spending and negative response of education, health and public order expenditures. We also show that increasing shocks in military and education spending lead to negative and positive response of democracy index in Iran, respectively.

Autocracies are shown to be persistent despite of their long run negative economic development consequences¹. For example, Deacon (2009) suggests that almost 68% of countries in the last half of 20th century were governed by dictators and one third of them remained in this status until 2000.

In autocracies a small dominant coalition rules the rest of population. Dictator needs to buy the loyalty of this limited coalition by allocating more budget and economic opportunities. Military lobby has been one of the main drivers of persistency of autocracies in history. By contrast, democracies represent a wide cross section of society and thus need to provide more public goods in a form of education and health rather than securing economic benefits of selected group of citizens in return for their political loyalty. It is also not only the issue of quantity of spending allocation but also quality of spending will be different in autocracy compared with democracy (Deacon and Sasha, 2006).

This paper is structured as follows: In Section 2, we explain the relevance of case study of Iran by presenting some stylized facts and background on sanctions. In Section 3 we present a review of literature on government spending and democracy nexus. In Section 4 we describe the data we use, and explain empirical methodology and results. In Section 5, we present a summary and discussion.

2- Background

Iran provides an interesting context for this analysis: It has experienced different political regimes, the autocracy of Pahlavi in which the Shah was the most powerful political figure and the post-1979 Islamic revolution which deals with factionalized semi-democracy (see Bjorvatn, Farzanegan and Schneider, 2013 for growth effects of factional politics in Iran).

¹ For long run negative economic development effects of autocracies see Olson (1993) in which he refers to the lack of individual property rights and weak enforcement of contracts in such societies.

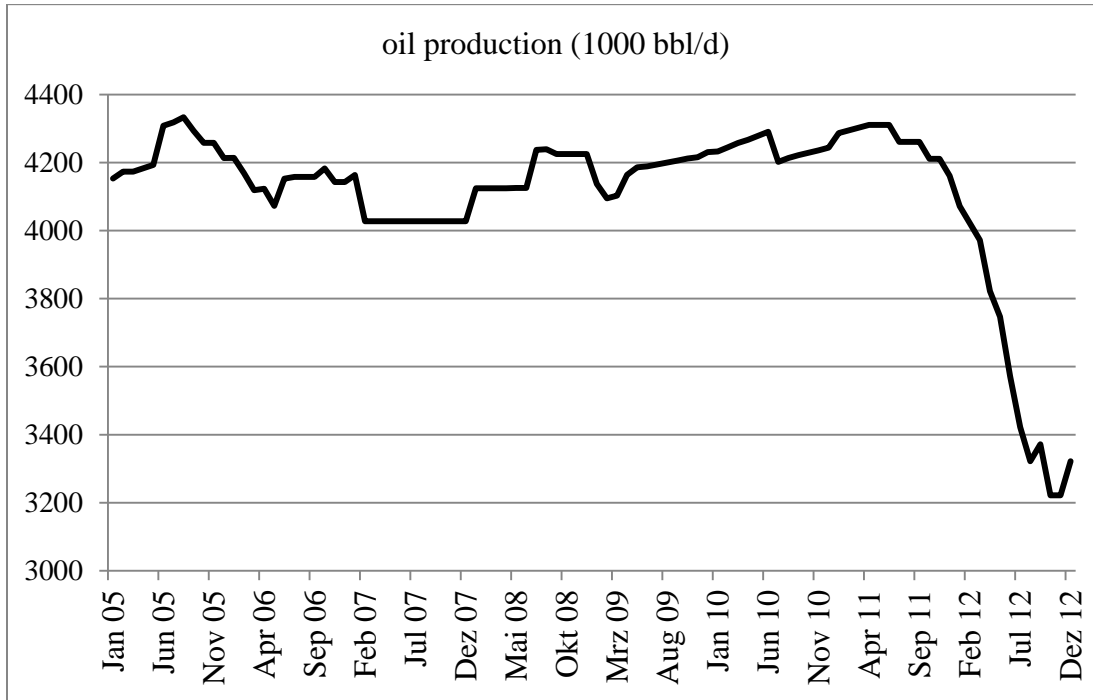
Military affiliated groups were the central supporter of the autocracy of Shah. Under his rule, the share of government spending for military in real prices in total government spending was 33%. The Islamic republic was established on popular support of middle and lower income classes. It represents a wider range of population than the former regime. Average military spending (as % of total government spending) in post 1979 revolution was 29%. Excluding the Iraq-Iran war period (1980-1988), this share reduces to 25% (CBI, 2013). The opportunity costs of patronage behavior is high: there is a negative and statistically significant (at 5% level of significance) correlation between military spending with education spending (-0.46), health spending (-0.30), and cultural spending (-0.31) from 1959-2006.

Another motivating reason for our analysis is recent multilateral energy and financial sanctions which aim to change the political attitudes of Iranian government by affecting main financial source of revenues, i.e., oil export. Indeed, one of the main funding channels of patronage and transfer policies in Iran is petrodollars. Literature and historical evidences show that dictators in oil rich economies depend on redistribution of oil rents and if it does not work they stick to repression policies. Oil revenue is key factor for both choices. For the repression of course they need well-established military and security apparatus (Wintrobe 2001 and 2012; Acemoglu et al., 2010).

As a result of energy and banking sanctions, Iran oil production shows a significant reduction of 1 million barrels per day (mbl/d): from about 4 mbl/d in 2005-2011 to approximately 3 mbl/d during 2012-2013. Given the average oil price per barrel in 2012 of \$111.67 (BP, 2013), the oil related sanctions has led to a daily loss of \$111,670,000 and in other words an annual loss of about \$ 41 billion. Figure 1 shows the trend of monthly oil production in Iran since 2005. The significant drop of oil supply since 2011 as a result of sanctions is evident. Reducing oil supply

is going also to shape the rest of the economy due to high dependence of national economy to oil industry. The share of oil revenues in GDP shows a continuous increase in Iranian government budget since revolution of 1979 from 11% during Iran-Iraq war (1980-1988) to 21% during Ahmadinejad's government (2006-2012).

Figure 1. Monthly Oil Production of Iran



Source: EIA (2013)

There is an increasing attention in literature and policy discussions on the effectiveness of sanctions for changing the political approaches of Iranian government in different fields such as nuclear program, military projects and human rights. In a recent study, Dizaji and Bergeijk (2013) show that the sanctions can affect the Iranian key macroeconomic variables, improving political openness in short term. Dizaji (2012) investigates the dynamic relationship between government revenues and government expenditures in Iran. His findings show that a strong causality is running from oil revenues (% of GDP) to government total expenditures (% of GDP).

This indicates that sanctions which damage the oil revenues can strongly affect the Iranian government expenditures and this in turn may affect the political behavior of the government. More critically, the foreign exchange reserves of Iran are highly dependent on oil exports. This is in spite of all efforts to increase the size of non-oil exports in post-revolution period. On average, during the Ahmadinejad state the share of oil exports in total exports was 74%. Negative shocks to the main source of government revenues following a wave of sanctions proved to be highly inflationary with negative consequences for industrial production (Farzanegan and Markwardt, 2009). For example, inflation rate shows a significant increase from 7% at last months of 2009 to more than 40% in July 2013. Industrial production has decreased by almost \$2 billion from \$7 billion in 2011 to \$5 billion at the end of 2012 (GEM, 2013).

Farzanegan (2011) was one of the first studies which investigated how sanctions (via negative changes of oil rents) affect the dynamic of government spending in Iran. His study shows that military and security spending of Iran has a significant and negative response to decreasing oil revenues following energy and banking sanctions. In a subsequent paper, he also shows that there is a significant interaction between economic growth and military spending in Iran. Sanction by reducing military spending also lead to lower economic growth in Iran due to strong linkages between military and economy in Iran (Farzanegan, 2012).

A key question of sanction designers is if such restrictions which reflect itself in the allocation of government budget in different fields bring any significant change in the political institutions of Iran. In our paper, we evaluate the government spending-political institutions nexus in Iran.

3- Review of theoretical and empirical literature

Although the relationships among regime type, economic growth, and income distribution are extensively explored in the literature, there is little work devoted to investigating the impact of political system characteristics on the different categories of government expenditures (Brown and Hunter, 1999; Kaufman and Segura-Ubierno, 2001).

Some of the existing studies consider the relationship between democracy and the total amount of the public sector. Aidt and Eterovic (2011) suggest that political competition appears to be negatively correlated with the government size, while the opposite is true for political participation. Moreover, Plümper and Martin (2003), Hausken et al. (2004) and Aidt et al. (2010) find a U-shaped relationship between democracy and public spending. They suggest that for low levels of democracy public spending is high to meet the demands of elites, while for high levels of democracy the usual median voter's model prediction applies and public spending is high due to popular demand of public goods. For medium levels of democracy, however, none of these pressures is active and government spending is at its minimum.

Some other studies have tried to focus on the relationship between democracy and government expenditure in a special area such as military, education, and health. Regarding the military expenditures it is generally believed that as the degree of democracy increases in a country, the military expenditures will decrease. Democratic states are more likely to be at peace and less prone to become involved in international conflicts (James et al., 1999; Oneal and Russett, 1997; Lebovic, 2001). Democratic states resolve their domestic conflicts by compromise and nonviolent means, providing an environment where international conflicts between democratic states are also settled peacefully. James et al. (1999) suggest that two democratic states are more likely to have peaceful relations. They develop a simultaneous two-equation system, showing

that peace and democracy foster each other during the cold war period. According to their findings the dyadic democracy-peace nexus generally was not statistically significant but the alternative, peace causing democracy, was much stronger. Lebovic (2001) shows a positive association between quality of democratic institutions and the share of non-military expenditures to the military ones. Also Yildirim and Sezgin (2005) use cross section and panel data for 92 countries from 1987 to 1997, finding an inverse relationship between the level of democracy and military spending.

There are few studies that investigate the relationship between the characteristics of political systems and education outcomes. Saint-Paul and Verdier (1993) present a model where public education constitutes an instrument of inter-generational redistribution and also creates human capital which promotes long-run growth by raising the human capital of successive generations. In their set-up, democratization rises spending on public education and increases both growth and equalization of income.

Brown and Hunter (2004), using time-series cross-sectional analysis, examine the relationship between democracy and education spending in 17 Latin American countries between 1980 and 1997. They show that democracies devote a higher percentage of their educational resources to primary education, the level that benefits the largest segment of the electorate and that is most critical for human capital formation in developing countries.

The association between political institutions and health spending is also examined in cross country analyses (for more details see Lake and Baum, 2001; Franco et al., 2004; and Besley and Kudamatsu, 2006). Our review shows the importance of examining the association between

political institutions and government spending compositions in case studies, reducing the crucial effect of heterogeneity between different countries in cross country analyses.²

4- Research design

Data description

To examine the dynamic interconnections between political institutions and the structure of the Iranian government spending, we use the following variables: Military expenditures (*ldefetot*), public order and disciplinary expenditures (*ldiciptot*), education expenditures (*ledutot*), health and medical services expenditures (*lhealthtot*), and cultural and recreational services expenditures (*lculttot*) from the Central Bank of Iran (CBI) online database in constant 1997 prices. These variables are expressed as their share in total government expenditures and in logarithmic form. Moreover, we use the Polity index as a widely used measure of political institutions (Marshall et al., 2012). This variable describes combinations of autocratic and democratic characteristics of the institutions of government (Marshall et al., 2012). Subtracting the autocracy score from the democracy score yields a summary measure Polity. This index is from -10 (full autocracy) to 10 (full democracy). The higher scores means a more open and competitive political system. For robustness tests we also use the objective democracy indicator of Vanhanen (2011). We use annual data from 1960 to 2006 for our analysis.

Methodology

We use the VAR model to estimate the interrelationships among our variables. The VAR provides a multivariate framework relating changes in a particular variable to changes in its own lags and to changes in (the lags of) other variables:

² Rodrik (2007, p. 4) also emphasizes on such case studies: “*I believe in the need for both cross-country regressions and detailed country studies. Any cross-country regression giving results that are not validated by case studies needs to be regarded with suspicion...*”.

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

Where y_t is a vector of k endogenous variables, x_t is a vector of d exogenous variables, A_1, \dots, A_p and B are matrices of coefficients to be estimated, 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.

We define the vector of exogenous variables as $x_t = [constant, D_1, D_2]$, where D_1 and D_2 are dummy variables capturing the 1979 Islamic Revolution and the Iran–Iraq war (1980–88), respectively. Since only lagged values of the endogenous variables appear on the right hand side of the equation, simultaneity is not an issue and OLS yields consistent estimates.

We use an unrestricted VAR models in levels. Firstly, structural VAR models are ‘very often misspecified’ (Tijerina-Guajardo and Pagan, 2003). Secondly, the Phillips-Perron and ADF unit root tests indicate that all variables are $I(1)$ ³. Since all the variables are non-stationary but cointegrated, differencing leads to loss of long run information. Sims (1980), Sims, Stock and Watson (1990), Doan (2000) and Fuller (1976) have argued against differencing. After all, in this study we are interested in impulse response functions rather than interpreting each coefficient of the VAR model (see also Farzanegan and Markwardt, 2009, Farzanegan, 2011 and Dizaji and Bergeijk, 2013 for the similar approach). Thirdly, in the short term, which is especially important in our analysis, an unrestricted VAR shows a better performance than a Vector Error Correction Model (for more details see Naka and Tufte, 1997; Engle and Yoo, 1987, Clements and Hendry, 1995 and Hoffman and Rasche, 1996).

³ These tests include a constant but not a time trend, as recommended by Dickey and Fuller (1979). To determine the number of cointegrating vectors we use the approach of Johansen and Juselius (1990). The test statistics indicate that the hypothesis of no cointegration among the variables can be rejected for Iran. The results reveal that at least three cointegrating vectors exist among the variables of interest.

The main applied tools in the VAR models estimation are the impulse response functions (IRF) and the variance decomposition analyses (VDC). The dynamic response of macroeconomic variables to innovations in a particular variable can be traced out using the simulated responses of the estimated VAR system (IRF). Thus, the IRF allows us to examine the dynamic effects of shocks to a particular variable (for example democracy) on the different categories of government expenditures. Through IRF we can observe the magnitude and statistical significance of such responses to one standard deviation increase in democracy related variable error (see Stock and Watson, 2001 for more details on IRF). Variance decomposition analysis shows the role and importance of a specific variable innovation in explaining the variance of other variables in the system.

Empirical results

We use a VAR model with six variables to examine the impact of political changes in Iran on the different categories of government expenditures. In our unrestricted VAR model, the vector of endogenous variables is as follows:

$$y_t = [polity2, health, military, disciplinary, education, culture]$$

This is our first choice as the Cholesky ordering in the VAR system. The first variable in a pre-specified Cholesky ordering has an immediate impact on all other variables (different kinds of government spending) in the system, excluding the first variable and so on. Health, military and disciplinary expenditures followed the first variable in the Cholesky ordering. Finally, education and cultural expenditures are categorized as the most endogenous variables in the VAR system. The Iranian government usually changes the share of these two latter costs to increase or maintain military, security, and health costs (we have followed Farzanegan (2011) in ordering of expenditure variables in Iran). We assume that health expenditures are rather sticky, so that they

are not affected contemporaneously by other kinds of expenditures. After all, health related issues are one of the top priorities of most governments and they cannot be neglected easily. Military and disciplinary expenditures are also sticky but can still be adjusted more easily during peace time.

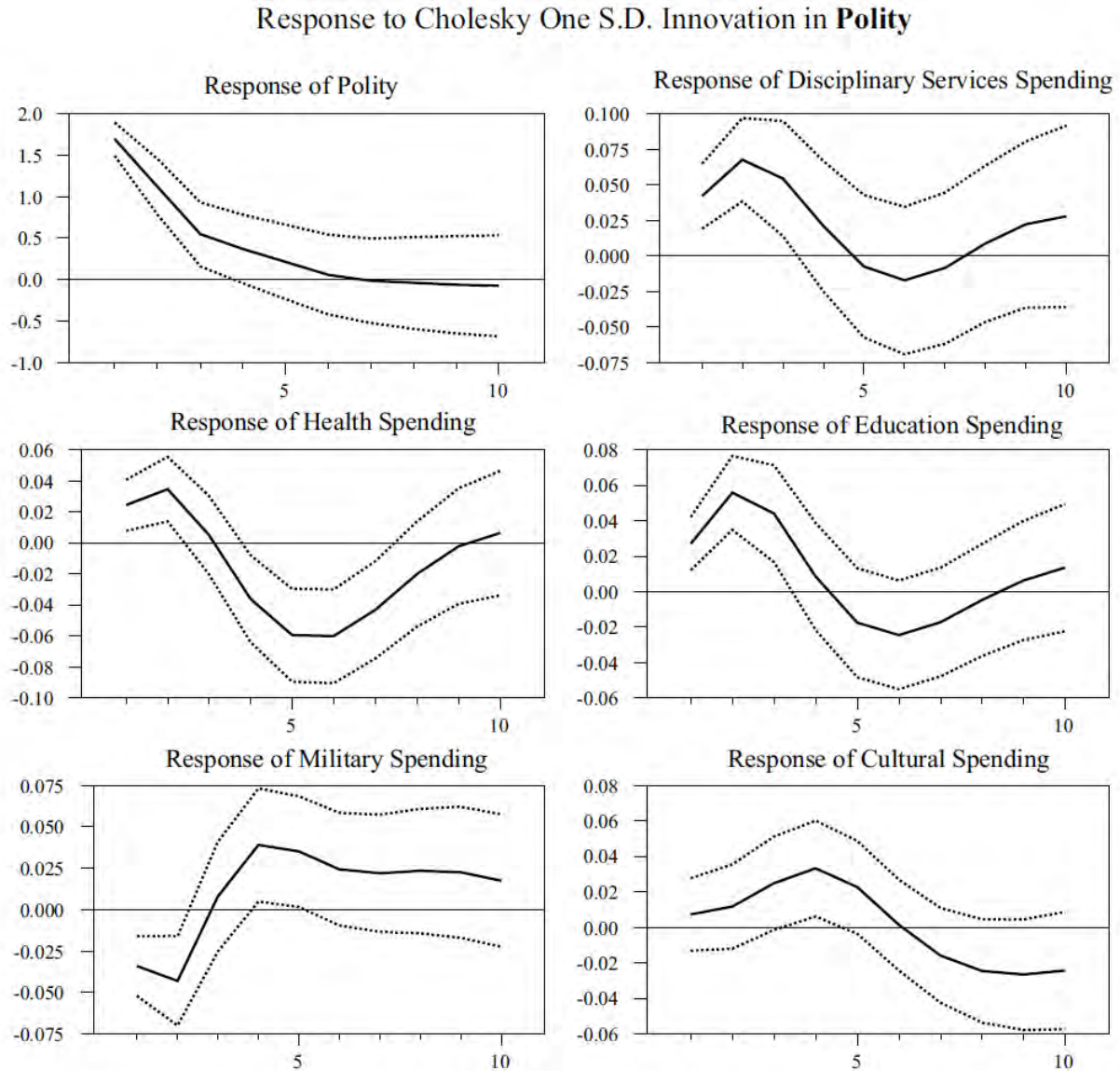
Determining an optimum lag length for a VAR model is also very important. Economic theory usually does not provide any definite guidelines on the appropriate level of lag length in a VAR model. For finding the optimum lag we use information criteria such as LR, FPE (final prediction error), AIC (Akaike information criterion), SC (Schwarz information criterion), and HQ (Hannan–Quinn information criterion). We select the lag length of 2 on the basis of the LR, FPE, and AIC criteria and also with respect to stability and diagnostic tests.

Impulse response functions

In this study, the impulse response functions trace out the response of current and future values of different categories of the Iranian government expenditures (military, education, disciplinary, health, and cultural) to a one standard deviation increase in the current value of political related variable errors. The middle line in IRFs displays the response of different government expenditures to a one standard deviation shock in Polity variable. The dotted lines represent confidence bands at 68% confidence intervals which are built by using 1000 Monte Carlos simulations (see Sims and Zha, 1999 who suggest using one standard deviation for error bands in the IRFs). If the confidence intervals include the zero horizontal line, then the impulse response for that specific period after initial shock is not statistically significant (Berument et al., 2010). In other words, the null hypothesis of “no effects political variable” on the specific government expenditure cannot be rejected. The horizontal line in IRFs shows the time period (years) after the initial shock. The vertical line in IRFs shows the magnitude of response to shocks.

Figure 2 displays the impulse responses of different categories of the Iranian government expenditures to a one standard deviation shock in Polity for a period of 1960–2006.

Figure 2. Impulse responses to one standard deviation shock in Polity index



Note: The graphs show impulse responses of different kinds of government spending (as % of total government spending) to one-standard-deviation shocks in Polity. The dotted lines represent ± 1 standard deviation. 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. All variables (except for Polity index) are used in logarithmic form.

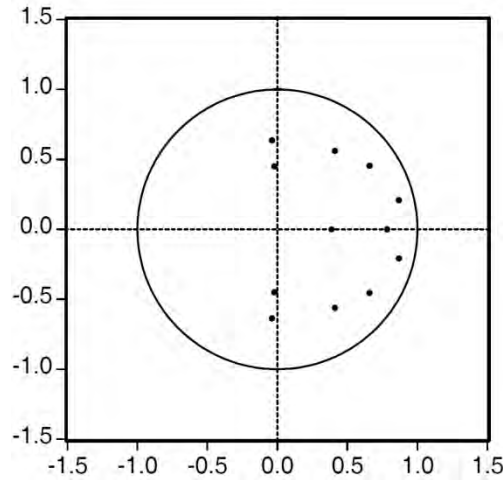
The Polity shock was identified on the basis of a standard Cholesky factorization, ordering Polity first followed by health, military, security, education and cultural expenditures (as % of total expenditures and all variables in logarithmic form except for Polity).

Figure 2 shows that the increasing shocks to Polity (higher political openness) have statistically significant and negative effect on government military expenditures. Military spending reduction in the short term (3 years after democratic shock) is statistically significant. This is in line with previous literature in which democratic development of the political system is associated with lower size of patronage spending. Interestingly the short term response of education, health, disciplinary and order spending to increasing shocks in Polity index is positive and significant.

Linking the results of Dizaji and Bergeijk (2013) with the results of our study implies that economic and energy sanctions cause positive short term effects on the indexes of democracy in Iran and this will perform negative effects on military expenditures and positive effects on government social expenditures such as disciplinary, health and education expenditures.

Also we have examined the diagnostic statistics of the estimated VAR model. For stability of our model Figure 3 shows the AR graph which reports the inverse roots of the characteristic AR polynomial. This figure shows that in the VAR model all roots have modulus less than one and lie inside the unit circle and the VAR model is stable (or stationary).

Figure 3. Inverse roots of AR Characteristic Polynomial



Moreover the results of autocorrelation LM test in Table 1 show lack of auto-correlation in the estimated VAR model's residuals. Overall our diagnostic criteria show that our estimated VAR model which is a basis for the impulse response functions in Figure 2 is stable and satisfactory.

Table 1. VAR residual Serial correlation LM test

Lags	LM-Test	P-value
1	47.4	0.09
2	34.2	0.55
3	42.5	0.21
4	23.3	0.94
5	46.9	0.10
6	35.3	0.50
7	42.2	0.21
8	35.3	0.49

Note: Null hypothesis: no serial correlation at lag order h

Variance decomposition

Table 2 shows that for almost all variables, the largest portion of variation is explained by their own trend in the first year. Hence at the start of the simulations the historical trend of each variable explains a large part of its own variation. Polity shocks play an important role in explaining the variation of the other variables in the long run (Its contributions in explaining the shocks to *ldefetot* and *ledutot* are about 14% and 19 % in 10th year). The contribution of Polity

shocks to government health expenditure shocks was about 10 % in the first year rising to about 26 % in the eighth year. The major part of the variations in military expenditures is explained by its own shocks in all years. However the shocks to Polity and disciplinary expenditures also affect the variance of the military expenditures significantly.

As is evidenced in table 2, shocks to cultural expenditures explained about 31 and 28 % of variation of education expenditures and disciplinary expenditures in the 10th year. This implies that considerable causalities can exist from cultural expenditures to education expenditures and disciplinary expenditures.

Additionally, the results show that forecast errors in Polity other than its own variations are mostly due to variations in education expenditures, disciplinary expenditures and military expenditures respectively. This finding indicates that while political changes can affect the different categories of government expenditures specially education and military expenditures, also these kind of government spending have a considerable role in determining the quality of political institutions in Iran. In other words, probably there are bidirectional causalities between Polity and education expenditures and also Polity and military expenditures.

Table 2. Variance decomposition

	<i>POLITY</i>	<i>LHEALTHTOT</i>	<i>LDEFETOT</i>	<i>LDICIPTOT</i>	<i>LEDUTOT</i>	<i>LCULTTOT</i>
Variance decomposition of <i>POLITY</i>						
1 Year	100	0.00	0.00	0.00	0.00	0.00
2 Years	87.50	1.64	0.04	5.33	5.47	0.00
5 Years	62.03	1.76	2.36	19.76	13.70	0.38
8 Years	52.16	1.81	3.86	20.06	21.62	0.48
10 Years	51.18	1.79	4.61	19.70	21.86	0.86
Variance decomposition of <i>LHEALTHTOT</i>						
1 Year	6.79	93.21	0.00	0.00	0.00	0.00
2 Years	11.32	77.02	0.96	8.27	1.67	0.75
5 Years	20.47	43.86	0.93	18.63	1.75	14.36
8 Years	26.24	30.01	2.97	22.59	8.23	9.95
10 Years	22.78	26.13	4.51	22.67	15.08	8.83
Variance decomposition of <i>LDEFETOT</i>						
1 Year	9.97	4.58	85.45	0.00	0.00	0.00
2 Years	11.09	4.08	80.16	2.99	1.13	0.53
5 Years	13.87	5.26	68.93	8.19	1.00	2.75
8 Years	13.79	6.87	54.25	15.59	4.61	4.90
10 Years	13.73	6.33	49.85	16.78	8.37	4.94
Variance decomposition of <i>LDICIPTOT</i>						
1 Year	9.8	6.97	6.18	77.04	0.00	0.00
2 Years	18.30	3.68	5.20	62.50	0.87	9.45
5 Years	11.96	2.40	3.14	47.56	2.65	32.30
8 Years	10.65	5.01	2.83	48.79	2.77	29.95
10 Years	11.33	5.45	2.73	48.72	2.94	28.83
Variance decomposition of <i>LEDUTOT</i>						
1 Year	9.26	14.03	2.89	8.84	64.98	0.00
2 Years	22.38	10.11	2.80	4.07	51.25	9.37
5 Years	19.50	7.66	1.81	6.69	33.70	30.64
8 Years	19.24	8.04	3.41	7.27	29.58	32.47
10 Years	18.60	8.56	4.00	7.99	29.48	31.37
Variance decomposition of <i>LCULTTOT</i>						
1 Year	0.38	0.19	6.95	2.16	0.43	89.90
2 Years	0.87	3.03	4.77	1.56	1.66	88.11
5 Years	8.28	6.23	5.14	3.41	3.85	73.07
8 Years	9.30	6.83	6.70	4.79	10.33	62.05
10 Years	11.70	6.95	6.29	8.77	9.66	56.62

Robustness analyses

a. Generalized impulse responses

Ordering of variables in the VAR system is important in order to calculate the IRFs and VDC analyses. Different ordering may result in different IRF results. In order to avoid the difficulties of identifying orthogonal shocks in VAR models, Pesaran and Shin (1998) introduced Generalized Impulse Responses (GIR). The GIR functions construct an orthogonal set of innovations that does not depend on the VAR ordering. For comparison, we calculate the generalized impulse responses of the different compositions of government spending to total government spending ratio to a one standard deviation shock in Polity. The responses are similar to those which we obtained using Cholesky one standard innovation⁴.

b. Alternative definition for quality of political institutions variable (Vanhanen index)

We use also an alternative institutional quality indicator called Vanhanen index (VI). The Vanhanen index of democratization is defined as the product of two underlying indices for political competition and political participation (Vanhanen, 2011). Since considering the effects of political changes on the different categories of the government expenditures is a key issue of our analysis, it is important Polity and VI measures do not only differ conceptually, but that their measurement also differs (Polity scores are subjective/judgmental while Vanhanen deploys numerical voting records). Consequently, the two indicators show different patterns of variation. The Vanhanen index is taken directly from the Finnish Social Science Data Archive (Vanhanen, 2011).

⁴ Since the GIR results are identical to those obtained by the Cholesky ordering, we have not reported them here. They are available upon request.

For this purpose we re-estimate the VAR model using the same Cholesky ordering (with Vanhanen index instead of Polity) as in previous analysis. Considering the different lag criteria, we use 2 lags as the optimum number of lags in our analysis. We also control for the exogenous shocks of the Islamic revolution and the war period with Iraq. The VAR stability condition test (Roots of Characteristic Polynomial) indicates that the VAR satisfies the stability condition. The impulse response analysis, using Vanhanen index as a shock variable is presented in Figure 4.

Looking at Figure 4 shows that response of disciplinary services and education spending to shocks in Vanhanen index is positive and significant in short term. However, military spending negative response is not statistically significant. Possibly, this is because we should make differences between *positive shocks and negative shocks* as it has been discussed in the literature of asymmetric shocks by Mork (1989) and Hamilton (1996).

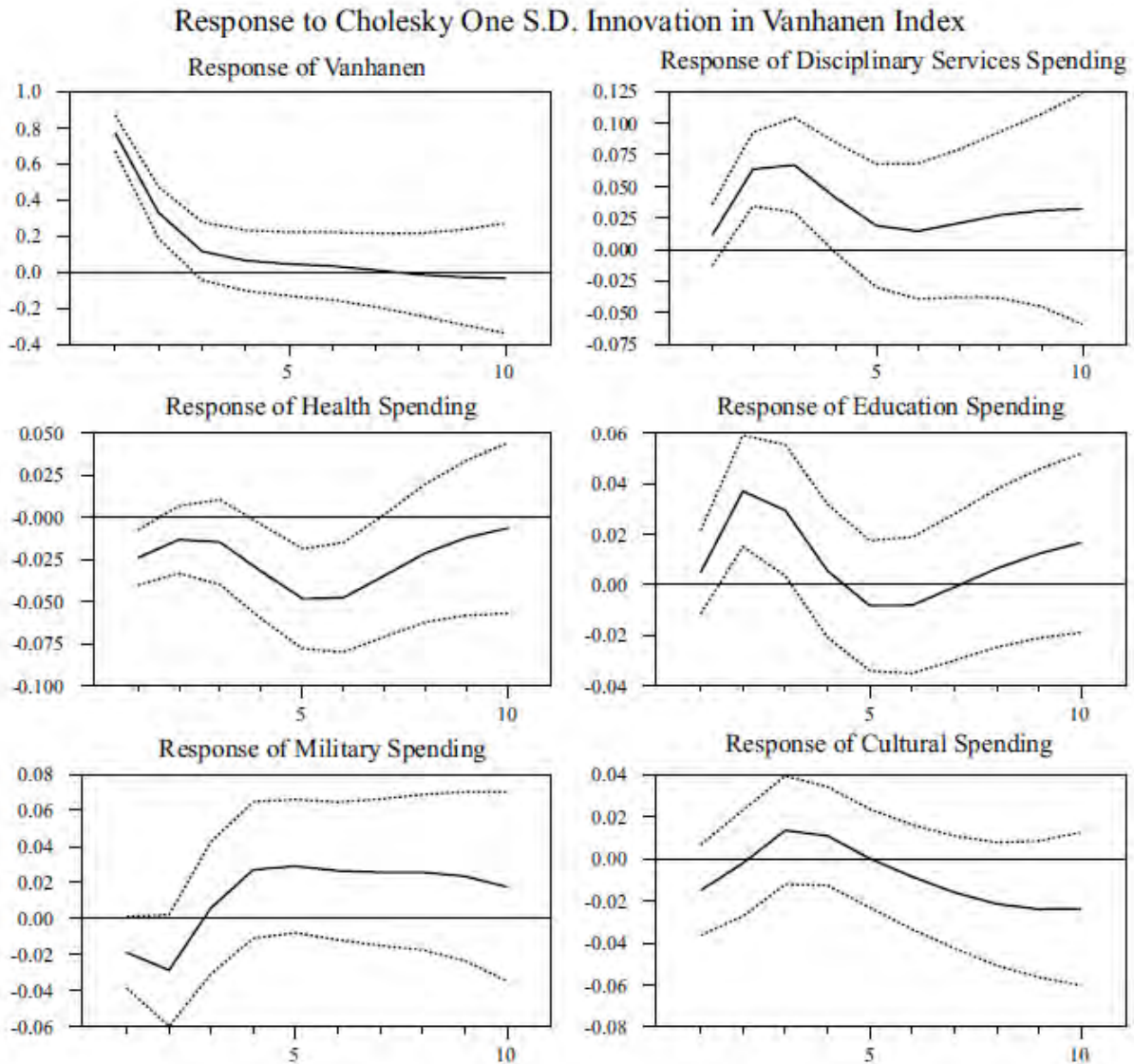
In line with Mork's work which has proposed an asymmetric definition of oil prices in order to distinguish between positive and negative oil price shocks, we define the positive and negative changes in Vanhanen index (VI) as follows:

$$MVI_{t+} = \max (0, (VI_t - VI_{t-1}))$$

$$MVI_{t-} = \min (0, (VI_t - VI_{t-1}))$$

where VI_t is Vanhanen index in time t . For more comprehensive details on asymmetric shocks see Mork (1994).

Figure 4. Impulse responses to one standard deviation shock in Vanhanen index

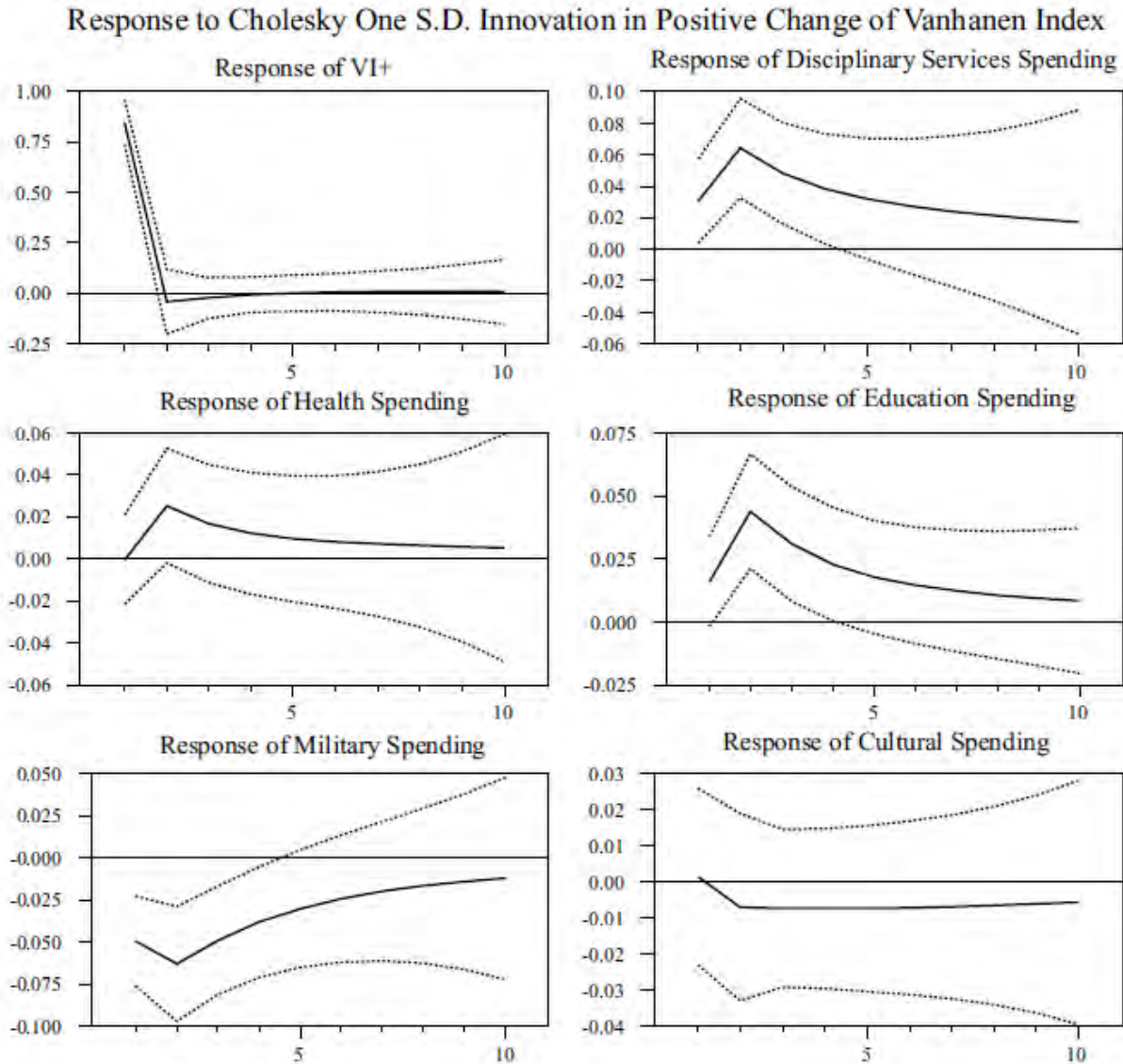


Note: The graphs show impulse responses of different kinds of government spending (as % of total government spending) to one-standard-deviation shocks in Vanhanen. The dotted lines represent ± 1 standard deviation. The deviation from the baseline scenario of no shocks is on the vertical axis; the periods (years) after the shock are on the horizontal axis. The vertical axis shows the magnitude of the responses. All variables (except for Vanhanen index) are used in logarithmic form.

Figure 5 shows IRFs based on one standard deviation shock to positive changes in Vanhanen index. We use 1 lag of endogenous variables on the basis of different lag criteria, controlling for

revolution and war with Iraq exogenous shocks. The results of stability test on our VAR model are also satisfactory⁵.

Figure 5. Impulse responses to one standard deviation shock in positive changes of Vanhanen index (MVI+)



Note: The graphs show impulse responses of different kinds of government spending (as % of total government spending) to one-standard-deviation shocks in positive changes of Vanhanen. The dotted lines represent ± 1 standard deviation. 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. All variables (except for Vanhanen index) are used in logarithmic form.

⁵ These results are available upon request.

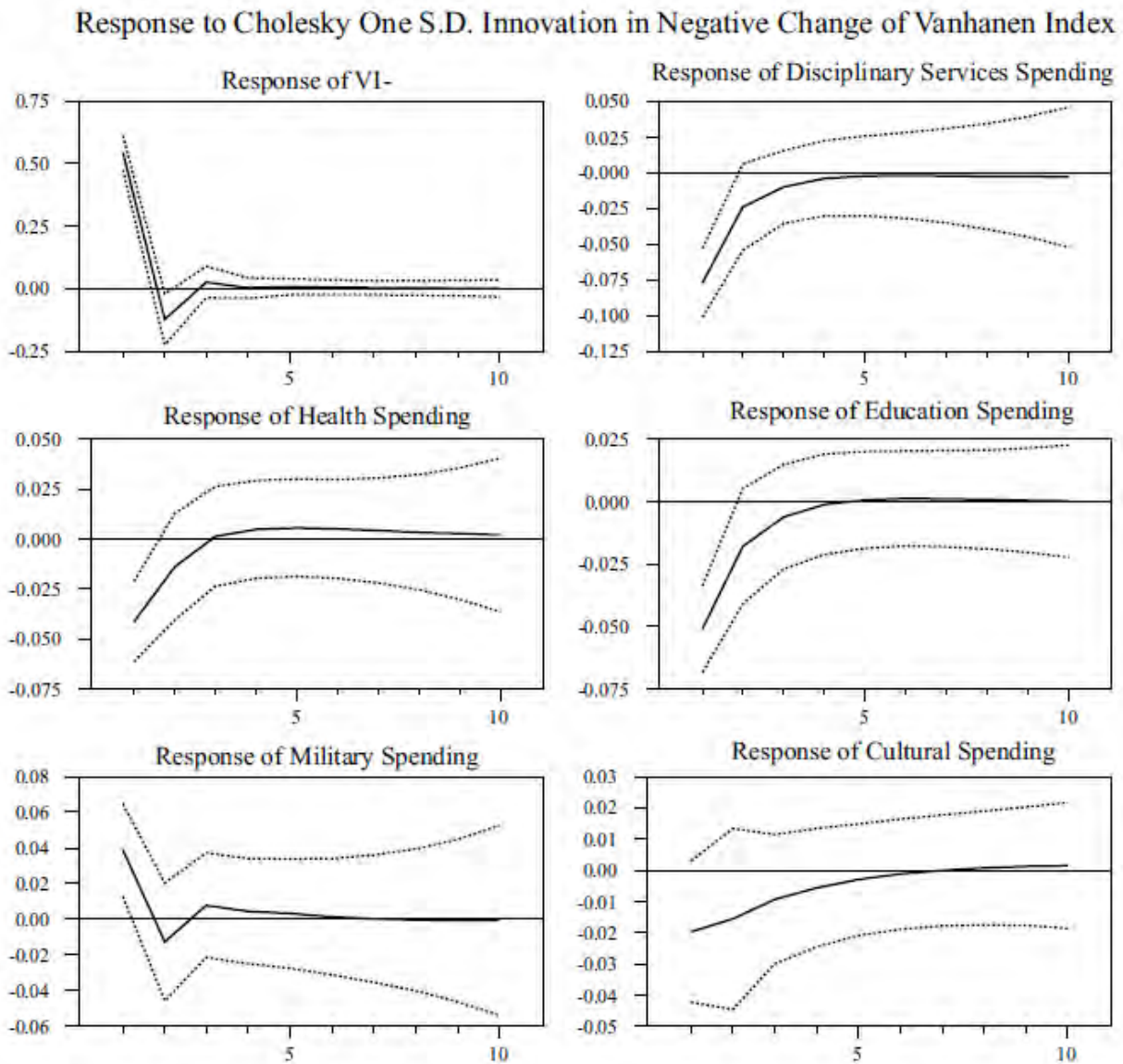
Following shocks in positive changes of the Vanhanen index of democracy, we can see a negative response of military spending which is also statistically significant until five years after initial positive democracy shocks. The military spending response reaches its lowest level in the second year after positive shock in democracy. Education and disciplinary (public order) spending show a positive response to positive democracy shocks which reached their maximum in the second year after shock. These responses are also statistically significant for the first 4 years after initial shock. These results show that positive development in democratic institutions lead to lower patronage spending and higher provision of goods and services which target a larger portion of population demands rather than meeting a small military group.

But what are the reflections of negative changes in democratic quality of institutions? Figure 6 illustrates the response of the relative share of different components of government spending in total budget to negative changes in Vanhanen index. We use 1 lag of endogenous variables on the basis of different lag criteria, controlling for revolution and war with Iraq exogenous shocks⁶. A one standard deviation increase in absolute values of “negative changes” of Vanhanen index for Iran accompanied with negative responses of the relative shares of government expenditures in health, disciplinary and education. However, these responses are only significant in the first and second years after initial shock. Interesting is the also the positive response of military spending to negative developments in democratic institutions. The positive response of military is only statistically significant in the first year after initial negative changes of democracy in Iran. This is again the line of our theoretical expectations. Less democratic states need to spend more on a selected portion of population and society which may provide physical support at the time of emergency such as revolutions or riots. The opportunity cost of military spending under

⁶ The estimated VAR model satisfied the stability and cointegration conditions. The results of these tests are available upon request.

negative democratic developments is also high: less funding will be available for education, health and public order.

Figure 6. Impulse responses to one standard deviation shock in negative changes of Vanhanen index (MVI-)



Note: The graphs show impulse responses of different kinds of government spending (as % of total government spending) to one-standard-deviation shocks in negative changes of Vanhanen. The dotted lines represent ± 1 standard deviation. 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. All variables (except for Vanhanen index) are used in logarithmic form.

In addition to Mork's approach in defining the asymmetric shocks, we also use another definition suggested by Hamilton (1996). In consistence with Hamilton's work which has proposed an

asymmetric definition of oil prices, we define the positive and negative changes in Vanhanen index (VI) as follows:

$$HVI_{t+} = \max [0, ((HI_t) - \max ((HI_{t-1}), \dots, (HI_{t-4})))]$$

$$HVI_{t-} = \min [0, ((HI_t) - \min ((HI_{t-1}), \dots, (HI_{t-4})))]$$

Our findings show that the responses with Hamilton's definition of asymmetric shocks are similar to those which we obtained using Mork's definition. Therefore we have not reported them here⁷.

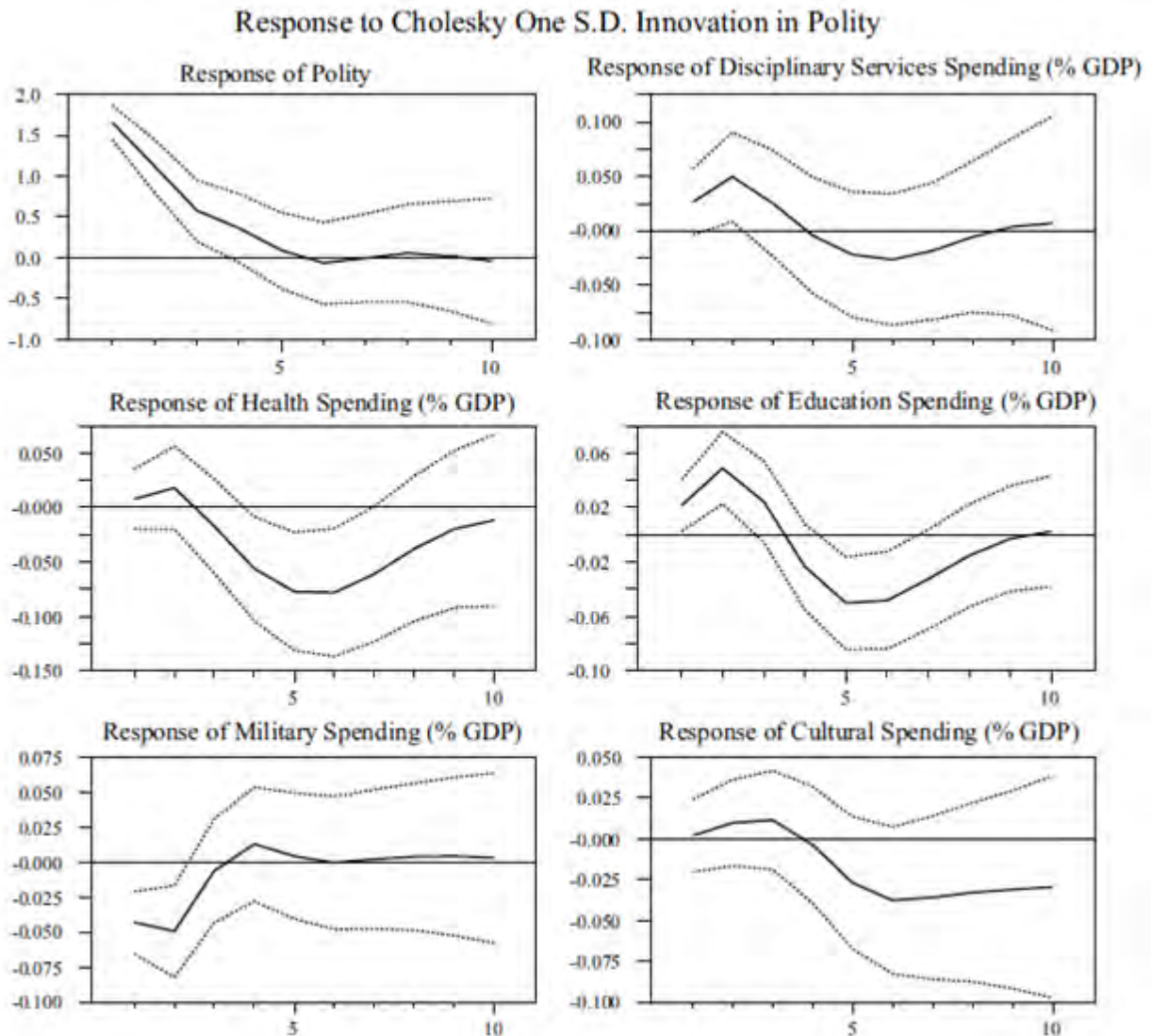
c. Using the ratio of government expenditures to GDP

As an alternative specification, we employ the ratio of each components of government spending to GDP instead of their relative share in budget in our impulse response analysis. How innovations in political variable (Polity) affect the distribution of different categories of government spending to GDP ratio? First, we estimate an unrestricted VAR model with an optimum lag number of 2 (on the basis of different lag criteria) and Cholesky ordering of [Polity, health to GDP, military to GDP, disciplinary to GDP, education to GDP, and cultural to GDP]. As in previous analysis, we include revolution and war dummy variables as exogenous shocks. The diagnostic statistics such as VAR stability condition show that no root lies outside of the unit circle and the model is stable. The model also does not show a specific problem with residual autocorrelation on the basis of LM test. Moreover the results of cointegration tests reveal that at least three cointegrating vectors exist among the variables of interest⁸.

⁷ The results with Hamilton's definition of asymmetric shocks are available upon request.

⁸ The diagnostic statistic results are available upon request.

Figure 7. Impulse responses to one standard deviation shock in POLITY index



Note: The graphs show impulse responses of different kinds of government spending (as % of GDP) to one-standard-deviation shocks in Polity index. The dotted lines represent ± 1 standard deviation. 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. All variables (except for Polity index) are used in logarithmic form.

Figure 7 shows that a one standard deviation increasing shock in Polity accompanied by initially negative and significant responses in military spending to GDP and positive and significant

responses in education spending to GDP within the first 2 years after initial shock, reinforcing our earlier results using relative share of spending in the government budget.⁹

d. Using the political variable as the response variable

Our variance decomposition analysis showed that while the Polity variable plays a considerable role in explaining the shocks to the different categories of government expenditures, but also the variations in different categories of government expenditures may affect the changes in Polity differently. In other words and from the political view we like to know if there is a possibility to shape the quality of political institutions by adjusting the spending behavior of Iranian government.

For this purpose we define another Cholesky ordering for our VAR model to deal with our political variable as a response variable instead of giving it the role of a shock variable. Then we estimate an unrestricted VAR model with an optimum lag number of 2 (on the basis of different lag criteria) and Cholesky ordering of [health to GDP, military to GDP, disciplinary to GDP, education to GDP, cultural to GDP, and Polity]. In this VAR model we are interested in considering the responses of Polity as our political variable to the shocks to the different categories of government expenditures. Figure 8 shows response of democracy in Iran to selected government spending shocks (health, military and education).

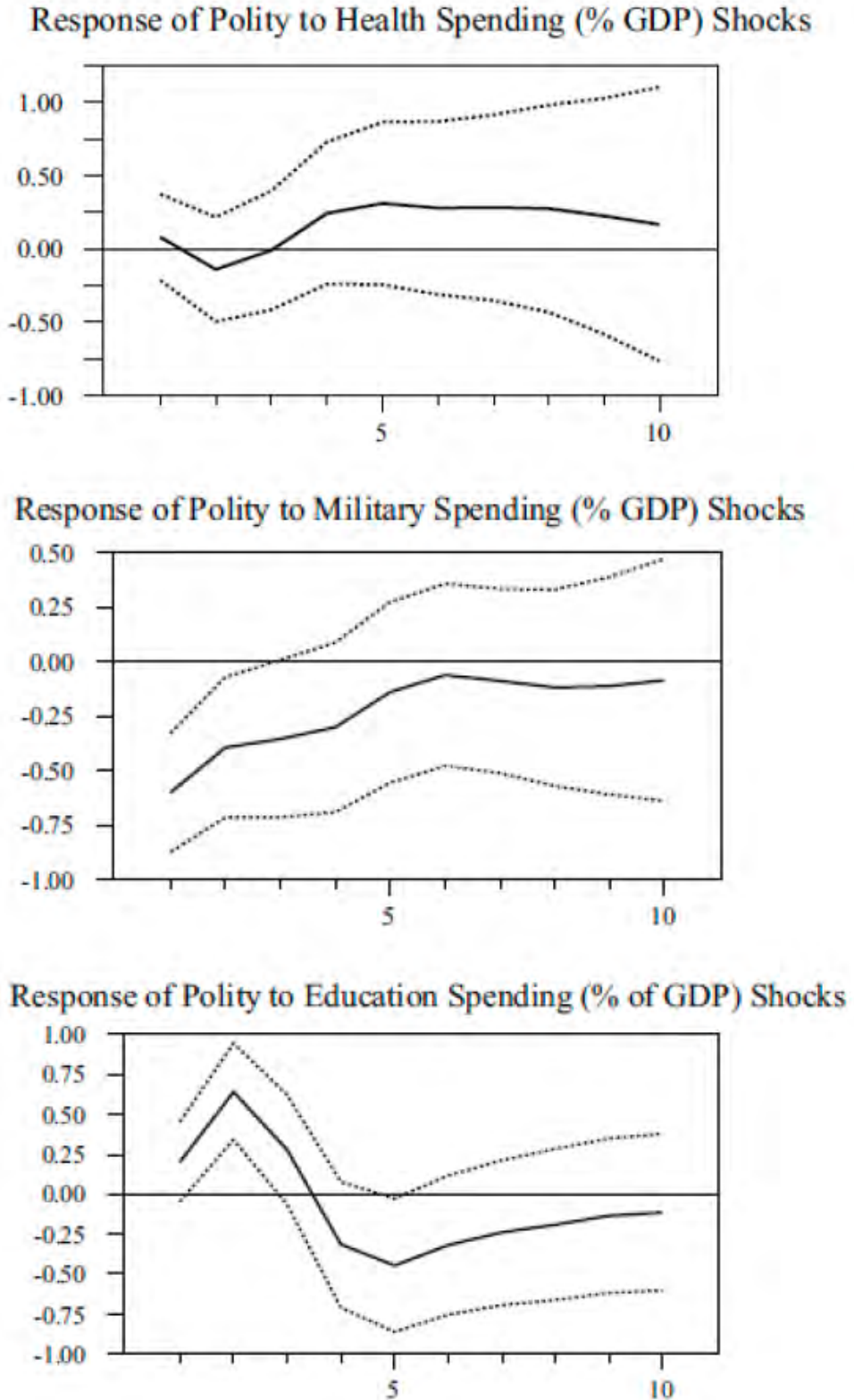
⁹ In addition, we have estimated a VAR model using the per capita form of each components of government spending. We have estimated an unrestricted VAR model with a Cholesky ordering of [*polity, lhealthcap, ldefecap, ldicipcap, leducap, lcultcap*]. We can find the significant responses only for the defense expenditures. The IRFs show that defense expenditures response both negatively and significantly (within the first 2 years after initial shock) to one standard deviation increasing shock in Polity. We cannot find significant responses regarding to the other kind of expenditures. These results are available upon request.

We include revolution and war dummy variables as exogenous shocks. The diagnostic statistics such as VAR stability condition show that no root lies outside of the unit circle and the model is stable. The model also does not show a specific problem with residual autocorrelation on the basis of LM test. Moreover the results of cointegration tests reveal that there are long run relationships among the variables of interest¹⁰.

Figure 8 shows that the response of democratic institutions (Polity) to a one standard deviation increasing shock to the military spending (% of GDP) is negative and statistically significant for the first three years after initial shock. Lifting economic and banking sanctions may increase spending the larger amount of GDP on military fields which then lead to significant degradation of political institutions in Iran. Interesting is the positive and significant response of democratic institutions to an increasing shock in education spending. This positive response reaches its maximum in the second year after shock. This shows the two way relationship between education spending and democracy. Increasing political openness (increasing shocks in Polity) may transfer government budget from patronage spending to more provision of public services such as education and health. Also spending on education might also increase the willingness of citizen for more accountability and transparency of political system (see Stasavage, 2005 for similar argument on education spending and democracy in Africa).

¹⁰ The diagnostic statistic results are available upon request.

Figure 8. Response of POLITY to one standard deviation shock in selected groups of spending



5- Discussion and conclusion

We investigate the dynamic relationship between different kinds of government spending and quality of political institutions in Iran from 1960 to 2006, using the impulse response functions and variance decomposition analysis. In this paper, we examine how positive and negative shocks in political institutions of Iran shape the current and future developments of government budget allocation to military and non-military categories. Additionally, we investigate how shocks in different category of government spending shape the current and future changes in quality of political institutions.

There is an increasing attention in scholarly and policy discussions on the effectiveness of sanctions to change the political institutions or behavior of Iran. Sanctions which reflect themselves in negative oil revenue shocks are proved to be of relevance for government budget allocation, especially regarding the significant response of military spending (Farzanegan, 2011). It is also shown that economic growth of Iran is significantly linked to military spending shocks (Farzangean, 2012). However, one can also examine the responsiveness of political institutions to shocks in specific groups of government spending and also how the government budget responds to any significant shock in quality of political institutions. We have filled this latter gap in literature by our analysis.

The impulse response analysis shows that response of military spending to positive changes in quality democratic institutions in Iran is negative and statistically significant for 3 years after initial shock. This is an important finding. If the sanctions are successful to change the political behavior of Iran in short run (as is shown in Dizaji and Bergeijk, 2013), then one can also expect to see a reduction in allocated budget for military (patronage) in Iran. In other words, lifting sanctions may repress the political openness and increase spending on military group in short

term. In addition, our results contribute to the literature on patronage and public goods provision under different political regimes in a developing country.

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