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Comparing the sanctions against Russia and Iran: VAR modelling of the political-economic impact of sanctions

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Abstract

This working paper analyses the interaction between economic and political variables paying special attention to how this interaction develops over time. We use an innovative approach to sanctions that provides a dynamic, forward-looking, perspective and deals with the economic and political outcome of sanctions simultaneously. We use Impulse Response Functions to report the main results of a comprehensive set of unrestricted Vector Auto Regression models that we use to analyse how negative oil and gas shocks impact on the economy and politics in Russia and Iran in order to find out differences and agreements between those cases. In both cases we find that the limitation of energy rents can improve political conditions in the short to medium term, but also that the beneficial impact of sanctions is limited as both economic and political behaviour adjust when time passes by.

Keywords

Economic Sanctions, Russia, Iran, VAR, comparative analysis.

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Comparing the sanctions against Russia and Iran
VAR modelling of the political-economic impact of sanctions

1 Introduction

Sanction research has often been characterized as a black box (van Bergeijk 2021). Typically, the empirical literature reports quasi reduced form equations based on a review of the relevant literature rather than a well specified structural model. There are basically two approaches that can distinguished by the assumed direction of causality: (a) the argument that takes the target's political behavior as the dependent variable and (b) the strand of the literature that investigates how sanctions exert an impact on the economy.

– *The determinants of the sanction target's political behavior*. The lefthand side variable of the black box equation is often some measure of success or failure, that is: the extent to which a sanction changes the target's political behavior. However, also other variables have been used to investigate the socio-political impact (e.g., human rights or changes in the political system). The righthand side of the black box equation consist of a set of explanatory variables that relate to

- economic vulnerability and resilience,
- economic impact including observed evasion,
- characteristics of the type of sanction and its goals and/or
- political indicators that reflect the relationship between sanction sender and sanction target as well as alliances with one of the parties.

Typically, and for obvious reasons, these explanatory variables are measured in the year before sanction threat and or imposition. Occasionally timing issues are considered, for example, to allow for adjustment and learning (van Bergeijk and van Marrewijk 1995).

– *The impact of sanctions on the target economy*. In this strand of literature, the lefthand side variable is some measure of economic impact. A great many dimensions have been investigated: trade flows (exports, imports, goods, services), capital flows (foreign investment, lending, development aid, remittances) firm level (e.q. productivity) or a macroeconomic impact measure for the target economy (production, unemployment, etc.).[1] The right-hand side variables typically use:

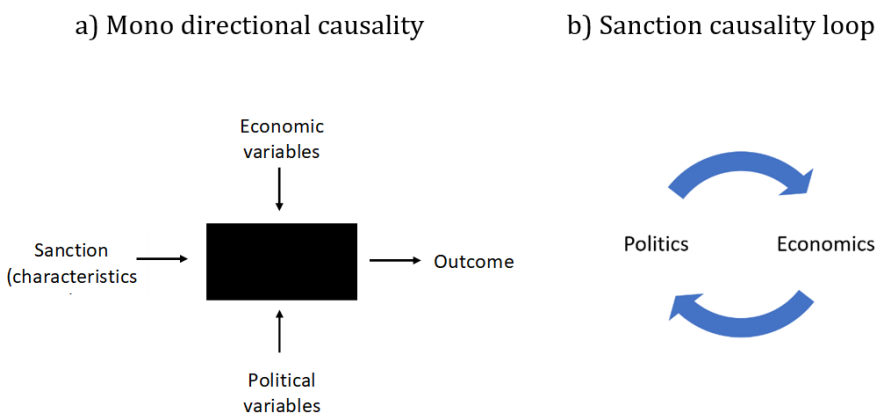
- a dummy variable for the application of a sanction (threat),
- indicators for the kind of sanction and
- indicators for vulnerability and resilience (some of which are economic, and some are political).

The lag structure predominantly assumes (and sometimes tests) that the impact of sanctions changes over time as the target economy adjusts and papers occasionally also investigate the impact of anticipation of future sanctions (Dai et al 2021).

[1] See, for example, Caruso, 2003.

The main point that this working paper addresses is the fact that the causality in these strands of the literature predominantly is mono-directional by assumption. As the hypotheses on the direction of causality differ it is not really a surprise that the sanctions literature is not converging (Clifton et al. 2021; Demena et al. 2021).[2] This strongly suggests that theory and application explicitly need to consider that politics and economics mutually influence each other in the case of sanctions. It is this third way that this working paper proposes (Figure 1).

Figure 1
Different approaches to sanction modelling



This working paper sketches an approach that takes the mutual dependence of economics and politics as a point of departure, introducing a loop between political and economic variables (Figure 1).[3] Our approach neither pre-imposes an economic structure nor a lag structure. The reason to use a dynamic statistical approach (Vector Auto Regression) is that we do not want to rely on specific theoretical assumptions, for example (neo) Keynesian, monetarist or (neo) classical. Theoretical *priors*, although sometimes suggested by conditions of time and place in actual cases, would moreover reduce the more general applicability that we strive for.

We will discuss two cases from a comparative perspective: the sanctions against Iran in 2012 and against Russia in 2022, respectively.[4] It should on the one hand, be clear from the start that the sanctions are to a large extent quite different both in terms of sanction goals (non-proliferation/military), sanction

[2] Relatedly, a problem is that the different vintages of data sets play havoc, see Irina (2021) and Van Bergeijk and Siddiquee (2017).
[3] See for a mono-directional VAR analysis of sanction damage: Pestovanna et al. (2022).
[4] We use these two cases because our analyses have been peer-reviewed and published: Dizaji and Van Bergeijk (2013 for Iran and 2023 for Russia).

instruments (largely macroeconomic/initially mainly targeted) and external economic environment (the aftermath of the Great Recession/COVID-19 pandemic; see van Bergeijk (2013, 2022). On the other hand, similarities exist, including a history of earlier imposed sanctions by the US and EU, an autocratic governing structure and the fact that both countries are energy exporters and may therefore suffer from the Resource Curse. While the differences may convince the reader that our approach is applicable in different cases, the similarities may warrant caution regarding applicability: the bottom line is that this working paper only demonstrates two cases and that we hope that our findings stimulate the development of such models for other sanction cases in order to find out whether our approach is generally applicable.

The remainder of this working paper is organized as follows. Section 2 provides our motivation for VAR-modelling of sanctions and offers a succinct introduction to this method. Section 3 discusses econometric and simulation issues. Section 4 compares the findings of the two cases, illustrating the use of impulse response functions and variance decomposition. Section 5 analyses the benefits and costs of VAR modelling of economic sanctions, from the perspective of policy makers, policy analysts and academic researchers. Section 6draws some conclusions and Section 7 offers suggestions avenues for future research.

2 Vector Auto Regressive Sanction modelling

Sanction research builds on a long history of qualitative case studies and descriptive statistics. Quantitative country case studies did exist, but formed a minority of studies, possibly due to data requirements, computational constraints, and complexity of macro-economic modelling.[5] As of 1985 the dominant approach in sanction research became the analysis of so-called large-*N* data sets, that are: collections of sanction case characteristics of which Hufbauer and Schott's (1085) *Economic Sanctions Reconsidered* is the seminal start and the Global Sanctions Data Base (Kirilakha et al. 2021) is the most recent best practice example. While important improvements have been made in coverage both in terms of cases and in period covered by the large-*N* data sets (Portela and Charron (2023), the approach appears to have reached its limits (van Bergeijk 2019). The empirical literature is by and large based on a limited number of data collections that essentially use approach pioneered by Hufbauer and Schott (Peksen 2019). In the core these data sets do not consider the channels by which politics and economics interact in the case of sanction threats and applications. How can we shift the literature's focus from essentially static observations (outcome of sanction cases and pre sanction values of 'determinants' towards an approach that recognizes the dynamic interplay of macroeconomic and political variables and also investigates how these factors *codetermine* the political impact of sanctions? Our aim is to discuss such an approach.

[5] Examples are Bayard, et al. (1983), Hughes Hallett, and Brandsma, (1983), Khan, (1988), and Porter (1979).

We recognize that such an ambition implies that we need to acknowledge practical constraints. To be useful the method needs to be applicable to a large domain of:

- *economic conditions*, ranging from underconsumption to excess demand,
- *economic structures*, ranging from countries with a large public sector to economies dominated by private firms,
- *levels of development,* and
- *political systems*, ranging from autocracies to democracies.

The implication is that structural models (such as large econometric models of computational general equilibrium models) with a significant number of fixed parameters to be established by means of econometric research are less fit for our goal. It is after all difficult to imagine a structural model that would be useful on this large domain. Therefore, rather than imposing an *a priori* theoretical structure, we decided to let the data speak by means of a Vector Autoregressive (VAR) model, that enables us to consider all variables to be (potentially) conjointly endogenous. A VAR moreover does not impose the kind of *a priori* restrictions on structural relationships that we want to avoid. Our methodology has its roots in economics (Sims, 1980) but is also acknowledged as a useful approach in political science especially when the short-run and long-run impact of interventions is important (see Freeman (1989), Enders and Sandler (1993) and Dizaji (2022).

Essentially, a 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:

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

where y_t is a vector of k endogenous variables, x_t is a vector of d exogenous variables, $A_1,\ldots, A_p$ and B are matrices of coefficients to be estimated, and ε_t is a vector of unexpected shocks that may be contemporaneously correlated but are uncorrelated both with their own lagged values and with all of the right-hand side variables. Since only lagged values of the endogenous variables appear on the righthand side of the equation, simultaneity is not an issue and OLS yields consistent estimates. The VAR treats all variables as jointly endogenous and does not impose *a priori* restrictions on structural relationships. Since the VAR expresses the dependent variables in terms of predetermined lagged variables, it is a reduced-form model.

Estimation of a VAR model with political-economic sanction loop in the real world encounters a number of challenges related to data availability. Typically, many of the variables are available on an annual basis only. This is especially true for the political variables. Many economic data are available with higher frequency.[6] The exchange rate, the interest rate and stock market data are available on a daily basis. Inflation, unemployment and trade flows are reported

[6] Typically, at lower levels of development the frequency for these data is lower.

monthly. Many countries report Gross Domestic Product, investment and consumption on a quarterly or biannual basis. However, also for economic observations annual observations are still the dominant or determining frequency.[7] By implication the data available for estimation will be of an annual frequency. Estimating large VARs would thus be hindered by too limited a degree of freedom. This is why we suggest to estimate a large family of small models. In these specifications one can distinguish between different sanction shocks, consider the impacts of sanctions on different sets of economic variables and analyze several indicators for movements along the autocracy-democracy spectrum. Running different specifications of the VAR model has the side benefit that it allows the researcher to test for robustness of the findings (Dizaji 2019) which is also relevant since indicators for the political system although coded by academic experts are prone to bias due to subjectivity and methodology.

The main tools in the VAR approach are:

1. *impulse response functions (IRFs)*
   IRFs are reported as graphs and allow us to examine the dynamic effects of sanction shocks on the other variables. The dynamic response of macroeconomic and political variables to unexpected shocks in a particular variable can be traced out by using the simulated responses of the estimated VAR system. Through the IRF graphs, we can observe the magnitude and statistical significance of such responses to a sanction shock.
2. *variance decomposition*.
   The variance decomposition can be used to analyze the proportion of the changes in the time series of a specific that are due to innovations in other variables. In particular this is useful to investigate the comparative importance of variables in the sanction loop.

Given the intellectual, computational and data collection requirements it is fair that we demonstrate the viability of this approach in concrete sanction cases. Therefore, we will discuss two sanctions cases where we have applied the VAR methodology in the next section.

3 Econometric and simulation issues

As already stated, the cases of the sanctions against Iran and Russia share similarities but also have important differences. We start this section with a discussion of the differences and similarities that occur in our modelling of both cases. Table 1 provides a summary of econometric aspects.[8] Both cases are built

[7] For example, the level of development is mainly determined on an annual basis, firm level data are produced on an annual basis while census data that report on one specific year may be collected only at long intervals.

[8] The table compares Dizaji and van Bergeijk (2013), *op. cit.* and van Bergeijk and Dizaji (2022) Energy sanctions and Russia's democracy – autocracy: a dynamic VAR analysis, *ISS working paper. General Series 703*, The Hague: International Institute of Social Studies.

on a family of VAR models and use a 10-year horizon for the IRFs and variance decomposition. We start with a similar set of explanatory variables. According to the Phillips–Perron and Augmented Dikey Fuller unit root tests our variables are integrated of order one *I*(1). Generally speaking, if all the variables in the system are non-stationary, it is better to use a VAR in levels. On the other hand, estimating a VAR in the levels in the case of cointegration may lead to the neglect of important constraints. Following the approach of Johansen and Juselius (1990), we reject the hypothesis of no cointegration among the variables for both Iran and Russia. We have applied several statistical criteria to find the optimal lag length of our VAR models. These information criteria are LR, FPE (final prediction error), AIC (Akaike information criterion), SC (Schwarz information criterion), and HQ (Hannan–Quinn information criterion).

Ordering of variables in VAR models is also important and can change the dynamics of a VAR system. The first variable in the Cholesky ordering is usually the most exogenous variable among the variables of the VAR system. We suppose that oil and gas revenues have been restricted by the international sanctions, and therefore it is determined by them. Then, we expect that significant shocks in oil and gas rents affect contemporaneously the other key variables in the system. Additionally, we have also applied a group of generalized impulse responses, suggested by Pesaran and Shin (1998), which are independent of the VAR ordering. The general results do not change.

The VAR stability condition test (roots of characteristic polynomial) indicates that the VAR satisfies the stability condition and therefore the results are reliable.

Table 1
Comparative econometric similarities and differences

	Iran	**Russia**
Model	VAR	VAR
Estimation period	48 years	31 years
Time horizon	10 years	10years
Sanction shock variable(s)	Total oil and gas rents p.c.	Oil rents p.c. Gas rents p.c.*)
Family of models	20	14
Economic variables	Government consumption p.c. Imports p.c. Gross capital formation p.c. GDP p.c. Exchange rate CPI	Government consumption p.c., Imports p.c. Gross capital formation p.c. GDP p.c. #) Exchange rate CPI#) Defense spending p.c.*)
Political variables	Polity Vanhanen	Polity V-Dem indicators for electoral, liberal, deliberative, egalitarian and participatory democracy

Notes:
*) robustness analysis
#) not included in VAR because of failed tests

For economic variables we used defense expenditure per capita as a robustness analysis for the case of Russia.[9] For political variables both cases investigate *Polity*.[10] The Iran case uses *Vanhanen* (2011) indicator as an alternative; in the case of Russia five V-Dem indicators for democracy have been used (Coppedge et al. 2015). Practical reasons and judgement play a role in the differences in the actual applications. Three issues are especially relevant:

–1. The estimation period differs considerably from 48 years for Iran to 31 years for Russia. The shorter estimation period is due to the economic and political break of the collapse of the Union of Soviet Socialist Republics (USSR) – thus, for practical reasons the data series on modern days Russia starts in 1990.[11] The time series is shorter than one would like, but the econometric results are still sufficiently reliable to do the analysis. However, this may be considered as a minimum requirement limiting the number of cases potentially available for our research strategy. For example, the 2014 EU sanctions against the Russian invasion of the Crimea cannot be analyzed with our approach.[12]

–2. The family of reported models. The number of alternative models that are presented differs basically due to the lower degrees of freedom for Russia that makes it more difficult to establish reliable VARs. Indeed, we do not have "preferred equations" but rather equations that pass the required tests or not. Note that in the Russian models both the choice of the five political (V-Dem) variables as well as the use of two sanction shocks (gas versus oil) increases the size of the family of models.

–3. The sanction shock variables. The differences relate to the actual sanctions discussed at the time of the modelling exercises. For Iran the total gas and oil rent was at stake.[13] For Russia sanctions were phased in with initially no role for gas sanctions due to the high European dependence on Russian gas.

It should be clear from this discussion that the results should be interpreted with caution in the comparative case study. With this caveat in mind, we proceed to take a look at the findings for the sanctions against Iran and Russia.

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[9] Economic data have been derived from World Bank's World Development Indicators (WDI) online database.

[10] These data on democracy/autocracy dimension are derived from the Polity5 project of the Center for Systemic. See Marshal (2017).

[11] See van Bergeijk and Oldersma (1990). Note that is not only the geography and structural change of the sanction target economy that plays havoc. We also limit ourselves to the post 1989 period since Eastern European data during the Cold War period were to a large extent manipulated (van Bergeijk 1995)

[12] See, however, van Bergeijk (2014) for an analysis based on a large-N estimated reduced form equation.

[13] Note, however, that Dizaji and van Bergeijk (2012) provides additional testing for real oil revenues 1965–2008 (for which 44 observations are available.).

4 Comparative case study findings for Iran and Russia

We focus our discussion on results for the political economic sanction loop. The comparison is limited to two variables that appear in all models and form the nucleus from an economic and political perspective:

- *gross capital formation per capita* (that is: gross investment) because this component of effective demand also translates into production capacity (and thus future production) and thus has both short-term (demand) and long-term (supply) effects.

- *polity* (a numerical indicator on where a country is located in the autocracy-democracy spectrum. An increase in Polity indicates that a country becomes more democratic.[14] First, we will look at the impulse response functions and then we consider the variance decomposition.

Impulse response functions are reported in Figure 2. Horizontally the IRFs shows the time period after the initial sanction shock in years. Vertically the IRFs shows the magnitude of response to shocks. The middle line in the IRFs displays the response of the variables of interest to a one standard deviation shock in oil (gas) rents per capita.[15]. On the vertical axis we measure the impact on the variables of interest in terms of their standard deviation. Following Sims and Zha (1999)As an indication of significance, we have estimated 68% confidence intervals for the IRFs (dashed lines represent confidence bands). When the horizontal line (x-axis; representing zero impact) in the IRFs falls between confidence bands, the impulse responses are not statistically significant. In other words, the null hypothesis of "no effects oil (gas) rents per capita" on the specific variable cannot be rejected (Berument et al. 2010).

From figure 2 we learn that the adjustment patterns for Iran and Russia to sanctions are quite different. While the direct magnitude of the sanction impact on gross capital formation is significant and of the same order of magnitude in terms of standard deviations in both cases, the impact pattern for Iran is more or less stable over time while the IRF for Russia shows fluctuations and actually gross capital formation per capita becomes significantly positive in the 8th year (panel 2a). Also, in the political domain (panel 2b) the response patterns are quite different. The initial (first year) reaction of *Polity* to a sanction shock in Iran is significant and positive; in Russia the impact is initially significantly negative before turning significantly positive in the 2nd to 5th year, inclusive.

It is important to note that the interpretation and translation of these findings into a concrete assessment always needs consideration. For example, the impact of the EU and US sanctions against Russia that we assess with the VARs definitely did not start with the announcement of the first sanction packages. Moreover, while the US imposed a full ban on Russian oil, gas and derivative products, the EU did only impose a ban on Russian crude oil shipping on December 5, 2022, and a ban on petroleum on February 5, 2023. (Also,

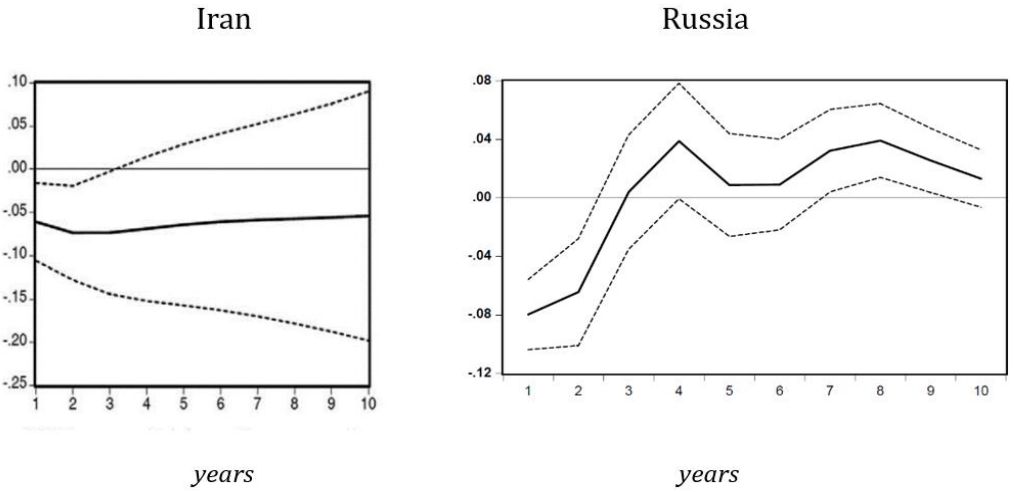
[14] Cross country comparisons are also possible, so as to indicate that a country is more (less) democratic.

[15] The numerical size of the shocks differs of course but since we use one standard deviation shocks a comparison is possible.

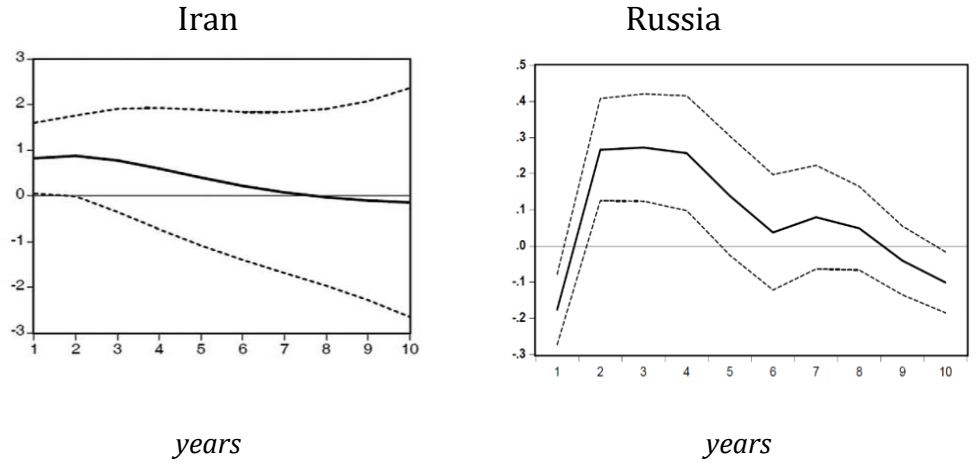
exemptions were granted to several EU members.) The EU at the time of writing did not impose sanctions on gas but only strived for significant independence from Russia. Moreover, price movements of oil and gas initially significantly increased compensating for quantity reductions. By implication the start of the oil sanction shock in the case of Russia should probably be located early 2023 so that gross capital formation per capita and polity could be expected to deteriorate in 2023 and 2024, while the positive political impact of sanctions according to the VAR could only emerge starting 2024.

Figure 2
Impulse response functions

2a Gross capital formation per capita

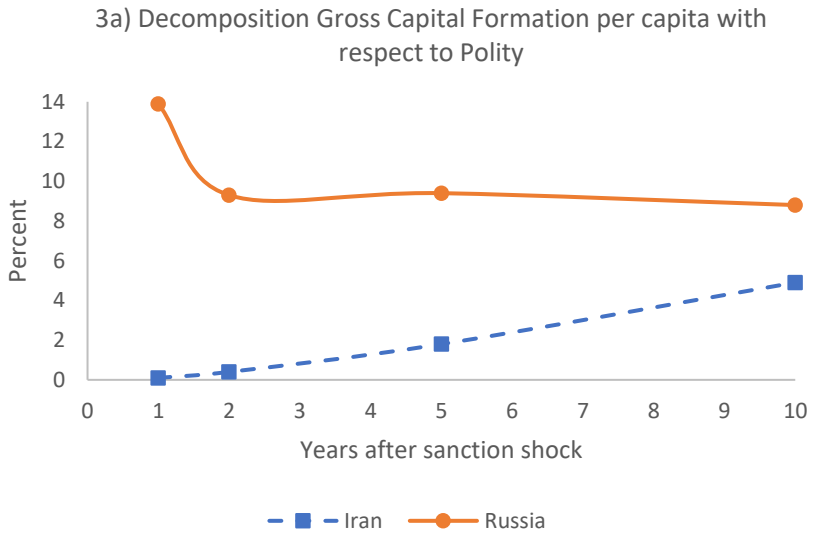


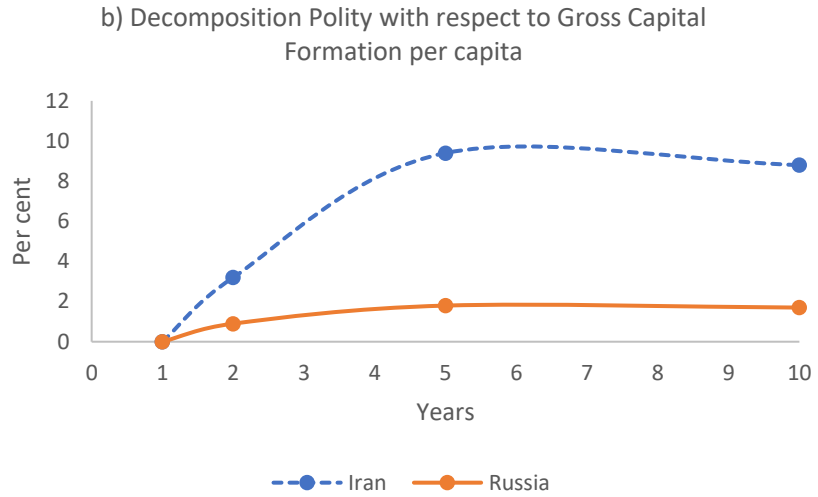
b. Polity



The second lens that we use to compare the two cases is based on the variance decomposition of forecasting error so that we can analyze the proportion of the changes in the time series that are due to innovations in a variable's own time series as opposed to innovations in other variables. Again, we focus on gross capital formation per capita and Polity (Figure 3) in order to assess the political economic sanction loop. Again, we find meaningful quantitative and qualitative differences between the two sanction cases.

Figure 3
Variance decomposition





The variance decomposition shows for the considered sanction cases that politics (Polity) has a persistently stronger impact on economics (Gross capital formation per capita) in Russia than in Iran even as Iran over the ten-year period that we consider in the VAR has been on an upward trend. For the impact of the economy on politics we find the opposite. Again, the VAR methodology brings differences in political and economic dynamics to the fore.

From a methodological point of view several observations could be made:

- a consistent finding is that the political and economic impact of sanctions changes over time. For one thing this means that political and economic interaction need to be considered simultaneously. For another thing, the time dimension of a sanction evaluation both with respect to sanction outcome (a measure for political change) and sanction contribution is a relevant dimension that should be considered more explicitly in sanction research.[16] A key issue to consider is therefore how much time has passed since the case was initiated at the moment of evaluation.
- it is important that the modelling approach that we propose in this working paper is able to describe such different patterns and thereby can provide fresh perspectives on the dynamic adjustment of the target's political-economic system. An important caveat is that we have only analyzed two cases yet and that it is difficult to generalize on the basis of these two cases. Application of VAR models on dissimilar cases, i.e. for democracies and/or non-oil exporting countries would be an important first step to investigate the further potential of our research strategy.
- VAR modelling is not a one size fits all project. Although we start the modelling exercise with a comparable set of variables and are able to have at least a core of identical explanatory variable technical case characteristics related to the availability of data, the possible estimation period and time series characteristics need to be assessed in a comprehensive case by case basis.

5 Benefits and costs of VAR modelling of economic sanctions

This section investigates the benefits and costs of our modelling strategy from three perspectives: academic knowledge production, policy advise and communication. It should be recognized beforehand that the reader may want to disagree on what we label costs and benefits. Indeed, what may appear to be a cost in one area may be a benefit in another area and sometimes what we identify as a cost may actually be a characteristic that is warranted under certain conditions of time and place. Analytical clarity may, for example, not be in the interest of parties involved in a conflict.

[16] By implication new vintages of data sets will have different observations and often different measures as well, compare van Bergeijk and Siddiquee (2017).

From an *academic point of view* the major benefit is that this method is much more transparent than the traditional coding of sanctions that are graded on a spectrum from total failure to total success by experts and this is true for both the element related to the sanction contribution as well as the component that assesses its impact on the target's behavior. Replication and changes due to data revisions enable a much stronger evidence base. The academic costs, however, also need to be considered. Meaningful VAR modelling is impossible without sufficiently long time series for both the sanction shock variable and the political and economic variables. Data needs may create a biased sample of cases (for example it will in general not pe possible to assess cases of the 1960s and 1970s) – in this sense one should not rely on assessment of sanction cases by VARs alone.

For *policy makers* the major benefit of our research strategy consists probably of the option to provide a quick evidence-based assessment of the dynamic effects and impacts of considered sanctions, in particular their timing. In the strategic context of threats and applications of economic sanctions timing (that is: the moment that an impact can be expected to be strongest) is key, but also it is important to know what such measures can and cannot achieve and also to understand which channels are important for achieving results. There are two costs that are particularly relevant to consider. First, rather than point estimates our research strategy provides confidence intervals and as we use families of VARs a great many outcomes need to be evaluated.[17] Second, the organizational costs of inhouse VAR estimation may be considered too high – this could be especially the case if potential sanction assessment is in the domain of the Ministry of Foreign Affairs where econometric capacity probably is scarce.

Communication is key both for academic researchers and for policy makers. VAR estimation helps to underpin many key insights, such as the extent to which policy changed can be expected to result from economic sanctions and the finding (at least in the two cases that we discussed) that the major economic damage and political impact occur on the short to medium term but fade away due to economic and political adjustments. The IRFs are useful to communicate such findings, avoid the pretense of accuracy and have an intuitive interpretation. It is also quite possible to show the impacts on all the variables in the model although a focus on a few graphs is preferable from a communication point of view. A danger exists in relying too much on the econometric toolbox. Often important aspects cannot be modelled and therefore sanction assessment is often an art rather than a science.

[17] Most policy makers would consider this lack of an unambiguous outcome a cost; we believe it is an opportunity to communicate uncertainty in the findings. Typically, model uncertainty is also relevant for structural models. For example, the estimates of nine independent modelling exercise of the negative economic impact of sanctions on Russian GDP ranged from –1% to –29% (median -11%) with both intra and inter study variation (Dizaji and van Bergeijk 2023, Table 1)

6 Conclusions

With a sample of only two cases, it is of course difficult to generalize, but with this caveat in mind this working paper has still brought several issues to the fore. Our comparative case study has demonstrated the do-ability and versatility of the use of VAR modelling of the economic and political processes of the sanction target simultaneously. Concrete cases can be analyzed on relatively short notice in a transparent framework open for replication. The two cases illustrate that these processes can, to differing degrees play a role in concrete sanction cases. An important finding of both cases is that the impact of sanctions wanes over time. Sanctions open a window of opportunity to find political solutions, but that window closes after some time. In the case of Iran, the recent history seems to vindicate that *ex ante* research finding (published as a working paper in June 2012)[18]; for the case of Russia the jury is still out.

VAR modelling is not a panacea: the requirement data may simply not be available (North Korea is a case in point), the time series may be too short (we can analyze the sanctions against the Russian invasion of the Ukraine in 2021 but cannot build a VAR model for the sanctions against the Russian occupation of the Crimea in 2014). Also, structural breaks may change an economy in such a way that the stability of a modelling exercise is compromised.

7 Suggestions for future research

We hope that this working paper stimulates VAR applications to economic sanction cases. At some future point in time when more and more VAR studies of sanction cases become available, research synthesis will move beyond narrative reviews of literature (such as the present one) and meta-analysis will become possible so that researchers will be able to assess genuine effects as well as the impact of heterogeneous methodological characteristics of primary VAR studies. Given the data requirements for meta-analysis it should be standard practice to report transparently on data and methodological issues as well as to provide confidence intervals in IRFs.19 A further avenue for research would be to combine the standard VAR model with panel data techniques makes it possible to develop a family of Panel-VAR models to find more general economic and political impact of sanctions on target countries (Dizaji and Murshed 2020).

A second avenue of research that could be pursued with the use of VARs is the analysis is the impact of sanctions on indicators of human development. This would offer the possibility to analyze in a consistent empirical framework some of the unintended sanction impacts on livelihoods of a population that often has little or nothing to do with the activities of the elite that sanctions try to influence. Indeed, sanctions often violate basic rights (see Textbox 1 below). The debate about the sign and significance is still ongoing (Gutman 2020). and

[18] Dizaji and van Bergeijk (2012).

[19] See Nguyen et al. (2021) for an example of a meta-regression analysis based on IRFs.

our modelling strategy could very well help to strengthen the empirical analysis of unintended effects.

Indeed, Nowadays, it is widely accepted that the design and implementation of sanctions need to be improved, and their humanitarian costs to ordinary citizens minimized as far as possible. Further empirical research is needed to directly compare smart against traditional sanctions with respect to their impact on human rights. It is also useful to take into account the intensity of sanctions when we are investigating their impact on the government and citizens of target countries as multilateral and unilateral sanctions may have different consequences.

TEXTBOX 1
Sanctions and SDGs

- By their very design, sanctions carry a negative impact on economic growth and employment (SDG 8).
- Sanctions tend to increase income inequality (Afesorgbor and Mahadevan, 2016) and thus, a negative trade-off exists with SDG 10 (reduction of inequality).
- A potentially negative trade-off also exists for such diverse areas as
    - SDG 2 ('End hunger.') Afesorgbor (2021),
    - SDG 4 (education) Hwami (2021),
    - SDG 5 (gender equality) Drury and Peksen, (2014)
    - SDG 3 (health) Gurman et al. (2021)
    - SDG 13–15 (environment) Fu et al., (2020).

References

Afesorgbor, S.K. (2021) 'Sanctioned to starve? The impact of economic sanctions on food security in targeted states' in: P.A.G. van Bergeijk (ed.), *Research Handbook on Economic Sanctions*, Edward Elgar, Cheltenham, pp. 440-68.

Afesorgbor, S.K. and R. Mahadevan (2016) 'The impact of economic sanctions on income inequality of target states,' *World Development*, 83(1), pp. 1–11.

Bayard, T.O., et al. (1983) 'An economic model of United States and western controls on exports to the Soviet Union and Eastern Europe', in Joint Economic Committee, *Soviet Economy in the 1980s: Problems and Prospects Congress of the United States:* Washington, DC, pp 507–55.

Bergeijk, P.A.G. van (1995) 'The accuracy of international economic observations', *Bulletin of Economic Research* 47(1), pp. 1-20.

Bergeijk, P.A.G. van (2014) "Russia's tit for tat", *Voxeu* 25 April 2014
Bergeijk, P.A.G. van (2015) 'Sanctions against Iran-A preliminary economic assessment', in: I. Dreyer and J. Luengo-Cabrera (eds), *On target? EU sanctions as security policy tools*, EIUSS: Paris and Brussels, pp. 49-58.
Bergeijk, P.A.G. van (2019) 'Can the sanction debate be resolved?' *CESifo Forum* 20(4), pp. 3-8.
Bergeijk, P.A.G. van (ed.) (2021) *Research Handbook on Economic Sanctions*, Edward Elgar: Cheltenham.
Bergeijk, P.A.G. van (2022) 'Sanctions against the Russian war on Ukraine: Lessons from history and current prospects', *Journal of World Trade* 56(4), pp. 571 – 586
Bergeijk, P.A.G. van and C. van Marrewijk (1995) 'Why do sanctions need time to work? Adjustment, learning and anticipation', *Economc Modelling* 12(2), pp. 75–86.
Bergeijk, P.A.G. van and H. Oldersma (1990) 'Détente, market-oriented reform and German unification: potential consequences for the world trade system' *Kyklos* 43(4), pp. 599-609.
Bergeijk, P.A.G. van and M. S. H. Siddiquee (2017) 'Biased sanctions? Methodological change in economic sanctions reconsidered and its implications", *International Interactions* 43, pp. 879–93.
Berument, M.H. et al. (2010) 'The impact of oil price shocks on the economic growth of selected MENA countries', *Energy Journal* 31(1), pp. 149–76.
Caruso, R. (2003) 'The impact of international economic sanctions on trade: an empirical analysis', *Peace Economics, Peace Science and Public Policy* 9(2), article 2.
Clifton, M.T. et al. (2023) 'Economic sanctions: Evolution, consequences, and challenges', *Journal of Economic Perspectives* 37(1), pp. 3-29.
Coppedge, M. et al. (2015) "Measuring high level democratic principles using the V-Dem data" *International Political Science Review* 37(5), pp. 580-593
Dai, M. et al. (2021) Timing the Impact of Sanctions on Trade, in: P.A.G. van Bergeijk (ed.) *Research Handbook on Economic Sanctions*, Edward Elgar, Cheltenham, 411-39.
Demena, B.A. et al. (2021) Publication bias of economic sanction research: a meta-analysis of the impact of trade linkage, duration and prior relations on sanctions success, in: P.A.G. van Bergeijk (ed.) *Research Handbook on Economic Sanctions*, Edward Elgar, Cheltenham, pp. 126-50.
Dizaji, S.F. (2019) 'Trade openness, political institutions, and military spending (Evidence from lifting Iran's sanctions)', *Empirical Economics* 57(6), pp. 2013-2041.
Dizaji, S.F. (2022) 'The impact of negative oil shocks on military spending and democracy in the oil states of the greater Middle East: Implications for the

oil sanctions', *Journal of Peace Research*, doi.org/10.1177/00223433221116654.

Dizaji, S.F and P.A.G van Bergeijk (2012) Early phase success and long run failure of economic sanctions: With an application to Iran. *ISS working paper. General Series* No. 544, The Hague: International Institute of Social Studies.

Dizaji, S.F. and P.A.G. van Bergeijk (2013) 'Potential early phase success and ultimate failure of economic sanctions: A VAR approach with an application to Iran*', Journal of Peace Research*, 50(6), pp. 721-36.

Dizaji, S.F. and S.M. Murshed (2020) The impact of external arms restrictions on democracy and conflict in developing countries. *ISS working paper. General Series* No. 661 Erasmus University: The Hague.

Dizaji, S.F. and P.A.G. van Bergeijk (2023) 'Sanctions and Russian autocracy', in: M. Bali (ed.) *Sanctions and the Impact of the Russia-Ukraine Conflict*, Nova Publishers (in print).

Drury, A.C. and D. Peksen (2014) 'Women and economic statecraft: The negative impact international economic sanctions visit on women,' *European Journal of International Relations* 20(2), pp. 463–90.

Enders, W. and T. Sandler (1993) 'The effectiveness of anti-terrorism polices: A vector-autoregression-intervention analysis', *American Political Science Review* 87(4), pp. 829–44., and

Freeman, J.R. et al. (1989) 'Vector autoregression and the study of politics', *American Journal of Political Science* 33(4), pp. 842–877.

Fu, Q., et al. (2020) 'The impact of international sanctions on environmental performance,' *Science of The Total Environment*, 745, doi: 10.1016/j.scitotenv.2020.141007

Gutmann, J. et al. (2020) 'Precision-guided or blunt? The effects of US economic sanctions on human rights,' *Public Choice* 185(1), pp. 161–182.

Gutmann, J. et al. (2021) 'Sanctioned to death? The impact of economic sanctions on life expectancy and its gender gap,' *Journal of Development Studies*, 57(1), pp. 139–162.

Hufbauer, G.C. and J.J. Schott (1985) *Economic sanctions reconsidered: history and current policy*, Peterson Institute for International Economics: Washington, DC.

Hughes Hallett, A.J. and A.S. Brandsma (1983) 'How effective could sanctions against the Soviet Union be?', *Weltwirtschaftliches Archiv*, 119, pp. 498–522.

Hwami, M., 2021, 'A comparative scoping review of the impact of international economic sanctions on education,' *Compare: A Journal of Comparative and International Education*, doi: 10.1080/03057925.2020.1846120.

Irina M. (2021) "FDI and Sanctions" in: P.A.G. van Bergeijk (ed.) *Research Handbook on Economic Sanctions*, Edward Elgar, Cheltenham, pp. 369-87.

Johansen, S., and K. Juselius (1990) 'Maximum likelihood estimation and inference on cointegration—with applications to the demand for money', *Oxford Bulletin of Economics and statistics* 52(2), pp. 169-210.

Khan, H.A. (1988) 'Impact of trade sanctions on South Africa: a social accounting matrix approach', *Contemporary Policy Issues*, 6, pp. 130–40.

Kirilakha, A. et al. (2021)'The Global Sanctions Data Base (GSDB): an update to include the years of the Trump presidency', in: P.A.G. van Bergeijk (ed.) *Research Handbook on Economic Sanctions*, Edward Elgar, Cheltenham, pp. 62-107

Marshall, M.G. et al (2017) *POLITY™ IV project*. Vienna, VA: Center for Systemic Peace.

Nguyen, M et al. (2021) Publication bias in the price effects of monetary policy: a meta-regression analysis for emerging and developing economies *International Review of Economics and Finance*, 71, pp. 567-583.

Peksen, D. (2019) 'When do imposed economic sanctions work? A critical review of the sanctions effectiveness literature', *Defence and Peace Economics* 30(6), pp. 635–47.

Pesaran, M.H., and Y. Shin (1998) 'Generalised impulse response analysis in linear multivariate models', *Economics Letters* 58(1), pp.17–29

Pestovanna, M. et al. (2022) 'The price of war: macroeconomic effects of the 2022 sanctions on Russia', *VoxEU* April 15.

Portela, C. and A. Charron (2023) 'The evolution of databases in the age of targeted sanctions'", *International Studies Review* 25(1), doi.org/10.1093/isr/viac061.

Porter, R.C. (1979) 'International trade and investment sanctions: potential impact on the South African economy', *Journal of Conflict Resolution* 23(4), pp. 579–612.

Sims, C.A. (1980) 'Macroeconomics and reality', *Econometrica* 48(1), pp. 1–48.

Sims, C.A., and T. Zha (1999) 'Error bands for impulse responses', *Econometrica* 67(5), pp. 1113-55.

Vanhanen, T. (2011) 'Measures of democracy 1810-2010', *FSD1289*, version 5.0. Tampere: Finnish Social Science Data Archive. Available at: https://www.prio.org/Data/Governance/Vanhanens-index-of-democracy/