ECONPOL FORUM

ECONOMIC POLICY AND ITS IMPACT

Who Should Bear the Burden of Increasing Fiscal Pressure? An Optimal Income Taxation Perspective

Mehmet Ayaz, Lea Fricke, Clemens Fuest and Dominik Sachs

INSTITUTIONS ACROSS THE WORLD

Discrimination of Sexual Minorities in Emerging Markets: Can the Needle Be Moved?

Cevat Giray Aksoy, Christopher S. Carpenter, Ralph De Haas, Mathias Dolls and Lisa Windsteiger

BIG-DATA-BASED ECONOMIC INSIGHTS

Measuring Remote Work Using a Large Language Model (LLM)

Peter John Lamber

POLICY DEBATE OF THE HOUR

How Sanctions Work - And Which Goals They Fail to Achieve

Jerg Gutmann, Matthias Neuenkirch and *Florian Neumeier, Constantinos Syropoulos* and *Yoto V. Yotov, Eckhard Janeba, Stefan Goldbach* and *Volker Nitsch, Kai A. Konrad* and *Marcel Thum, Dario Laudati, Mohammad Reza Farzanegan*
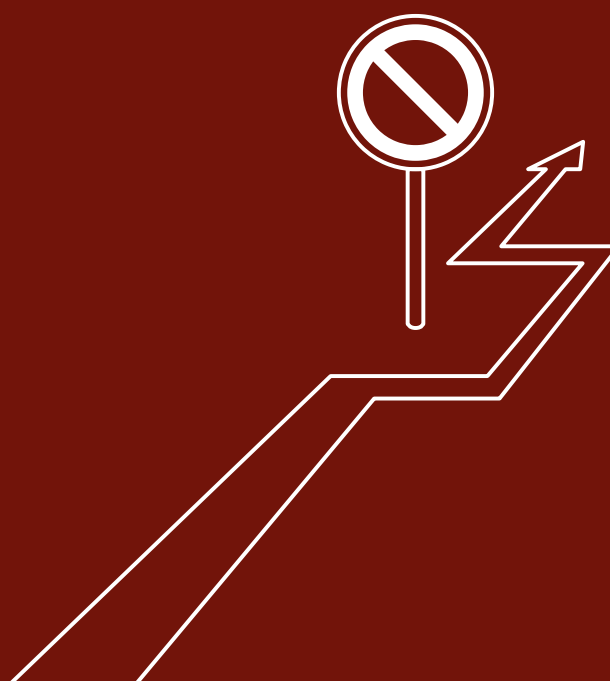
CESifo ifo INSTITUTE

EconPol is CESifo's economic policy platform. With key support from the ifo Institute, it seeks to leverage CESifo's globe-spanning network of 1 800 high-ranked economists – eleven of whom have won the Nobel Prize – and ifo's decades-deep research expertise to provide well-founded advice to European policymakers. Drawing on the wide range of specializations of its members, EconPol's mission is to contribute to the crafting of effective economic policy in the face of the rapidly evolving challenges faced by the European economies and their global partners.

In the light of geopolitical conflicts and instability, sanctions play an important role in the international economic policy debate - especially against countries such as Russia, Iran and China. Economic sanctions are often intended to achieve foreign and security policy goals: fighting terrorism, protecting democracy and human rights, or resolving conflicts. In this issue of EconPol Forum, our authors examine, using the evidence-based studies, the extent to which various sanctions have achieved their goals. How do they affect economic growth, trade, and prosperity? In addition, we want to understand their impact on sectoral development of agriculture, energy and mining, as well as on human rights, military spending or life expectancy. In this context, international trade, financial transactions, technology transfer and other economic activities, among others, are systematically studied. And researchers look at different types of sanctions, such as unilateral, multilateral, and extraterritorial.

We shed light on the major and immediate challenges for target countries and sender countries. And our authors examine implications for other regions. At the same time, they make a critical assessment of past sanctions strategies and experiences. They offer some suggestions on how policymakers can make sanctions more effective in the future.

In "Economic Policy and Its Implications," the authors show who should bear the burden of increasing fiscal pressure from the perspective of optimal income taxation. "Institutions Around the World" looks at discrimination against sexual minorities in emerging markets. Finally, in "Big-Data-Based Economic Insights," we explore how remote work can be measured using a large language model.

Introduction to the Issue on

How Sanctions Work - and Which Goals They Fail to Achieve

Chang Woon Nam

Economic sanctions have been widely used for foreign and security policy purposes to promote counterterrorism, counternarcotics, nonproliferation, democracy and human rights, conflict resolution, and cybersecurity. However, the dispute over their effectiveness has not yet been fully settled: many criticize that sanctions are often poorly designed and rarely succeed in changing the target country's behavior, while some proponents argue that they have become more effective over time and remain an important foreign policy tool.

Recently, a number of evidence-based studies have been conducted to better understand the impact of sanctions on economic growth, trade, and welfare, and the scope of research has been further expanded to include sectoral development of agriculture, energy, and mining, as well as other issues related to human rights, military spending, life expectancy, gender, and more. In this context, not only are the various economic activities to which sanctions apply (e.g., international trade, financial transactions, technology transfer, etc.) systematically examined, but the various types of sanctions (unilateral, multilateral, extraterritorial) are additionally considered. Due to ongoing geopolitical conflicts and instability, Western sanctions, especially against countries such as Russia, Iran, and China, will continue to play an important role in the international economic policy debate.

This issue of EconPol Forum brings together several interesting, evidence-based articles that examine the extent to which different types of sanctions have recently achieved their goals. They shed light on the major and immediate challenges faced by both target and sender countries, and the implications for other countries, while critically assessing past sanctions strategies and experiences. They also suggest some ways to increase the effectiveness of the policies and actions needed to make sanctions implementation more successful in the future.

According to *Jerg Gutmann, Matthias Neuenkirch,* and *Florian Neumeier,* there is overwhelming empirical evidence that sanctions can cause substantial economic harm to target countries, leading to a slump in GDP per capita and its components such as private investment, consumption, and trade. Furthermore, sanctions may cause severe collateral damage, as they harm all dimensions of human development of the target country's population while also undermining their political rights and civil liberties.

Although there are signs that their success rate is increasing, *Constantinos Syropoulos* and *Yoto V. Yotov* point out that most sanctions fail to achieve their intended political goals. While the economic impact on target states is severe and detrimental, the severity of this impact is mitigated by the possible diversion of trade toward third countries. In general, sender states do not suffer large sanctions-related losses, with the exception of the recent cases against Russia.

Drawing on the experience of the protracted conflict between the US and Iran, where the threat of Europe's loss of access to the US market was a powerful tool to restrict European trade with Iran, *Eckhard Janeba* warns of the potential danger of the geopolitical rivalry between the US and China spilling over into Europe via such extraterritorial sanctions. In this context, European countries need to invest in strategic sovereignty to prepare for the possible impact of the US-China geopolitical conflict.

Stefan Goldbach and Volker Nitsch assess financial sanctions, especially those imposed by the United Nations, as highly effective due to the lower risk of sanctions evasion and their strong and immediate negative impact on direct financial flows with the target country. In addition, there is limited evidence that financial sanctions cause collateral damage by reducing trade in goods and services.

In a theoretical context, sanctions may increase pressure to end a conflict if sanction costs are to persist throughout the conflict phase and be lifted only when the conflict ends; they must furthermore effectively and exclusively affect the target country for the duration of the conflict. However, *Kai A. Konrad* and *Marcel Thum* argue that this is less true for energy export embargoes, because oil that is not sold today, for instance, does not vanish and can be sold in the future, making declining sales revenues today an unsuitable gauge of the effectiveness of this kind of embargoes. A significant sanctioning effect can be expected if the ruling elite, for example in Russia, wants to extract energy resources as quickly as possible in the absence of sanctions and invest the proceeds safely abroad.

According to *Dario Laudati,* the direct economic impact of sanctions that extend over many years, as in the case of Iran, is increasingly severe in the form of lost production. In addition, there are indirect effects such as rent-seeking, resource allocation distortions, and general costs associated with efforts to mitigate

and circumvent sanctions regimes. Furthermore, these long-lasting sanctions can have significant political and socio-demographic effects, as illustrated by the example of Iran's gender-based policies and its redistribution of educational resources.

Finally, *Mohammad Reza Farzanegan* examines the relationship between Iran's military spending and economic growth, incorporating the forward and backward linkages of the defense industry with the rest of the Iranian economy. He finds evidence that economic sanctions have reduced military spending in that country.

We hope you enjoy this Policy Debate of the Hour!

Jerg Gutmann, Matthias Neuenkirch and *Florian Neumeier*

The Impact of Economic Sanctions on Target Countries: A Review of the Empirical Evidence

Economic sanctions are a particularly important tool of statecraft in international politics. Since the end of the Cold War, their use has increased rapidly (Aidt 2020). While they aim at coercing target governments to comply with the interests of the imposing country or with international law, they are often considered to be a less violent, less controversial, and – at least for the imposing country – a less costly alternative to other coercive measures, especially military interventions.

Economic sanctions can take many forms. The most important sanction types are (i) financial sanctions, which include, inter alia, access restrictions to international financial markets and freezing the target country's (or its political elite's) foreign assets; (ii) trade sanctions, which range from bans on the import and/or export of specific goods and commodities to a complete embargo on trade;[1] and (iii) travel sanctions, which typically prohibit members of the target country's elite to visit the imposing countries. The most frequent senders of economic sanctions are Western democracies, above all the United States and the European Union, while African countries are the most frequent sanction targets (Felbermayr 2020a). The main reasons for the imposition of sanctions are (i) to force target states to stop threatening or infringing the sovereignty of another state, such as by engaging in violence against it or by destabilizing its incumbent government; (ii) to foster democratic change in a target, protect democracy, or destabilize an autocratic regime; and (iii) to protect the citizens of a target state from political repression and protect human rights (Hufbauer et al. 2009).

The effectiveness of economic sanctions in terms of meeting their stated objectives is heavily disputed.

[1] This may include sanctions on the import of arms or any other goods that can be used in the target country's military industry.

KEY MESSAGES

■ **The use of economic sanctions has increased rapidly since the end of the Cold War**

■ **Economic sanctions can inflict huge economic costs on target countries**

■ **Sanctions may also have unintended effects and cause collateral damage**

■ **The effectiveness of sanctions in terms of meeting the proximate goals for which they are imposed is disputed**

Hufbauer et al. (2009) and Pape (1997) provide rather dispiriting news, as they conclude that economic sanctions are ineffective in 65 percent to 95 percent of all cases. In contrast, Felbermayr et al. (2020a) are more optimistic. According to them, sanctions imposed with the aim of fostering democratic change or protecting democracy are at least partially successful in around 80 percent of all cases, while sanctions aiming at improving the targeted regime's respect for human rights are (partially) successful in almost half of all cases. The findings by Morgan and Schwebach (1997) suggest that the higher the economic costs that sanctions inflict on target states, the more likely it is that the senders' objectives are met. Steinbach et al. (2023) find that sanctions aimed at improving human rights tend to lead to a deterioration of the human rights situation.

A large body of literature in economics and political science has studied the consequences of economic sanctions for the target country's population. The results of this literature are concerning, as they indicate

Jerg Gutmann

is Assistant Professor of Behavioral Law & Economics at the University of Hamburg. His research focuses on questions at the interface of economics, law, and politics.

Matthias Neuenkirch

is Professor of Empirical Economics at Trier University. In one of his research strands, he analyzes the economic and humanitarian consequences of economic sanctions.

Florian Neumeier

is head of the Research Group Taxation and Fiscal Policy at ifo Institute. He started his research on economic sanctions about ten years ago during his PhD.

that economic sanctions can cause significant harm to the civilian population of target countries. This is particularly problematic since the regimes against which sanctions are directed typically lack democratic legitimation. Due to that, economic sanctions are often criticized as "blunt" weapons that cause severe collateral damage. However, the results reported in the extant literature should be interpreted with caution since many studies analyze correlations rather than causal relationships. Also, the justifiability of the (potential) humanitarian harm caused by sanctions depends on whether one considers the alternative to be no sanctions or outright military conflict.

The present paper provides an overview of the empirical literature and analyzes the consequences of economic sanctions along three dimensions: economic outcomes, political outcomes, and health outcomes. Imposing costs on the target country is regarded as a prerequisite for the effectiveness of economic sanctions. However, the costs of sanctions may be borne not only by the political regime, but also by the general population. With regard to their political consequences, many researchers have analyzed the effects of economic sanctions on the targeted regime's respect for human rights and democratic institutions. The health consequences of sanctions are particularly relevant for understanding the extent to which sanctions adversely affect the civilian population.

ECONOMIC EFFECTS OF SANCTIONS

Sanctions have a significant impact on a target country's economy, especially in terms of the level and distribution of income. Focusing on the economic consequences of multilateral sanctions imposed by the United Nations and unilateral sanctions imposed by the US, Neuenkirch and Neumeier (2015) find that GDP growth decreases, on average, by 2 percentage points per year when a country is under UN sanctions and 1 percentage point if it is targeted by US sanctions. For a "typical" sanction episode, these effects translate into a decline in GDP per capita of 25 percent in the case of UN sanctions and 13 percent in the case of US sanctions. Using an event study design, Gutmann et al. (2021b) demonstrate that virtually all subcomponents of GDP are adversely affected by economic sanctions and that the adverse effect of sanctions is most pronounced in the first two years of an episode. The authors report a significant decline in private consumption, investment, trade, and FDI during sanction episodes. This evidence is consistent with previous studies, which report reductions in trade (Afesorgbor 2019; Crozet and Hinz 2020; Felbermayr et al. 2020b) and foreign direct investment (Biglaiser and Lektzian 2011; Mirkina 2018).

Figure 1 summarizes the results by Gutmann et al. (2021b) graphically. The figure shows how the growth rates of per capita GDP, private consumption and investment, government expenditure, and trade

develop in countries targeted by economic sanctions. The first vertical black line indicates the year in which sanctions are imposed, the second vertical black line the year in which they are lifted. As can be seen, the growth rates of GDP and its main components tend to decline immediately after sanctions are imposed. What is more, there is no indication of a recovery even after sanctions have been lifted, which implies that sanctioned countries are pushed to a lower growth path and remain there.

However, the costs economic sanctions inflict on target countries are unevenly distributed. Neuenkirch and Neumeier (2016) show that US sanctions affect especially those who live in or close to poverty. Their findings suggest that the poverty gap – a measure that combines information on how many people in a country live on less than 1.25 US dollars per day and how large the average shortfall relative to 1.25 US dollars is – increases by roughly 28 percent when economic sanctions are imposed. Regarding the sanctions imposed on Iran in 2012, Ghomi (2022) reports that it was mainly the young, illiterate, and rural population that suffered the consequences, while the educated and those employed in the public sector were hardly affected. In a similar vein, Afesorgbor and Mahadevan (2016) report that economic sanctions are associated with an increase in economic inequality in target countries and that trade and financial sanctions exert the strongest effects. These increases in poverty and income inequality cannot be mitigated by informal economic activities, as there is no clear effect of sanctions on the size of the informal economy (Early and Peksen 2019; Farzanegan and Hayo 2019).

One way in which sanctions can harm economies is by triggering economic crises (Hatipoglu and Peksen 2018; Peksen and Son 2015). This effect is amplified by a reduced willingness of the International Monetary Fund to lend to countries under sanctions (Peksen and Woo 2018).

Target countries are not the only ones feeling the economic effects of sanctions: senders also pay a price. This has been demonstrated especially for the sanctions against Russia after its illegal annexation of Crimea in 2014 (Bělín and Hanousek 2021; Crozet and Hinz 2020; Gullstrand 2020; Kholodilin and Netsunajev 2019) and against China after the Tiananmen Square Incident in 1989 (Webb 2020). These target countries are of course not representative, since they are some of the largest possible targets of international sanctions.

POLITICAL EFFECTS OF SANCTIONS

The goal of virtually all sanctions is to alter the target government's political course. However, many empirical studies yield discouraging results. Instead of improving the political and human rights situation in target countries, economic sanctions often appear to increase infringements of economic and political

rights through, for instance, the confiscation of private property (Peksen 2016b), the use of political repression (Adam and Tsarsitalidou 2019; Peksen and Drury 2009 and 2010), as well as violations of basic human rights (Escribà-Folch 2012; Peksen 2009; Steinbach et al. 2023; Wood 2008). Sanctions are also reported to amplify discrimination against women (Drury and Peksen 2014) and marginalized social groups, especially ethnic minorities (Peksen 2016a). Yet, there is some evidence that democratic sanction may actually induce democratization by destabilizing autocratic governments (von Soest and Wahman 2015).

One reason why sanctions often seem to achieve the opposite of what they are supposed to is that they increase pressure on the political elite. Hence, incumbents feel compelled to resort to violence to stay in power. In this context, Allen (2008) demonstrates that sanctions promote antigovernment activity and, according to Grauvogel et al. (2017), the mere threat of imposing sanctions can trigger domestic protest. Marinov (2005) shows that sanctions increase the turnover of political leaders.

One problem that characterizes many empirical studies is that their findings are based on correlations without a plausible causal interpretation. Economic sanctions are often imposed in a dramatic political or human rights situation, which makes it difficult to empirically differentiate between cause and effect of sanctions. Unlike many previous studies, Gutmann et al. (2020) find no support for adverse effects of sanctions on economic rights or basic human rights when accounting for the endogeneity of economic sanctions. With respect to women's rights, the authors' findings even indicate a positive effect of sanctions, especially on women's economic rights. Only for political rights and civil liberties do Gutmann et al. (2020) find a significant deterioration when economic sanctions are imposed. Their results underline that it is not only important to account for the endogeneity of sanctions, but also to distinguish between dimensions of rights, as the effects of sanctions along these dimensions may differ considerably.

HEALTH EFFECTS OF SANCTIONS

We have already indicated the bluntness of sanctions as a policy instrument with respect to their effects on political rights and civil liberties, income inequality, and poverty. Health outcomes provide another opportunity to measure the extent to which the general population is harmed by sanctions that may even be intended to protect them. Allen and Lektzian (2013), for instance, report that economic sanctions negatively affect the health situation in the target country in a way that is similar to the public health consequences of major military conflicts. Peksen (2011) studies the effect of sanctions specifically on child mortality rates and finds that the human cost of sanctions depends on how costly they are for the

Figure 1

Effects of Economic Sanctions on the Growth Rates of GDP and Its Main Components
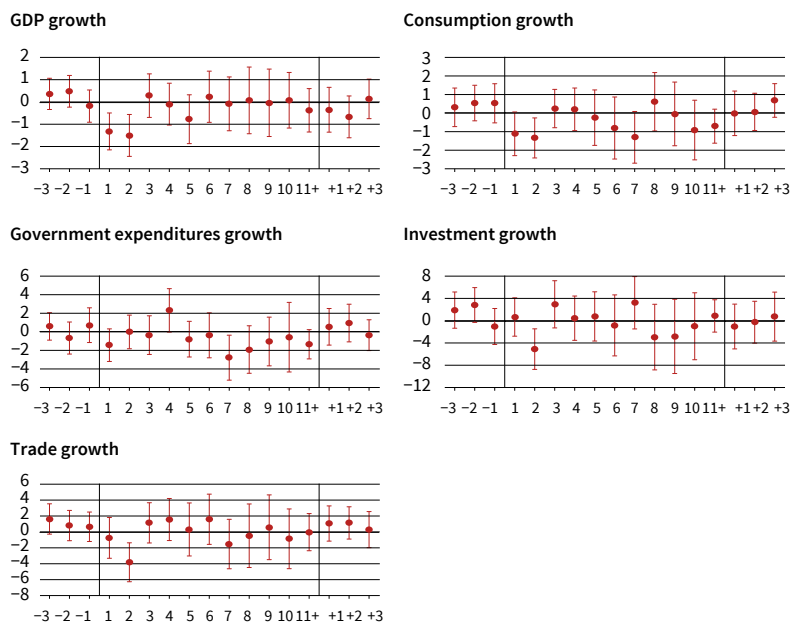
Note: The figure shows the effect of sanctions during the first (1), second (2), …, eleventh plus (11+) year in which they are in effect. The labels −3, −2, and −1 on the x-axis indicate the three years before sanctions are imposed, the labels +1, +2, and +3 the first three years after sanctions were lifted. The effects are estimated based on an event study design. 95 % confidence bands are indicated by whiskers.
Source: Gutmann et al. (2021b).   © ifo Institute

target's economy. Parker et al. (2016) analyze the consequences of sanctions under Section 1502 of the United States' Dodd-Frank Act against firms operating in the Democratic Republic of the Congo. The authors find that the boycott of mineral purchases meant to disrupt the finances of local warlords increased infant deaths in villages near the targeted mines by over 140 percent. The reason for this effect is that the boycott, inter alia, reduced mothers' consumption of infant health care goods and services.

Focusing on economic sanctions against 98 less- and least-developed countries, Gutmann et al. (2021a) show that sanctions imposed by the UN on average cause a decrease in life expectancy of about 1.2 to 1.4 years and sanctions imposed by the US of 0.4 to 0.5 years. Distinguishing between the life expectancy of men and women demonstrates further that women are affected more severely by the imposition of sanctions, which confirms that sanctions tend to affect vulnerable groups in society disproportionately. In that sense, sanctions are not different from violent conflicts and natural disasters, which have also been shown to affect women more than men (Neumayer and Plümper 2007; Plümper and Neumayer 2006). An increase in child mortality and cholera deaths as well as decreasing public spending on health care appear to be important transmission channels through which economic sanctions adversely affect the population's life expectancy.

Aside from income and health, education is commonly considered the third dimension of human development. In contrast to the effects of sanctions on health, there is little evidence on how target popu-

lations' education is affected. Moeeni (2022) shows that sanctions imposed on Iran in 2006 decreased the time children spent in school by 0.1 years and their probability of attending college by 4.8 percentage points. Moreover, Iranian households reduced their education spending by 58 percent . These effects were larger for children that were exposed to sanctions for a longer time.

POLICY CONCLUSIONS

Economic sanctions are a popular tool for coercing other governments into changing their policies. There is overwhelming empirical evidence that sanctions can cause substantial harm for target countries. They lead to a slump in GDP per capita and its main components, especially private investment, consumption, and trade. These costs are a prerequisite for the effectiveness of economic sanctions.

Whether sanctions can be considered effective in terms of regularly meeting the senders' objectives is disputed. What is more, existing empirical studies indicate that sanctions may cause severe collateral damage, as they harm all dimensions of human development of the target country's population while also undermining their political rights and civil liberties. This is particularly concerning since the governments against which sanctions are directed often lack democratic legitimacy. However, this does not automatically imply that it would be better to refrain from using economic sanctions. Sanctions are often imposed on countries to end wars and human rights violations or to restore democracy. It is unclear whether the side effects of sanctions are worse than the population's fate if the international community fails to act. For example, many blame the measured response of Western countries to Russia's occupation of Crimea in 2014 for encouraging its 2022 invasion of larger parts of Ukrainian territory – the first major land war on European territory in decades with possibly hundreds of thousands of fatalities. Moreover, if governments are set to intervene, sanctions might offer a less harmful alternative to military conflict.

REFERENCES

Adam, A. and S. Tsarsitalidou (2019), "Do Sanctions Lead to a Decline in Civil Liberties?", *Public Choice* 180, 191-215.

Afesorgbor, S. K. (2019), "The Impact of Economic Sanctions on International Trade: How Do Threatened Sanctions Compare with Imposed Sanctions?", *European Journal of Political Economy* 56, 11-26.

Afesorgbor, S. K. and R. Mahadevan (2016), "The Impact of Economic Sanctions on Income Inequality of Target States", *World Development* 83, 1-11.

Aidt, T. S., F. Albornoz and E. Hauk (2021), "Foreign Influence and Domestic Policy", *Journal of Economic Literature* 59, 426-487.

Allen, S. H. (2008), "The Domestic Political Costs of Economic Sanctions", *Journal of Conflict Resolution* 52, 916-944.

Allen, S. H. and D. J. Lektzian (2013), "Economic Sanctions: A Blunt Instrument?", *Journal of Peace Research* 50, 121-135.

Bělín, M. and J. Hanousek (2021), "Which Sanctions Matter? Analysis of the EU/Russian Sanctions of 2014", *Journal of Comparative Economics* 49, 244-257.

Biglaiser, G. and D. Lektzian (2011), "The Effect of Sanctions on U.S. Foreign Direct Investment", *International Organization* 65, 531-551.

Crozet, M. and J. Hinz (2020), "Friendly Fire: The Trade Impact of the Russia Sanctions and Counter-sanctions", *Economic Policy* 35, 97-146.

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, 463-490.

Early, B. R. and D. Peksen (2019), "Searching in the Shadows: The Impact of Economic Sanctions on Informal Economies", *Political Research Quarterly*, 821-834.

Escribà-Folch, A. (2012), "Authoritarian Responses to Foreign Pressure: Spending, Repression, and Sanctions", *Comparative Political Studies* 45, 683-713.

Farzanegan, M. R. and B. Hayo (2019), "Sanctions and the Shadow Economy: Empirical Evidence from Iranian Provinces", *Applied Economics Letters* 26, 501-505.

Felbermayr, G. J., A. Kirilakha, C. Syropoulos, E. Yalcin and Y. V. Yotov (2020a), "The Global Sanctions Data Base", *European Economic Review* 129: 103561.

Felbermayr, G. J., C. Syropoulos, E. Yalcin and Y. V. Yotov (2020b), "On the Heterogeneous Effects of Sanctions on Trade and Welfare: Evidence from the Sanctions on Iran and a New Database", *Drexel University School of Economics Working Paper Series* 2020-04.

Ghomi, M. (2022), "Who Is Afraid of Sanctions? The Macroeconomic and Distributional Effects of the Sanctions against Iran", *Economics and Politics* 34, 395-428.

Grauvogel, J., A. A. Licht and C. von Soest (2017), "Sanctions and Signals: How International Sanction Threats Trigger Domestic Protest in Targeted Regimes", *International Studies Quarterly* 61, 86-97.

Gullstrand, J. (2020), "What Goes around Comes around: The Effects of Sanctions on Swedish Firms in the Wake of the Ukraine Crisis", *The World Economy* 43, 2315-2342.

Gutmann, J., M. Neuenkirch and F. Neumeier (2020), "Precision-guided or Blunt? The Effect of US Economic Sanctions on Human Rights", *Public Choice* 185, 161-182.

Gutmann, J., M. Neuenkirch and F. Neumeier (2021a), "Sanctioned to Death? The Impact of Economic Sanctions on Life Expectancy and Its Gender Gap", *Journal of Development Studies* 57, 139-162.

Gutmann, J., M. Neuenkirch and F. Neumeier (2021b), "The Economic Effects of International Sanctions: An Event Study", *CESifo Working Paper* 9007.

Hatipoglu, E. and D. Peksen (2018), "Economic Sanctions and Banking Crises in Target Economies", *Defence and Peace Economics* 29, 171-189.

Hufbauer, G. C., J. J. Schott, K. A. Elliott and B. Oegg (2009), *Economic Sanctions Reconsidered*, 3rd Edition, Peterson Institute, Washington DC.

Kholodilin, K. A. and A. Netšunajev (2019), "Crimea and Punishment: The Impact of Sanctions on Russian Economy and Economies of the Euro Area", *Baltic Journal of Economics* 19, 39-51.

Marinov, N. (2005), "Do Economic Sanctions Destabilize Country Leaders?", *American Journal of Political Science* 49, 564-576.

Mirkina, I. (2018), "FDI and Sanctions: An Empirical Analysis of Short- and Long-run Effects", *European Journal of Political Economy* 54, 198-225.

Moeeni, S. (2022), "The Intergenerational Effects of Economic Sanctions", *The World Bank Economic Review* 36, 269-304.

Morgan, T. C. and V. L. Schwebach (1997), "Fools Suffer Gladly: The Use of Economic Sanctions in International Crises", *International Studies Quarterly* 41, 27-50.

Neuenkirch, M. and F. Neumeier (2015), "The Impact of UN and US Economic Sanctions on GDP Growth", *European Journal of Political Economy* 40, 110-125.

Neuenkirch, M. and F. Neumeier (2016), "The Impact of US Sanctions on Poverty", *Journal of Development Economics* 121, 110-119.

Neumayer, E. and T. Plümper (2007), "The Gendered Nature of Natural Disasters: The Impact of Catastrophic Events on the Gender Gap in Life Expectancy, 1981-2002", *Annals of the Association of American Geographers* 97, 551-566.

Pape, R. A. (1997), "Why Economic Sanctions Do Not Work", *International Security* 22, 90-136.

Parker, D. P., J. D. Foltz and D. Elsea (2016), "Unintended Consequences of Sanctions for Human Rights: Conflict Minerals and Infant Mortality", *Journal of Law and Economics* 59, 731-774.

Peksen, D. (2009), "Better or Worse? The Effect of Economic Sanctions on Human Rights", *Journal of Peace Research* 46, 59-77.

Peksen, D. (2011), "Economic Sanctions and Human Security: The Public Health Effect of Economic Sanctions", *Foreign Policy Analysis* 7, 237-251.

Peksen, D. (2016a), "Economic Sanctions and Official Ethnic Discrimination in Target Countries, 1950-2003", *Defence and Peace Economics* 27, 480-502.

Peksen, D. (2016b), "How Do Target Leaders Survive Economic Sanctions? The Adverse Effect of Sanctions on Private Property and Wealth", *Foreign Policy Analysis* 13, 215-232.

Peksen, D. and A. C. Drury (2009), "Economic Sanctions and Political Repression: Assessing the Impact of Coercive Diplomacy on Political Freedoms", *Human Rights Review* 10, 393-411.

Peksen, D. and A. C. Drury (2010), "Coercive or Corrosive: The Negative Impact of Economic Sanctions on Democracy", *International Interactions* 36, 240-264.

Peksen, D. and B. Son (2015), "Economic Coercion and Currency Crises in Target Countries", *Journal of Peace Research* 52, 448-462.

Peksen, D. and B. Woo (2018), "Economic Sanctions and the Politics of IMF Lending", *International Interactions* 44, 681-708.

Plümper, T. and E. Neumayer (2006), "The Unequal Burden of War: The Effect of Armed Conflict on the Gender Gap in Life Expectancy", *International Organization* 60, 723-754.

Steinbach, A., J. Gutmann, M. Neuenkirch and F. Neumeier (2023), "Economic Sanctions and Human Rights: Quantifying the Legal Proportionality Principle", *Harvard Human Rights Journal*, Forthcoming.

Von Soest, C. and M. Wahman (2015), "Are Democratic Sanctions Really Counterproductive?", *Democratization* 22, 957-980.

Webb, C. (2020), "Re-examining the Costs of Sanctions and Sanctions Threats Using Stock Market Data", *International Interactions* 46, 749-777.

Wood, R. M. (2008), ""A hand upon the Throat of the Nation": Economic Sanctions and State Repression, 1976-2001", *International Studies Quarterly* 52, 489-513.

Constantinos Syropoulos and *Yoto V. Yotov*

Reflections on the Impact of Economic Sanctions

KEY MESSAGES

■ **As exemplified by the 2022 and ongoing sanctions on Russia, economic sanctions are more popular than ever in policy circles and an active topic of research**

■ **Sanctions aim to achieve political objectives. Nonetheless, despite evidence that their rate of success may be increasing, most sanctions fail to achieve their intended goals**

■ **The effects on sanctioned states are strong and adverse. However, the severity of these effects is mitigated by the possible diversion of economic activity toward third countries**

■ **Normally, sanctioning states do not suffer large losses. But the sanctions on Russia indicate that these nations may suffer significant losses too**

■ **The effects of economic sanctions on third countries, which are transmitted through general equilibrium and extraterritorial channels, may also be extensive and may entail losses or gains**

Constantinos Syropoulos

is the Trustee Professor of International Economics at the School of Economics, LeBow College of Business, Drexel University (Philadelphia, USA), and a CESifo Research Network Fellow.

Yoto V. Yotov

is a Professor at the School of Economics of the LeBow College of Business at Drexel University (Philadelphia, USA) and a Research Professor at the Center for International Economics of the ifo Institute.

The popularity of economic sanctions is higher than ever. Figure 1, which depicts the evolution of existing and new sanction cases in the world between 1950 and mid-2022 and is based on the latest edition of the Global Sanctions Database (GSDB; Syropoulos et al. 2022), confirms this point. The observed surge in 2022 has largely been due to the sanctions on Russia. Although these sanctions are still evolving across various dimensions, their stringency is increasing over time. At the end of February 2023, the European Union adopted its 10th package of sanctions "… against Russia and those that support it in its illegal aggression against Ukraine" (European Commission 2023).

The new package comprised multiple new measures, including an extended list of sanctioned individuals and entities, additional export and import bans, newly imposed financial restrictions, and new enforcement and anti-circumvention measures.

The evolution, coverage, and possible assessments of the EU sanctions on Russia illustrate the complexity of the problems that arise in connection with the rationale(s), implementation, and effects of sanctions on all sides. They also underscore the need for academics and policymakers to address such questions as: Why are sanctions imposed? What explains their increasing popularity? What is the impact of sanctions? Do sanctions work? How could their effectiveness and efficiency be improved? The objective of this note is to shed some light on a subset of these questions. More specifically, we discuss the political and economic effects of sanctions. Based on various contributions to the literature, we also attempt to draw some policy implications and conclusions related to the determinants of sanctions' effectiveness and success.

THE POLITICAL IMPACT OF SANCTIONS

The primary reason for imposing sanctions on a country is "… to persuade that country to change its policies or to address potential violations of international norms and conventions" (Morgan et al. 2023, 3). In short, the desired/intended effect of sanctions is a policy change or a political outcome.[1] The salient political objectives of sanctions during the period 1950-2022 are captured in Figure 2, which also is constructed from the GSDB. The top panel of this figure depicts the evolution of the number of sanctions in levels, while the bottom panel displays the same relationship in percentage shares.

Based on Figure 2, we may draw the following conclusions on the intended political outcomes of economic sanctions. First, the relatively small fraction of objectives under the category "Other" suggests that the main political objectives of sanctions could be classified in the following eight distinct groups: to prevent wars, end wars, promote democracy, support human rights, fight terrorism,

---

[1] As discussed in Morgan et al. (2023, 14), however, it is also possible that "… senders may issue 'fake' sanctions based on political pronouncements aiming to camouflage their economic motives. Thus, the imposition of sanctions may be intended to provide gains for the sender rather than to fulfill the declared political objectives of sanctioning. This story is also consistent with the notion that sanctions may be issued to serve the interests of specific interest groups (Kaempfer and Lowenberg 2007)."

destabilize regimes, resolve territorial conflicts, and trigger policy changes.[2]

Second, Figure 2 unveils a decrease in the number of sanctions (upper panel) and, especially, in the fraction of sanctions aiming to "Destabilize Regime" and resolve "Territorial Conflict" (lower panel). Among other things, the fall in the number of sanctions aiming to destabilize regimes may be explained by the relatively low rate of sanction success. The decrease in the number of sanctions associated with territorial conflicts may be driven by the fact that, often, such conflicts result in interstate wars, which cause the sanction objective to become "End War" (witness, e.g., the ongoing war between Russia and Ukraine). Third, in addition to the rise in sanctions aiming to end wars, Figure 2 identifies a significant increase in the number and fraction of sanctions aiming to improve "Human Rights", fight "Terrorism", and promote "Democracy."

Understandably, the political science literature focused primarily on the political impact and political success of sanctions. Assessments in this literature of whether sanctions work has evolved over time. Early work consisted mostly of case studies (e.g., Galtung 1967; Doxey 1972) and concluded that sanctions do not work. More systematic assessments of the effectiveness of sanctions (e.g., Hufbauer et al. 1990) established that about one-third of all sanctions achieved their political objectives. However, in more recent work, Kirilakha et al. (2021) and Morgan et al. (2023) have documented an increase in the number and proportion of successful sanctions. One possible explanation for these findings may be that, due to learning effects, policymakers may become more efficient over time in administering sanctions, with the US being a prominent example (Early 2021). Another possible explanation—with stark policy implications— may be that the more recent economic sanctions have become "smarter" and more targeted, e.g., toward specific individuals, companies, and sectors (Cortright and Lopez 2002; Bapat et al. 2013).

Despite the observed increase in the rate of sanction success—to about 50 percent in recent years (Kirilakha et al. 2021)—this rate remains relatively low, especially when considering the ever-increasing popularity of sanctions. What is more, there is no consensus among academics and policymakers on the key factors affecting the probability of sanction success (e.g., Bapat et al. 2013; Demena et al. 2021). The low rate of sanction success poses important challenges related to the design, implementation, and appropriate use of economic sanctions. What is especially puzzling about this low success rate is that often the economic costs of sanctions for sanctioning nations,

[2] We do note (from the bottom panel of Figure 2) that, while still relatively small, the fraction of "Other" sanctions has increased since the early 2000s. This finding could be driven by several factors, including the two deep recessions during this period, as well as various geoeconomic/geopolitical changes. An implication of this observation is that the diversity of political outcomes due to sanctions may rise, thereby increasing the complexity of analyses aiming to assess their impact and effectiveness.

Figure 1

Evolution of Economic Sanctions, 1950–mid 2022
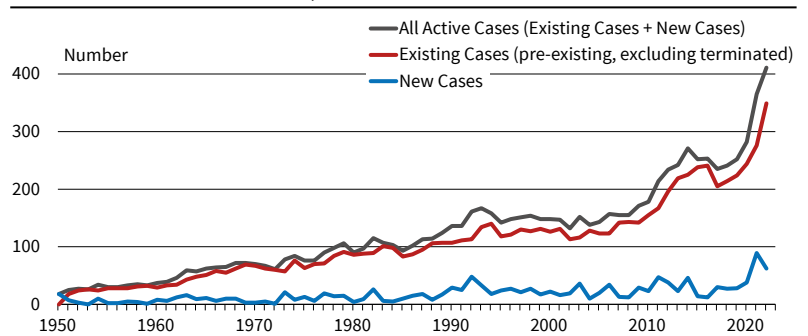
Note: This figure, which appears as panel (a) of Figure 1 in Syropoulos et al. (2022), illustrates the number of all active sanctions (black line), all pre-existing (excluding terminated) sanctions (red line), and newly imposed sanctions (blue line) in each year between 1950 and mid-2022.
Source: Syropoulos et al. (2022).   © ifo Institute

Figure 2

Evolution of Sanctions by Objective, 1950–mid 2022
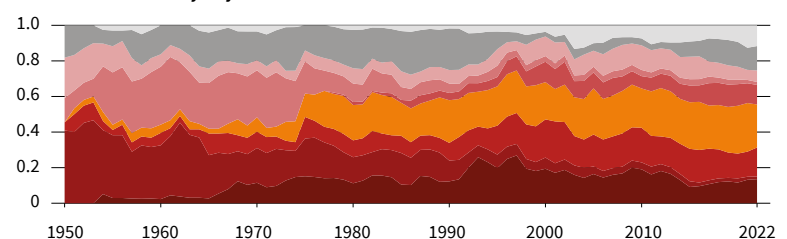
Note: This figure is from Morgan et al. (2023), where it appears as Figure 3. The figure depicts the evolution of sanctions depending on their objective over the period between 1950 and mid-2022. The top panel presents the evolution of the number of sanctions in levels, while the bottom panel displays the same relationship as percentage shares. Some sanction cases include more than one objective. We refer the reader to Felbermayr et al. (2020a) and Syropoulos et al. (2022) for definitions and examples for the various sanction objectives.
Source: Morgan et al. (2023).   © ifo Institute

third countries and (especially) for sanctioned states are extensive.

THE ECONOMIC IMPACT OF SANCTIONS

Although, as noted earlier, the literature has not identified a specific set of factors that guarantee sanction success, it does suggest that "*ceteris paribus*" larger economic costs for a target state are associated with increased compliance and likelihood of success. It is also commonly accepted in the literature that the effects of sanctions extend beyond the target states. To analyze the main effects of sanctions on different economic agents, in what follows, we rely on Figure 3 to represent the possible interactions among three distinct agents: (i) the "Sender(s)" of the sanction,

Figure 3

The Impact of Economic Sanctions
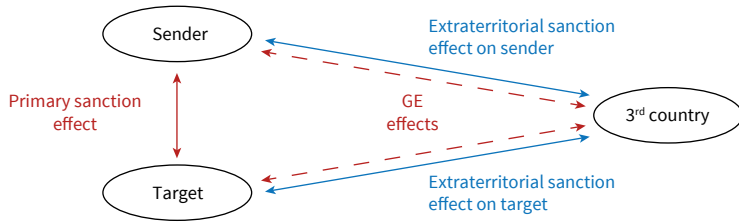
Note: This figure depicts the main actors and main effects (including transmission channels) of economic sanctions. It distinguishes between three agents: (i) the "Sender" of the sanction, (ii) the "Target", and (iii) a "Third country" representing the rest of the world. The figure captures the two main relationships between the three agents: (i) the "Primary Sanction Effect" on the target, the sender, and the relationship between them (captured by the solid red arrow); and (ii) the effects of sanctions on third countries, which we classify as direct "Extraterritorial" effects (captured by the blue arrows) and indirect "General Equilibrium" effects (captured by the dashed red arrows). All arrows in the figure point in both directions to reflect the possibility of retaliatory sanction responses in the case of the primary sanction effects, and reciprocal actions and impact across all possible sanction effects.
Source: Authors' presentation.   © ifo Institute

Figure 4

Evolution of Economic Sanctions by Targeted Impact

This figure is from Morgan et al. (2023), where it appears as Figure 2. The figure displays the evolution of sanctions depending on their type over the period between 1950 and mid-2022. The top panel depicts the evolution of the number of sanctions in levels, while the bottom panel presents the same relationship in percentage shares. Some sanction cases may include more than one type of sanction. We refer the reader to Felbermayr et al. (2020a) and Syropoulos et al. (2022) for definitions and examples for the alternative types of sanctions.
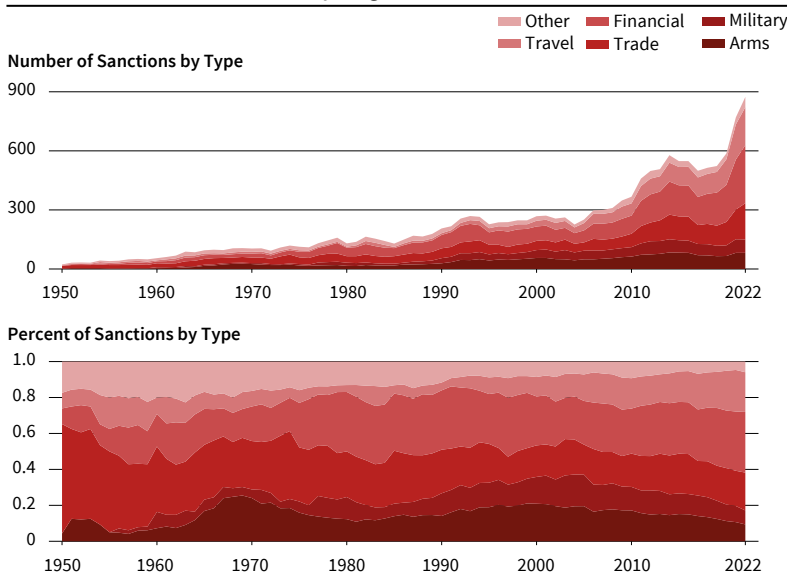Source: Morgan et al. (2023).   © ifo Institute

which could be a single country (e.g., the US), an organization (e.g., the EU or the UN), or many different countries that do not formally coordinate their actions (e.g., senders of the ongoing sanctions on Russia); (ii) the "Target" of the sanction, which is usually a single country (e.g., Russia or Iran) but could also be a group of countries (e.g., the League of Arab States); and (iii) a "Third country" representing the rest of the world (ROW). In most cases, especially when bilateral sanctions are imposed, ROW is a large region consisting of a heterogeneous set of countries, which may be "friends" or "enemies" to either the sender or the target. As discussed below, the size of the countries that are not part of a sanction episode and their relationship with the sanctioned and sanctioning sides play a key role in the determination of the effectiveness of sanctions.

Figure 3 also captures the two main relationships among the three agents: (i) the "Primary Sanction Ef-

fect" on the target and the sender (captured by the solid red arrow); and (ii) the effects of sanctions on third countries, which we classify as direct "Extraterritorial Sanction Effects" (captured by the blue arrows) and the indirect "General Equilibrium Effects" (captured by the dashed red arrows). All arrows in Figure 3 point in both directions to capture the possibility of retaliatory sanctions in the case of the primary sanction effects, reciprocal actions, and the impact associated with all possible sanction effects. To characterize the economic effects of sanctions, we next consider their impact on each of the three agents.

The Effects of Sanctions on Targets and Senders

A natural starting point in analyses of the impact of sanctions on senders and targets is to identify the key economic areas and activities that are affected by sanctions. This is not a difficult task because almost all sanctions in official documents are classified in five groups/categories that include: trade sanctions, financial sanctions, travel sanctions, sanctions on arms, and sanctions on military assistance. These five sanction categories and their evolution over time (in levels and in shares) are depicted in Figure 4, which once again is based on the GSDB.

Two notable patterns may be discerned in this figure: (i) the gradually increasing use of financial and travel sanctions, and (ii) the decreasing frequency of trade sanctions. The explanation for these findings may be that the gradual move toward smart sanctions (e.g., financial and travel sanctions), which target specific individuals and entities, usually aim to avoid or minimize collateral damage. Even within trade sanctions, there has been a notable departure from complete embargoes toward more targeted, partial sanctions, which focus on specific sectors.

Most of the empirical literature has focused on the impact of sanctions on targeted states, and the consensus among analysts is that the economic harm on these countries has been multi-dimensional and significant. Included in this harm are the effects on: individuals and firms (e.g., Ahn and Ludema 2021; Miromanova 2021); specific sectors (e.g., Larch et al. 2021 and 2022); aggregate trade (e.g., Hufbauer et al. 2007; Felbermayr et al. 2020b); foreign direct investment (Yang et al. 2004; Mirkina 2021); growth (e.g., Neuenkirch and Neumeier 2015; Kwon et al. 2022a); poverty (e.g., Neuenkirch and Neumeier 2016); and political stability (e.g., Peksen 2021). These and many other studies reveal that sanctions have been an impactful policy tool in the sense of inflicting economic pain on targets. As can be expected, the impact of sanctions on targeted nations is stronger when more countries participate in the group of senders. Thus, unsurprisingly, the most devastating sanctions have been those imposed by the United Nations (witness, e.g., the sanctions on Iraq for its 1990 invasion of Kuwait).

But while the main negative economic impact of sanctions is borne by target states, the senders of sanctions can be affected too. Historically, the effects of sanctions on sanctioning states have not attracted much attention in the literature, and when they did, the consensus was that these effects were relatively small and relatively short-lived (Bayard et al. 1983; Farmer 2002). Possible explanations for these conclusions include: (i) the disproportionately large size of senders relative to targets, (ii) the weak economic ties among the two sides, and (iii) the fact that the senders may select their preferred sanction(s) from a menu of policy options with a view toward minimizing the negative effects on their own economies. The recent sanctions on Russia offer an additional observation regarding this type of selection: some countries that could have incurred (significant) economic costs from the imposition of sanctions chose not to participate.

Recent studies (e.g., Felbermayr et al. 2020a; Besedeš et al. 2021; Crozet et al. 2021) use new methods and better data to search for more rigorous evidence that sanctions may indeed affect sender states. However, these studies, too, confirm the general conclusion that the effects of sanctions on senders are relatively small. The sanctions on Russia due to its invasion of Ukraine, though, may be a prominent counter example; that is, large and powerful senders, such as the EU and the UK, may suffer significant losses from their punitive actions, too. Simon Jenkins emphasized in The Guardian that "… [t]he EU should forget about sanctions—they're doing more harm than good," e.g., because "[s]ix million households in Britain face the possibility of morning and evening blackouts this winter to maintain sanctions against Russia, as do consumers across Europe" (Jenkins 2022). Policy analysts and the economic agents themselves quickly recognized the difficulties encountered in adjusting to the impact of the sanctions on Russia. To be sure, the notion that sanctions (like the ones on Russia) also affect sanctioning states adversely may contain valuable lessons on the design and implementation of economic sanctions. It surely points to the need for additional analysis and better frameworks to capture such effects.

The Effects of Sanctions on Third Countries

In addition to hurting targets and senders, sanctions may also affect third countries. As shown in Figure 3, to understand these effects it helps to distinguish between "general equilibrium" (GE) sanction effects and "extraterritorial" sanction effects on the countries in the rest of the world. The GE effects on third countries are usually positive because sanctions normally divert economic activity (e.g., trade, FDI, etc.) from senders and targets to the rest of the world (Haidar 2017; Felbermayr et al. 2020a; Besedeš et al. 2021). As a possible illustration, one could consider the re-

cent trade diversion of Russia's oil and natural gas exports from the EU to China and India. For example, as reported by Al Jazeera, "Russian oil sales to India surged more than 22-fold [in 2022] as European buyers turned to other markets following the conflict in Ukraine" (Al Jazeera 2023). Meanwhile, according to Reuters, "Russia more than doubled its rail exports of liquefied petroleum gas to China in 2022 as part of the Kremlin's drive to diversify its energy export sales" (Reuters 2023).

Importantly, the GE effects of sanctions on third countries tend to be small (e.g., because these effects are distributed among different countries that are not directly involved in the imposition of a sanction).[3] However, when taken together, the cumulative GE effect may be significant. It is the GE sanction effects that often are considered as an important reason for why sanctions "do not work" (e.g., as in the case of Russia's oil trade). The diversion of trade due to the GE sanction effects is also key reason of why senders attempt to influence third countries' policy actions directly, thus giving rise to the so-called "extraterritorial" sanction effects. We turn to these effects next.

Morgan et al. (2023, 15) characterize as extraterritorial "penalties on individuals, companies, organizations, and other entities from non-sanctioned countries due to their engagement in activities (e.g., trade, investment, other business activities, etc.) with a sanctioned state." The effects of such sanctions have been the object of intense debate (and often resentment) among representatives of potential senders. Still, the extraterritorial sanction effects are poorly understood and rarely quantified. Most existing studies provide descriptive and qualitative evidence for the presence of such effects (e.g., Gordon 2016; Han 2021). Kwon et al. (2022b) is a recent attempt aiming to estimate more systematically the extraterritorial effects of trade sanctions. Their findings suggest that these effects could be strongly negative for target states, but relatively small for third countries. The policy implication may be that, by increasing the cost on target states, extraterritorial sanctions may improve the likelihood of sanction success.

POLICY CONCLUSION

Despite their popularity among policymakers, and the significant economic harm sanctions inflict on targeted states, most sanctions, including the recent sanctions on Russia, fail to achieve their political objectives. One of the factors contributing to this "ineffectiveness" may be that often sanctions are not comprehensive in terms of the composition of senders (e.g., many countries did not sanction Russia for its

---

[3] Due to the size of the Russian economy, and especially its energy sector, the GE effects on the countries that maintained or even increased their trade with Russia may also be significant. Usually, targeted states are relatively small. Nevertheless, the sanctions on Russia constitute an important precedent that should inform future sanctions.

invasion of Ukraine) or in terms of the coverage of sectors (e.g., a year after the start of the war in Ukraine, the EU continues to import oil from Russia). The idea that sanctions are costly to senders and third countries may also challenge, if not circumvent, potential agreements among allies. Still, the emergence of suggestive evidence for an increasing rate of sanction success together with the absence of more attractive policy alternatives indicate that economic sanctions will likely remain popular in the foreseeable future.

REFERENCES

Al Jazeera News (2023), "Russia Says Oil Sales to India Soared 22-fold Last Year", https://www.aljazeera.com/news/2023/3/28/russia-says-oil-sales-to-india-soared-22-fold-last-year.

Ahn, D. P. and R. D. Ludema (2020), "The Sword and the Shield: The Economics of Targeted Sanctions", *European Economic Review* 130, 103587.

Bapat, N. A., T. Heinrich, Y. Kobayashi and T. C. Morgan (2013), "Determinants of Sanctions Effectiveness: Sensitivity Analysis Using New Data", *International Interactions* 39, 79-98.

Bayard, T. O., J. Pelzman and J. Perez-Lopez (1983), "Stakes and Risks in Economic Sanctions", *World Economy* 6, 73-87.

Besedeš, T., S. Goldbach and V. Nitsch (2017), "You're Banned! The Effect of Sanctions on German Cross-Border Financial Flows", *Economic Policy* 32, 263-318.

Besedeš, T., S. Goldbach and V. Nitsch (2021), "Cheap Talk? Financial Sanctions and Non-Financial Firms", *European Economic Review* 134, 103688.

Cortright, D. and G. A. Lopez (eds., 2002), S*mart Sanctions: Targeting Economic Statecraft*, Rowman and Littlefield, Lanham et al.

Crozet, M., J. Hinz, A. Stammann and J. Wanner (2021), "Worth the Pain? Firms' Exporting Behaviour to Countries under Sanctions", *European Economic Review* 134, 103683.

Demena, B. A., A. S. Reta, G. B. Jativa, P. B. Kimararungu and P. A. G. van Bergeijk (2021), "Publication Bias of Economic Sanctions 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 Publishing, Cheltenham, 125-150.

Doxey, M. (1972), "International Sanctions: A Framework for Analysis with Special Reference to the UN and Southern Africa", *International Organization* 26, 527-550.

Early, B. R. (2021), "Making Sanctions Work: Promoting Compliance, Punishing Violations, and Discouraging Sanctions Busting", in P. A. G. van Bergeijk, ed., *Research Handbook on Economic Sanctions*, Edward Elgar Publishing, Cheltenham, 167-186.

European Commission (2023), "EU Agrees 10th Package of Sanctions against Russia", https://ec.europa.eu/commission/presscorner/detail/en/ip_23_1185, 25 February.

Farmer, R. D. (2002), "Costs of Economic Sanctions to the Sender", *World Economy* 23, 93–117.

Felbermayr, G., A. Kirilakha, C. Syropoulos, E. Yalcin and Y. V. Yotov (2020a), "The Global Sanctions Data Base", *European Economic Review* 135, 103561.

Felbermayr, G, C. Syropoulos, E. Yalcin and Y. V. Yotov (2020b), "On the Heterogeneous Effects of Sanctions on Trade and Welfare: Evidence from the Sanctions on Iran and a New Database", *School of Economics Working Paper Series* 2020-4, Drexel University.

Galtung, J. (1967), "On the Effects of International Economic Sanctions: With Examples from the Case of Rhodesia", *World Politics* 19, 378–416.

Gordon, J. (2016), "Extraterritoriality: Issues of Overbreadth and the Chilling Effect of Sanctions in the Cases of Cuba and Iran", *Harvard International Law Journal January* 57.

Han, B. (2921), "Secondary Sanctions Mechanism Revisited: The Case of US Sanctions against North Korea", in P. A. G. van Bergeijk, ed., *Research Handbook on Economic Sanctions*, Edward Elgar Publishing, Cheltenham, 223-237.

Hufbauer, G. C., J. J. Schott and K. A. Elliott (1990), *Economic Sanctions Reconsidered: History and Current Policy*, 2nd Edition, Peterson Institute, Washington DC.

Hufbauer, G. C., J. J. Schott, K. A. Elliott and B. Oegg (2007), *Economic Sanctions Reconsidered: History and Current Policy*, 3rd Edition, Institute for International Economics, Washington DC.

Jenkins, S. (2022), "The EU Should Forget about Sanctions – They're Doing More Harm Than Good", https://www.theguardian.com/commentisfree/2022/may/30/eu-forget-sanctions-russia-ukraine-food-energy-prices, The Guardian.

Kaempfer, W. H. and A. D. Lowenberg (2007), "The Political Economy of Economic Sanctions", in T. Sandler and K. Hartley, eds., *Handbook of Defense Economics*, Elsevier, Amsterdam, 867-911.

Kirilakha, A., G. J. Felbermayr, C. Syropoulos, E. Yalcin and Y. V. Yotov (2021), "The Global Sanctions Data Base (GSDB): An Update That Includes the Years of the Trump Presidency", in P. A. G. van Bergeijk, ed., *Research Handbook on Economic Sanctions*, Edward Elgar Publishing, Cheltenham, 62–106.

Kwon, O., C. Syropoulos and Y. V. Yotov (2022a), *Do Sanctions Affect Growth*, Manuscript, School of Economics, Drexel University.

Kwon, O., C. Syropoulos and Y. V. Yotov (2022b), "The Extraterritorial Effects of Sanctions", 2022b, *School of Economics Working Paper Series* 2022-3, Drexel University.

Larch, M., J. Luckstead and Y. V. Yotov (2021), "Economic Sanctions and Agricultural Trade", *School of Economics Working Paper Series* 2021-16, Drexel University.

Larch, M., S. Shikher, C. Syropoulos and Y. V. Yotov (2022), "Quantifying the Impact of Economic Sanctions on International Trade in the Energy and Mining Sectors", *Economic Inquiry* 60, 1038-1063.

Mirkina, I. (2021), "FDI and Sanctions", in P. A. G. van Bergeijk, ed., *Research Handbook on Economic Sanctions*, Edward Elgar Publishing, Cheltenham, 369-387.

Miromanova, A. (2021), "Quantifying the Trade Reducing Effect of Embargoes: Firm Level Evidence from Russia", *Technical Report*, Working Paper.

Morgan, T. C., C. Syropoulos and Y. V. Yotov (2023), "Economic Sanctions: Evolution, Consequences, and Challenges", *Journal of Economic Perspectives* 37, 3-30.

Neuenkirch, M. and F. Neumeier (2015), "The Impact of UN and US Economic Sanctions on GDP Growth", *European Journal of Political Economy* 40, 110-125.

Neuenkirch, M. and F. Neumeier (2016), "The Impact of US Sanctions on Poverty", *Journal of Development Economics* 121, 110-119.

Peksen, D. (2021), "Economic Sanctions and Political Stability and Violence in Target Countries", in P. A. G. van Bergeijk, ed., *Research Handbook on Economic Sanctions*, Edward Elgar Publishing, Cheltenham, 187-201.

Reuters (2023), "China's 2022 Trade with Russia Hit Record $190 Bln - Customs", https://www.reuters.com/world/china-customs-says-trade-with-russia-hit-new-high-2022-2023-01-13/.

Syropoulos, C., G. Felbermayr, A. Kirilakha, E. Yalcin and Y. V. Yotov (2022), "The Global Sanctions Data Base - Release 3: COVID-19, Russia, and Multilateral Sanctions", *School of Economics Working Paper Series* 2022-11, Drexel University.

Wrede, I. (2022), "Can the EU Do without Metals from China?", https://www.dw.com/en/the-eus-risky-dependency-on-critical-chinese-metals/a-61462687, DW.

Yang, J., H. Askari, J. Forrer and H. Teegen (2004), "US Economic Sanctions against China: Who Gets Hurt?", *World Economy* 27, 1047-1081.

Eckhard Janeba

The Export of Sanction Policies: Extraterritorial Sanctions and Geopolitical Conflict

Russia's invasion of Ukraine has brought sanctions to the forefront of the political agenda. The broad coalition of countries arrayed against Russia is surprising, given that French President Macron considered NATO brain-dead not long ago and international coordination of economic policies experienced setbacks because of the UK's Brexit decision and former President Trump's unilateral policy agenda of "America First."

Beneath the broad-based alliance against Russia are cracks, however, that speak to countries' partly diverging interests. An example is the EU's oil embargo regime against Russia, which allows for reduced Russian oil exports to some EU countries because of their difficulty of finding energy substitutes quickly. Diverging interests are also reflected in the number of abstention votes in the UN General Assembly condemning Russia's invasion.

The heterogeneity of interests is neither surprising nor per se bad. In this article, however, I argue that the rising geopolitical rivalry between the United States and China may allow little room in the future for diverging policies among Western allies. In fact, US policymakers may demand that European allies take a hard stand against China, be it in technology or economic exchange. While Europe's strategy vis-à-vis China appears to be one of de-risking, decoupling appears to be on the horizon for both the US and China.

The instrument for extending the own (sanction) policy to other countries abroad is extraterritorial sanctions, also called secondary sanctions, which forces allies who do not follow the same sanction policies on their own to move in lockstep: "Extraterritoriality generally refers to the unilateral use of measures that are taken under a state's sovereign powers to enforce its own law, in a territory other than its own, for actions committed outside its territory by entities or people from other countries" (Jacques Delors Institute 2018).

The threat of extraterritorial sanctions is real, with secondary sanctions having been applied by the US government several times in the past. For example, the Nord Stream 2 gas pipeline was designed to export Russian gas to Germany. Before the war in Ukraine started, the pipeline was heavily promoted by multiple German governments, while strongly opposed by the US and also several Eastern European governments. Similarly, in the context of US sanctions against Cuba, the Helms-Burton Act of 1996 threatens US sanctions against foreign firms trading with Cuban state enterprises.

KEY MESSAGES

■ **The geopolitical rivalry between the US and China may spill over to Europe via extraterritorial sanctions**

■ **The US-Iran conflict shows that Europe losing access to the US market has been a powerful threat to limit Europe's trade with Iran**

■ **US extraterritorial sanctions, seen as a tool to limit Iran's sponsorship of international terrorism, became more attractive as the US became a energy exporter**

■ **Countermeasures against extraterritorial sanctions exist but proved largely ineffective in the past**

■ **European countries need to invest in strategic sovereignty to prepare for a possible fallout from the US-China geopolitical conflict**

Secondary sanctions have not been used by just the US. For example, the EU's data protection policy may have similar effects by forcing non-EU companies located outside the EU to comply for their domestic customers with the EU standards, because it is economically too costly or technically too difficult to apply different data protection policies within the same firm. The dominant role of the EU in setting standards is known as the Brussels effect (Bradford 2011). Unlike the previously noted cases, the EU does not require US firms to apply the European standard, but the policy may nevertheless have the same effect of exporting own policies to other countries (see also Svantesson 2014).

When allies do not share the same policies as the country imposing secondary sanctions, policy responses are to be expected and have been taken in the past. I briefly review policy options available, such as special purpose vehicles, blocking measures, and counter measures. Such actions are often limited in its success, however, which establishes the case for investment in strategic sovereignty.

EXTRATERRITORIAL SANCTIONS IN PRACTICE: THE US-IRAN CONFLICT

The history of sanctions by Western countries against Iran is informative about the reason for the emergence

Eckhard Janeba

is a professor of economics at the University of Mannheim. He is a member of the Scientific Advisory Board to the German Federal Ministry for Economic Affairs and Climate Action.

of extraterritorial sanctions and points to the difficulties in diluting them. The history contains periods in which the US and Europe marched in lockstep, and another when the two sides did not (for a detailed account of sanctions against Iran, see Nazareth 2019 and Gheibi 2022). This raises the natural question as to what induced the latter.

Since the early 2000s Iran's nuclear program became a concern among Western countries. A UN Security Council Resolution in 2006 demanded the stop of Iranian uranium enrichment. Iran refused to do so, and in fact declared its intention to produce highly enriched uranium, which would imply the ability to develop nuclear weapons within a few years. The US had imposed sanctions on Iran much earlier, but the sanction regime became tighter and more encompassing the more Iran's nuclear ambitions rose. Importantly, these sanctions were backed by UN Security Council resolutions, and were narrow in the sense of attempting to limit Iran's nuclear capabilities (Gheibi 2022). From 2010 onwards, the sanctions became more aggressive, now involving Iran's financial sector and targeting its oil revenues (Lohmann 2019).

The sanctions had also extraterritorial reach, but they didn't create a conflict between EU and US because—encouraged by the UN Security Council Resolutions and the fear about Iran's nuclear program—the EU imposed its own sanctions, which banned European investments in Iran's energy sector, cut financial relations, and disallowed European insurers from insuring transport of Iranian oil to foreign markets (Gheibi 2022). The economic impact of these joint sanctions on Iran was significant, and included a steep rise in unemployment, a strong depreciation of Iran's currency, and a rise in food prices. As a result, Iran's leadership changed with the election of President Rouhani in 2013. This paved the way for international negotiations.

In 2015, an international agreement known as the Joint Comprehensive Plan of Action (JCPOA) was reached between Iran and the members of the UN Security Council plus Germany (Gheibi 2022). The agreement included the shutdown of Iran's uranium and plutonium enrichment paths and was to be supervised through international inspections performed by the International Atomic Energy Agency. In exchange, sanctions against Iran were lifted, and Iran was brought back into compliance with international law, as reflected in UN Security Resolution 2231. The economic recovery of Iran was slow, despite the lifting of sanctions, as foreign investors were afraid of new sanctions being imposed again at some later point, which would then make those investments questionable economically (known as "chilling effect").

In late 2016 President Trump was elected in the US. With his election opposition to JCPOA became more forceful, and eventually Trump abandoned the agreement in May of 2018 (Nazareth 2019). The extraterritorial sanctions by the US that existed before the JCPOA

were put back in place, even though Iran complied with the inspection regime of its nuclear program. This compliance may have been one reason why European countries did not follow suit and in fact stated that Iran was fulfilling its commitments under the JCPOA.

Interestingly, President Trump referred in his decision not only to Iran's nuclear ambitions, but also to its sponsorship of international terrorism, a point to which I will return below. His decision seemingly justified ex post the hesitation of foreign investors after the JCPOA was agreed to. In other words, the chilling effect was now operative, as potential foreign investors had been right that new sanctions could well arise at a later time. Not surprisingly, the economic fallout in Iran of Trump's decision was massive, with inflation and unemployment rising sharply (Gheibi 2022).

The US decision and its reinstalling of secondary sanctions had severe consequences and exposed Europe as helpless (Lohmann 2019). Firms considering trade with Iran were practically forced to choose whether to trade with Iran or the US, because the US could sanction foreign firms engaged in trade with Iran by blocking their transactions conducted through the US financial sector or by freezing their assets in the US. The EU tried to counteract this threat by creating the Instrument in Support of Trade Exchanges (INSTEX), which was established in Paris in 2019. This is a special purpose vehicle (SPV) that facilitates trade between European and Iranian firms. Since it is a state-run entity, it does not face the same threat as individual firms. US sanctions against INSTEX would be equivalent to sanctions against European governments. However, INSTEX seems to be little more than symbolic and is used for products such as medical supplies that are in any case exempt from the hard sanction regime.

While Gheibi (2022) views US extraterritorial sanctions after JCPOA as counterproductive and unlawful, because Iran was compliant with JCPOA, it raises the question as to why they were reintroduced under President Trump. One may argue that the decision satisfied domestic political interests more than it tried to accomplish something abroad. The literature on (primary) sanctions has recognized that domestic considerations may be an important aspect in explaining their emergence (see Kaempfer and Lowenberg 1988), but this is not the only explanation.

A THEORY OF EXTRATERRITORIAL SANCTIONS

In Janeba (2022), I have suggested an explanation for the use of secondary sanctions that relates to the concern about Iran's sponsorship of international terrorism. It is an explanation for the emergence of such sanctions, not a normative justification. Iran has been involved in funding such terrorist groups as Hezbollah around the world (Kane 2018). Importantly, and

in contrast to Iran's nuclear ambitions, it is hard to enforce an international agreement like the JCPOA that would limit Iran's engagement in sponsoring terrorism abroad.

This aspect may explain the use of extraterritorial sanctions by the US ("the sender country"). In contrast to the traditional use of sanctions to change another country's behavior ("the target"), such as changing Iran's nuclear program, the goal of a sender country is rather to limit the amount of resources Iran has available to sponsor international terrorism. Of course, such sanctions make only sense if the reduced resources lead to less sponsorship of terrorism by the target, not more. The latter cannot be ruled out a priori because for political reasons a target country may find it advantageous to spend more on defense and military ambitions rather than less even if its own population is suffering economically.

If lower economic resources reduce sponsorship, extraterritorial sanctions are not used to influence via a stick-and-carrot approach the contractible activity "nuclear program," but rather the non-contractible activity "sponsorship of terrorism:" Iran is deprived not only of export revenues with the US, but also of those with European countries. A statement of President Trump in 2019, in the context of the US pulling out of the JCPOA, is consistent with the relevance of the latter activity: "… the actions of the Government of Iran and Iranian-backed proxies, particularly those taken to destabilize the Middle East, promote international terrorism, and advance Iran's ballistic missile program, and Iran's irresponsible and provocative actions in and over international waters, including the targeting of United States military assets and civilian vessels…" (Executive Order 13876 of 2019).

One may wonder, however, why conventional sanctions jointly levied by the US and European countries did not arise, as in a situation before the JCPOA became in effect. In Janeba (2022) I show that the situation of secondary sanctions by one sender country is a unique equilibrium of a non-cooperative sanction game between two sender countries if there are important asymmetries between the two sanctioning parties, i.e., US and the EU. Specifically, I argue that the fracking boom in the gas sector in the US over the last twenty years (Feyrer et al. 2017) transformed the US from a net energy importer to a small net energy exporter. As Iran's main export good is oil, the US benefits from trade with Iran diminished substantially over the years, while for European countries energy import dependence was and stayed very high, a fact that became painfully clear in the current conflict with Russia after its invasion of Ukraine.

Moreover, I assume that the use of extraterritorial sanctions involves a cost, as such sanctions violate the traditional international economic order, under which trade disputes are typically settled within the World Trade Organization (WTO) according to pre-set rules such as the Dispute Settlement Mechanism. Im-

posing the US policy on other countries via secondary sanctions therefore involves a reputational cost for the US president and may involve monetary costs due to trade disputes. President Trump looked down on international agreements, exemplified by pulling out of the Paris Agreement on climate change and his "America first" agenda, thus indicating that reputational cost or costs from trade disputes appear to play no huge role. This was different under President Obama, the period before JCPOA, who was more supportive of multilateral approaches.

POLICY OPTIONS AGAINST EXTRATERRITORIAL SANCTIONS

As the European response to US secondary sanctions shows, countries affected by such sanctions try to counteract their negative effects. INSTEX is a special purpose vehicle (SPV) set up in Europe to facilitate trade between European countries and Iran, which would not be affected by US secondary sanctions. Its success was very limited (Lohmann 2019). In theory, it would work because a SPV is a clearing house run by a state entity not subject to such sanctions, and it could allow for trades whose financial transactions would not run through international payment systems like SWIFT or involve US banks. A SPV may also be needed to facilitate legitimate trade such as humanitarian aid that itself is not covered by secondary sanctions but may be negatively affected by the general sanction regime.

The reason why INSTEX had limited success is that even if a European firm that was involved in a legitimate humanitarian deal with Iran operated under INSTEX, it could be accused of violating secondary sanctions in other business activities of the firm (Tilahun 2022). Another open question is whether SPVs are consistent with most-favored-nation (MFN) treatment under WTO law, which requires granting the same market access condition across all trading partners covered by MFN. An SPV could be interpreted as a favorable treatment. If so, other countries could claim to get access to the SPV, such as INSTEX, and if not granted could challenge the SPV as a violation of MFN treatment.

A second instrument to counter extraterritorial sanctions are blocking statutes, which many countries including the EU (Regulation 2271/96, see also European Parliament 2018), Canada (Foreign Extraterritorial Measures Act), and China have in place. Blocking statutes prohibit compliance with foreign sanctions, including non-recognition and non-enforcement of foreign legal proceedings that arise because of foreign sanctions. In other words, the intention of blocking statues is to penalize firms from compliance with foreign sanctions, rather than helping the firms to overcome them via SPVs (Tilahun 2019).

In the context of the US-Iran conflict, European firms have not made use of the rights granted under

the EU's blocking statute, perhaps in part because the value that could have been recovered in European courts if a European firm had pursued trade with Iran and been sanctioned by the US is smaller than losing access to the US market. It is therefore unclear whether existing EU law is sufficiently strong to protect European firms. Rather, it may appear that blocking statutes are intended to stop extraterritorial sanctions from being implemented in the first place, so are more political than economic in nature (Tilahun 2019).

Finally, countermeasures are instruments by governments against sanctioning countries that are not tied to the original sanction but rather impose harm on the sanctioning country, such as travel restrictions to persons from the sanctioning state. Of course, trade-related countermeasures are subject to WTO rules and dispute settlement regulations, and as such are more constrained by international law than blocking statutes and SPVs.

POLICY CONCLUSIONS

The rising geopolitical rivalry between the US and China presents not only a military danger to the world. The rivalry may affect in a fundamental way Europe's international economic relations. A confrontational US policy towards China (and vice versa) is likely to spill over to Europe, as the US will try to foist zits trade and foreign policy onto its traditional allies in Europe. While there is increasing skepticism in Europe regarding its economic dependence on China, it is conceivable that European countries, individually or even jointly, may take a different stand than the US. However, Europe may not have that choice if US extraterritorial sanctions were to be put in place. For this reason, it is important for Europe to regain strategic sovereignty (Leonard et al. 2018, European Council on Foreign Relations 2019).

The case of the US-Iran conflict is illustrative in this context. US secondary sanctions effectively shut down European non-humanitarian trade with Iran. European counteractions such as INSTEX and blocking statutes have proved largely ineffective. The relevance of safeguarding access to the US market, or the need to run foreign trade operations through international payment systems like SWIFT or the US banking system, are the reason. In other words, European trade with Iran is too small relative to its trade with the US to effectively counter the threat of US secondary sanctions.

US political and economic relations with China are more complex than those with Iran, as China is economically much more powerful and a much more important trading partner for the US than Iran. The rivalry is economic, political, and potentially military,

because of China's ambition to bring Taiwan under its control. The situation is also different for European countries. China is one of the largest trading partners, if not the largest, for several European countries, including export-oriented Germany. For this reason, a European firm's cost-benefit analysis of maintaining trade relations with China versus keeping them with the US is not as clearcut compared to the analysis when it comes to trade with Iran.

At this point it is hard to see that Europe would give up its political and defense alliance with the US to secure economic benefits with China. Nevertheless, Europe is well advised to develop economic tools that allow it to operate more independently of the US (as well as of China), such as in data storage, key technologies such as GPS and network structures, and financial transaction systems, to reduce its vulnerability in case of a further deepening of the US-China geopolitical conflict. The fallout from the US-Iran conflict should serve as a lesson.

REFERENCES

Bradford, A. (2012), "The Brussels Effect", *Northwestern University Law Review* 107, 1-68.

European Council on Foreign Relations (2019), *Strategic Sovereignty: How Europe Can Regain the Capacity to Act*, https://www.ecfr.eu/page/-/ecfr_strategic_sovereignty.pdf.

European Parliament (2018), *Updating the Blocking Regulation, The EU's Answer to US Extraterritorial Sanctions*, https://www.europarl.europa.eu/RegData/etudes/BRIE/2018/623535/EPRS_BRI(2018)623535_EN.pdf.

Executive Order 13876 of June 24, 2019, *Imposing Sanctions with Respect to Iran*, Federal Register Vol. 84, No. 123, 26 June 2019.

Feyrer, J., E. T. Mansur and B. Sacerdote (2017), "Geographic Dispersion of Economic Shocks: Evidence from the Fracking Revolution", *American Economic Review* 107, 1313-1334.

Gheibi, P. (2022), "The Rise and Fall of U.S. Secondary Sanctions: The Iran Outcasting and Re-Outcasting Regime", *Georgia Journal of International and Comparative Law* 50, 389-440.

Jacques Delors Institute (2018), "EU and US Sanctions: Which Sovereignty?", *Policy Paper* 232, 23 October.

Janeba, E. (2022), "Extraterritorial Trade Sanctions: Theory and Application to the US-Iran-EU Conflict", *Review of International Economics*, Forthcoming.

Kaempfer, W. H. and A. D. Lowenberg (1988), "The Theory of International Economic Sanctions: A Public Choice Approach", *American Economic Review* 78, 786-793.

Kane, J. R. (2018), "A Life Cycle Analysis of Hezbollah: Where the Group Came from and Where It Is Going", *American Intelligence Journal* 35, 67-73.

Leonard, M., J. Pisani-Ferry, E. Ribakova, J. Shapiro and G. Wolff (2019), "Redefining Europe's Economic Sovereignty, in M. Leonard and J. Shapiro, eds., Strategic Sovereignty: *How Europe Can Regain the Capacity to Act*, European Council on Foreign Relations, 19-48, https://www.ecfr.eu/page/-/ecfr_strategic_sovereignty.pdf.

Lohmann, S. (2019), "Extraterritorial U.S. Sanctions, Only Domestic Courts Could Effectively Curb the Enforcement of U.S. Law Abroad", *SWP Comment* No. 5, February.

Svantesson, D. B. (2014), "The Extraterritoriality of EU Data Privacy Law: Its Theoretical Justification and Its Practical Effect on U.S. Businesses", *Stanford Journal of International Law* 50, 53-102.

Tilahun, N. (2022), "Resisting (US) Sanctions: A Comparison of Special Purpose Vehicles, Blocking Statutes and Countermeasures", *Global Trade and Customs Journal* 17, 380 – 388.

Stefan Goldbach and *Volker Nitsch*

On the Economic Effects of Financial Sanctions: Evidence from Germany[*]

Over the past decade, there has been a growing interest in the economic effects of diplomacy. Recent research not only covers a wide range of diplomatic activities, from membership in international organizations to the operation of embassies and consulates, from foreign travels by politicians to visa policies. An increasing number of papers is also concerned with the wider picture, examining the economic implications of growing geopolitical tensions and possible shifts in the international balance of power.

A policy instrument that has recently received considerable attention in the literature on economic diplomacy is sanctions. Sanctions have become of particular interest for at least two reasons. First, from a conceptual perspective, sanctions are presumably a very powerful tool in the toolkit of diplomatic strategies. Since direct action is taken, sanctions typically go beyond other diplomatic initiatives, such as meetings or negotiations. Moreover, by banning cross-border interactions, they imply costs which affect both the country targeted by sanctions and the country that imposes the restrictions. Second, sanctions have of late been increasingly used (again) in practice. Most notably, massive sanctions have been imposed on Russia in response to its war of aggression against Ukraine.

Despite this sizable interest, however, the identification of the economic effects of sanctions is far from trivial. An obvious challenge is to isolate the effects of sanctions on the targeted country, whose economy is likely to be affected by many factors, including developments which may have led to the imposition of sanctions in the first place. Another issue is that sanctions are often composed of various, very specific measures, making it difficult to identify individual as well as aggregate effects of those restrictions. In February 2023, for instance, the European Union adopted its 10th package of sanctions against Russia.[1]

In view of these difficulties, we developed a research agenda that helps to avoid many of these issues by analyzing the impact of sanctions in a very specific (and maybe even unique) setting. In particular, our research is characterized by three key features. First, instead of covering the full range of pos-

KEY MESSAGES

- **Financial sanctions are effective. They have a strong and immediate negative effect on direct financial flows with the sanctioned country**

- **Financial sanctions imposed by a subset of countries, such as the European Union alone, face a higher risk of sanctions evasion, as opposed to sanctions imposed by the United Nations**

- **Financial sanctions tend to be smart, with their effects mostly concentrated on the targeted activity. There is limited evidence that financial sanctions create collateral damage by reducing trade in goods and services**

- **Domestic firms doing business with sanctioned countries tend to be large enough to divert their activities to alternative business opportunities with non-sanctioned countries when sanctions are imposed.**

sible restrictive measures,[2] we typically focus on a single type of restrictions, namely financial sanctions. In practice, many restrictive measures are indeed targeted at the financial sector.[3] Examples include investment bans and restrictions on access to capital markets and the provision of financial services. Moreover, other types of restrictions often contain constraints on financial transactions and are, therefore, also officially recorded as financial sanctions. Embargoes on exports of specific types of goods, for instance, typically involve restrictions on technical assistance, training and financing; travel bans on

Stefan Goldbach

is a Senior Economist in the Balance of Payments, Exchange Rates and Capital Markets Analysis Division at Deutsche Bundesbank.

Volker Nitsch

is Professor of International Economics at Technical University of Darmstadt.

named individuals are often accompanied by other restrictive measures, such as the freezing of funds and financial assets.

Second, we examine data on cross-border financial activities from only a single country, Germany. With this setup, analyzing bilateral financial interactions between Germany and other countries over time, we are able to identify patterns of adjustment in financial relationships after the imposition of a sanction. Implicitly, we also take advantage of the fact that Germany only imposes sanctions authorized by either the European Union or the United Nations.

Third, we analyze highly disaggregated data. Our main source of data is the Deutsche Bundesbank's balance of payments statistics, which provide detailed information on financial transactions between Germany and the rest of the world. For instance, for each single declaration, the value and the partner country of the transaction is provided, along with the name and address of the reporting unit (bank or corporation) and the type of asset that is transferred. As a result, we are able, for instance, to decompose the aggregate value of German capital flows with a partner country into various factors, including the unique number of reporting units that declare financial transactions with that country, the unique number of asset classes in which business has taken place, and the average value of capital flows by declarant-asset pair.

Equipped with this framework, we examine the economic impact of sanctions along various dimensions.

FINANCIAL SANCTIONS AND FINANCIAL FLOWS

In a first application (Besedeš et al. 2017), we focus on the activity targeted by financial sanctions, cross-border financial flows. The motivation for this exercise is twofold. First, while the ultimate goal of sanctions is to achieve a change in the target's policies, the definition of success as well as the contribution to success made by sanctions depend to a significant degree on subjective evaluation. Therefore, a more straightforward approach to assess the effectiveness of sanctions is to analyze their impact on the targeted activities.

Second, while sanctions, embargoes, asset freezes and other forms of legally imposed restrictions can be, in principle, expected to reduce financial transactions, the overall effect of sanctions on bilateral financial flows is unclear. On the one hand, the effect may be negligible, since many of these restrictive measures have become increasingly targeted at specific sectors or listed individuals, mainly to limit the humanitarian consequences of such actions. On the other hand, financial outflows could also decline in formally unrestricted business areas due to an increase in market uncertainty abroad (possibly related to fears that the target country may take retaliatory

action on the sender country) or to a greater administrative effort, such that the overall effect would be large.

Applying a difference-in-differences analysis on 20 sanctions episodes over the period from 2005 through 2014, we find that financial activities between Germany and the targeted country decline significantly after the imposition of financial sanctions. Responding to the restrictive measures, German investors tend to sell their assets held in sanctioned countries. Similarly, investors from targeted countries engage less with the German financial market. Sanctions also work across the board; they do not only lower the value of financial flows, but also lessen the number of transactions and the number of asset categories. Overall, our estimates indicate that, after the imposition of financial sanctions, German financial flows with the sanctioned country decrease by about 50 percent.

We also find a number of other interesting results. For instance, in one extension, we distinguish between United Nations (UN) and European Union (EU) sanctions and find that if only a subset of countries imposes sanctions, in these cases the EU, there seems to be rampant evasion through third countries. In other words, UN sanctions seem far more effective in cutting off financial flows than EU-only sanctions, indicating that the effect of EU-only sanctions may be more in the political area than the economic area. We also find little evidence of anticipation effects, though this may be a consequence of sanctions being imposed soon after the stated reason for them (usually one to two months). Finally, the easing or strengthening of sanctions does seem to matter, too. Thus, changing the intensity of sanctions may not only serve as a political signal, but also as an economic one.

FINANCIAL SANCTIONS AND DOMESTIC FIRMS

With the decline in cross-border financial flows, sanctions imply costs for both the target and the sender country. In fact, business groups in the sanctions-imposing country typically oppose such measures. When the US government, for instance, considered a tightening of sanctions against Russia in June 2014, the US Chamber of Commerce and the National Association of Manufacturers issued a newspaper advertisement stating that "[w]e are concerned about actions that would harm American manufacturers and cost American jobs. […] The only effect of such sanctions is to bar U.S. companies from foreign markets and cede business opportunities to firms from other countries."[4]

In Besedeš et al. (2021), we assess the costs of financial sanctions on the imposing country in more detail. In particular, we examine the effects of finan-

---

[4] See, for instance, "Business Groups Oppose Any New Sanctions on Russia" in USA Today, June 25, 2014 (https://eu.usatoday.com/story/news/politics/2014/06/25/obama-russia-sanctions-national-association-of-manufacturers-us-chamber-of-commerce/11349731/).

cial sanctions on German non-financial entities, i.e., declarants that are classified neither as banks nor as entities in section K ("financial and insurance activities"), according to the NACE Rev. 2 classification. To the extent that financial restrictions have any measurable effect on the economic performance of individual declarants, these effects should be particularly observable for non-financial business entities. For German banks and insurance companies, in contrast, with their large-scale financial operations in major national and international markets, the reduction in business opportunities due to sanctions policies is expected to have generally limited consequences on their overall activities.

A main advantage of our analysis is that our data set allows us to identify entities that declared business with the sanctioned country shortly before sanctions were imposed and, therefore, can be assumed to be directly affected by the restrictive measures. Therefore, we begin our analysis by characterizing such German firms in more detail. As it turns out, German firms that declared financial transactions with sanctioned countries have been disproportionately large and generally very active in (many) international markets. However, this finding is perhaps not very surprising, given that in our sample of 23 sanctions over the period from 1999 through 2014, restrictive financial measures have been primarily imposed, with only a few exceptions (e.g., Russia), on countries of small, even tiny, importance for Germany as counterparts in financial transactions.

As a result, however, firms affected by sanctions are expected to have various outside options in response to newly-imposed restrictions. More importantly, there is also consistent evidence that they indeed make use of such options, significantly expanding their business operations with non-sanctioned countries. In fact, when we examine the impact of sanctions on firm-level variables such as total sales and number of employees, the business performance of firms affected by sanctions is not measurably different from that of firms doing business only with non-sanctioned countries. Based on our estimation results (derived from a sample which ends in 2014 and, therefore, does not include the latest sanctions against Russia), we conclude that financial sanctions have, at most, limited economic consequences for non-financial business entities in the sanctioning country and, therefore, can be indeed considered as being "smart."

FINANCIAL SANCTIONS AND DOMESTIC BANKS

We complement our analysis of the impact of sanctions on German non-financial firms by a study of German bank lending in countries targeted by financial sanctions. In Efing et al. (2023), we identify the effects of sanctions on different groups of German banks (bank affiliates) in a standard differences-in-differences setting. In particular, we compare the business of German banks in a country before and after the country is targeted by sanctions and then examine whether any change in business is different for German banks that are located in Germany and abroad.

Interestingly, we find that domestic banks in Germany reduce lending in sanctioned countries, whereas their foreign bank affiliates outside Germany increase lending. In some cases, this is because the bank affiliates' host countries have not imposed sanctions themselves. However, even German bank affiliates in host countries that enact sanctions like Germany increase lending if these host countries lack strong institutions and anti-crime policies. These findings suggest that even universally adopted sanctions distort bank capital flows and competition if the level of their enforcement varies across bank locations.

SPILLOVER EFECTS OF FINANCIAL SANCTIONS

Sanctions are typically composed of a collection of measures that target a range of activities. Often, restrictive measures are defined in great detail, which raises the question of secondary effects, that the effect of one type of sanctions may spill over into another sphere of cross-border interactions. In fact, a simple link could be that the presence of financial sanctions increases the risk of doing business, any business, with the sanctioned country, resulting in a broad reduction in economic interaction between the sender of sanctions and its target.

In Besedeš et al. (2022), we examine the extent to which financial sanctions imposed by Germany through its EU and UN commitments cause collateral damage on Germany's trade in goods and services. It turns out that financial sanctions reduce Germany's inflows and outflows of financial assets, as well as imports and exports of goods and services. However, the relative effects on trade in goods and services are weaker than on financial assets, about half as large in the case of goods and two-thirds as large in the case of services. More notably, this reduction is entirely due to financial sanctions that were accompanied by restrictions on German exports. Since export restrictions are designed to limit trade, one can hardly think of these effects as being evidence of collateral damage. Rather, it is consistent with the idea of sanctions being smart: reducing precisely the activity that they target.

Our results also indicate that the primary channel through which financial sanctions affect cross-border flows is the extensive margin, reducing the number of firms or products engaged in cross-border flows when sanctions are in effect.

FINANCIAL SANCTIONS AND TARGET PAYMENT FLOWS

In most of our empirical work on sanctions, we usually do not analyze sanctions individually but pool

across a number of sanctions episodes. This approach, however, may not be particularly useful for an assessment of the effects of the latest massive sanctions against Russia (which are not included in our samples anyway).

In Drott et al. (2022), we examine the effect of financial sanctions against Russia at the most disaggregated level possible, individual bank accounts. Using data down to the daily frequency level from the Eurosystem's real-time gross settlement system TARGET2, we provide empirical evidence that sanctions imposed by the EU on Russian banks following the country's military interventions in Ukraine in 2014 and 2022 have sizably reduced financial transactions with sanctioned Russian bank accounts. Among the various sanction measures taken, exclusion from SWIFT (which prohibits the exchange of financial data for payments in SWIFT, a global provider of secure financial messaging services) turns out to have the largest effects.

POLICY CONCLUSIONS

The question whether sanctions actually work is, as Kaempfer and Lowenberg (2007, 871) put it, "a prickly conundrum." While sanctions are still widely used in practice, sanctions strategies are usually designed to end at the threat stage.

If implemented, financial sanctions are effective. They have a strong and immediate negative effect on direct financial flows with the sanctioned country.

Financial sanctions also tend to be smart, with their effects mostly concentrated on the targeted activity. There is limited evidence that financial sanctions create collateral damage by reducing trade in goods and services.

At the same time, however, there is considerable risk of sanctions evasion. Consequently, UN sanctions seem far more effective in cutting off financial flows than EU-only sanctions. Moreover, the harmonization of rules and regulations for cross-border financial flows has to be accompanied by efforts to seriously enforce these rules in practice.

REFERENCES

Besedeš, T., S. Goldbach and V. Nitsch (2017), "You're Banned! The Effect of Sanctions on German Cross-Border Financial Flows", *Economic Policy* 32, 263-318.

Besedeš, T., S. Goldbach and V. Nitsch (2021), "Cheap Talk? Financial Sanctions and Non-Financial Firms", *European Economic Review* 134: 103688.

Besedeš, T., S. Goldbach and V. Nitsch (2022), "Smart or Smash? The Effect of Financial Sanctions on Trade in Goods and Services", *Deutsche Bundesbank Discussion Paper* 28/2022.

Drott, C., S. Goldbach and V. Nitsch (2022), "The Effects of Sanctions on Russian Banks in TARGET2 Transactions Data", *Deutsche Bundesbank Discussion Paper* 38/2022.

Efing, M., S. Goldbach and V. Nitsch (2023), "Freeze! Financial Sanctions and Bank Responses", *Review of Financial Studies*, Forthcoming.

Kaempfer, W. H. and A. D. Lowenberg (2007), "The Political Economy of Economic Sanctions", in T. Sandler and K. Hartley, eds., *Handbook of Defense Economics*, Vol. 2, Elsevier, Amsterdam, 867-911.

Kirilakha, A., G. Felbermayr, C. Syropoulos, E. Yalcin and Y. Yotov (2021), "The Global Sanctions Data Base: An Update That Includes the Years of the Trump Presidency", in P. A. G. van Bergeijk, ed., *Research Handbook on Economic Sanctions*, Edward Elgar, Cheltenham, 62-106.

Kai A. Konrad and *Marcel Thum*

Do Resource Sanctions Work?

THE LOGIC OF SANCTIONS

As the signs mounted that Russia was preparing to invade Ukraine, a group of countries tried to dissuade it by wielding the threat of sanctions. The general logic was much like that for fighting crime: the threatened consequences of a criminal act are intended to deter the possible perpetrator from committing the crime. If the consequences are sufficiently drastic, this can prevent crime. The effectiveness of sanctions is related to the threatened cost they impose on the perpetrator. Thus, in a situation where a possible perpetrator commits a crime despite the threats of punishment, sanctions have lost their initial purpose: deterrence.

This is, however, not the end of the story. Sanctions can serve a purpose even in the face of a military incursion that has already begun. In this case, the purpose is to influence the duration and intensity of the conflict and the range of possible negotiated solutions to end the conflict. This may explain why, while we write this, the European Union is currently forging the tenth sanctions package against Russia. Ongoing fighting has costs for the conflicting parties, and sanctions can affect the cost of the ongoing conflict. The perspective that sanctions will be lifted once the conflict ends makes an early end of the conflict more attractive.

A few further aspects have been uncovered in the theory of international relations. These start with the puzzle of why the parties do not strike a deal that ends the violence. If a violent conflict continues, this imposes costs on the fighting parties, which might be higher for one side than for the other. However, as long as the sum of costs is negative on balance, bargaining and early conflict resolution lead to a peace dividend that can be shared among the conflict parties.

Differences in the cost of continued violence make one party more "patient" than the other party, and own patience is an advantage in negotiations. However, differences in patience do not remove the puzzle of enduring conflict. It only suggests that the more patient conflicting party should attain a larger share in the peace dividend. Sanctions that impose higher ongoing costs on the opponent than on one's party would be advantageous and give the own party a larger share in the peace dividend. However, in line with Ronald Coase's (1960) fundamental insights, immediate conflict resolution should result. The real puzzle is that the conflict endures.

Economists and political scientists have invoked a number of reasons why costly conflict might endure. These include asymmetric

information about each other among the fighting parties (Powell 2004). Fighting itself is a means to learn about the coordinates that determine the conflicting party's bargaining position, including the adversary's resourcefulness and resolve, assessment of possible outcomes, and political constraints such as audience costs. In the course of the enduring conflict, the two parties might learn about each other, and this might make a successful bargaining outcome more feasible.

The second major obstacle to successful negotiations is the problem of credibility (Powell 2006). Peace treaties are helpful only if they lead to a security architecture that makes them self-enforcing. This problem is significant, particularly in an international context of "Realpolitik," where there is no ultimate enforcer of peace contracts. Credible sanctioning threats might play a role in this context and help enforce a peaceful order. A vital aspect in this is the cost imposed on the sanctioned adversary in comparison to the cost imposed on the sanctioning party. In what follows, let us look at this cost aspect for a particular set of sanctions prominent in the Russia-Ukraine conflict.

KEY MESSAGES

- Damage created by an export embargo on exhaustible resources is typically much smaller than the foregone revenues

- Sanctions prompt the sanctioned country to extract resources later

- With competitive resource markets, sanctions create no costs—to any of the countries

- With non-price takers, the sanctioned country and worldwide consumers suffer losses

- With insecure property rights, sanctions hurt the autocrat most if his or her job security is low, but his international financial assets are safe

---

Kai A. Konrad
is Director at the Max Planck Institute for Tax Law and Public Finance.
Photo: © Kai Konrad

Marcel Thum
is Professor of Public Economics at TU Dresden and Director of ifo Dresden.

THE COST FLOW OF OIL AND GAS SANCTIONS

In the Russia-Ukraine conflict, the threat of sanctions has failed. Western countries announced they were willing to impose harsh sanctions in case of an invasion. When the invasion occurred nonetheless, they were willing to incur high costs to end the war and force Russia to withdraw from Ukraine. The sanctions were intended to target the leadership in Moscow, not the Russian population. In addition, they should cost the West as little as possible. However, when there was no sign of Russia giving in, politicians and the public entertained harsher measures, such as a halt to all gas and oil deliveries from Russia. Even though such a move could significantly impact the population in Western countries, from energy shortages to rapidly rising prices, most of the population seemed open to such measures. According to a poll conducted shortly after the Russian invasion, 55 percent of Germans favored halting all oil imports from Russia.[1]

The German government has been somewhat hesitant to agree to an oil and gas embargo, quite in line with the theoretical considerations outlined below.

OIL EXPORT SANCTIONS ARE JUST AN ASSET SWAP

There needs to be more clarity about what consequences an oil and gas embargo will have for the economy and society. It is unclear whether stopping all gas and oil deliveries from Russia would even affect the Russian government and the oligarchs associated with it. In a recent research paper (Konrad and Thum 2023), we have investigated under which conditions sanctions on the export of depletable resources can harm the sanctioned resource owner.

In the debate, the focus is on Russian revenues from the sale of resources to the West. The somewhat simplistic argument is that Russia will suffer losses to the extent of these revenues if it is no longer allowed to export resources to the West. An embargo, however, does not make these resources vanish. Russia can still sell some resources to countries that do not join the sanctions. Then, only the resource flows are diverted. Russian oil now flows to countries that previously sourced oil from the Middle East. For example, Russia has replaced Iraq as the most significant oil supplier for India. Hence, Russia's damage is not equal to the foregone revenues from sales to Europe; instead, Russia's sanction costs are the hassle of creating new transport routes and the discount on Urals crude oil.[2]

Even in the case that Russian oil exports are effectively limited in quantity, the ruling elite in Russia need not suffer any real economic damage, because even if the sanctions last several years, the oil will not have disappeared. Instead of being sold in the present, the oil will be sold in the future. The economic theory of exhaustible resources shows that in competitive markets with clearly defined property rights, it makes no difference to the present value of profits of single resource owners when they sell their oil. This insight goes back to the famous seminal paper by Harold Hotelling (1931). The basic idea is that from the perspective of a resource owner, extraction is merely an asset swap. Instead of holding wealth in the form of oil in the ground, some of the oil is extracted and sold; the revenues are invested in financial assets. In a market equilibrium, the (marginal) resource owner can be indifferent about whether to extract an additional barrel of oil today and earn the interest on the financial investment, or keep the barrel in the ground for longer. Accordingly, the Russian government would not care whether it sells its oil today or in ten years. In competitive markets, the temporary loss of market access for an oil-exporting country imposes exactly no cost to any of the countries. Additional exports from other countries will exactly offset the reduced oil exports from Russia. If resource sanctions are entirely neutral, should we care at all whether such sanctions are implemented? Yes, because neutrality crucially depends on competitive markets, where the sanctioned country is not a dominant exporter, and on secure property rights for natural resources and financial assets. We will discuss the consequences of imperfect competition and incomplete property rights.

MARKET POWER CONSIDERATIONS

The resource markets are certainly not as perfect as in Hotelling's model. Interestingly, market power per se makes no difference in a world without sanctions. For instance, under isoelastic demand, a resource monopolist will follow precisely the same extraction path as a competitive oil industry and, therefore, generate the same price path (Stiglitz 1976). The equivalence of competitive and imperfect markets also holds for a duopoly with two equally large resource owners, e.g., Russia and the MENA countries. Will sanctions on one resource owner be neutral as in the competitive case? No, because a sanction on Russia will effectively increase the other, non-sanctioned country's market power. The sanction forces Russia to delay oil extraction. The non-sanctioned oil exporter compensates for part of this negative supply shock but not all of it. The resource owner finds it optimal to keep the supply slightly lower to exploit its current market power. This drives up prices now and lowers them in the future. Hence, sanctions on Russia in a market with two big resource exporters benefit the other resource exporter. It harms the consumer countries, as they must pay more for their oil imports (in present value terms). Finally, the sanction creates economic

---

[1] https://www.tagesspiegel.de/politik/mehrheit-der-deutschen-fur-importstopp-von-gas-und-ol-aus-russland-6596143.html.
[2] In December 2022, the discount amounted to $12-$15 per barrel versus a monthly average of Brent crude oil (https://www.reuters.com/business/energy/russian-oil-sold-india-below-price-cap-buyers-market-2022-12-14/).

damage for Russia. However, the economic damage is again not equivalent to current foregone sales as often claimed in the political debate. The damage is just the lower present value of revenues because of the depressed price in the future.

POLITICAL INSTABILITY

An even more critical aspect is the incomplete property rights of Russia's resource owners. Resource economics has pointed to the role of political instability in a government's incentive to exploit its country's natural resources. Autocratic country leaders benefit from the extraction resource flow only as long as their time in office lasts. The threat of losing office incentivizes them to speed up extraction (Long 1975). As a countervailing effect, weak property rights could slow down exploration and investment in capital for drilling and extracting. The results by Bohn and Deacon (2000) on the comparative strength of these two effects are somewhat inconclusive. Merrill and Orlando (2020) find that oil at risk accelerates exploitation.

In the Russian context, a regime change that puts Vladimir Putin out of office is an event with positive, albeit unknown, probability. However, expert assessments and betting markets for this event exist,[3] with probability estimates fluctuating from a few single-digit percentage points to above 20 percent. Applying Long's (1975) logic, the Russian president prefers to extract resources today to extracting them years later. An export sanction forces the autocrat to switch to extracting later, i.e., to the less preferred alternative. Hence, the sanctions impose some burden.

As Konrad et al. (1994) explained, however, political uncertainty is only one type of uncertainty that can affect the speed of extraction the autocrat finds desirable. Equally important is whether the autocrat can safely stash away the sales revenues for the times after he or she has lost office. Decades ago, offshore financial centers provided this safety. Overthrown dictators could trust that their offshore savings accounts were safe and could use these savings for a good life after losing political power. The recent loss of the safety of offshore savings changes the autocrat's arbitrage calculus. It makes an asset swap towards offshore savings less attractive and reduces their incentives to speed up resource extraction. If, in the extreme case, the autocrat automatically loses their offshore financial assets together with losing power at home, the differential benefit of early extraction vanishes. Suppose the probability of losing offshore financial assets and political power is positive but still smaller than that of losing political power only. In that case, the autocrat's incentive of early extraction persists. The Russian President and the

Russian oligarchs are probably uncertain whether they will still have control over Russian natural resources. Over time, many oligarchs have fallen from grace, and Putin's rope networks will not last forever. Therefore, the Russian elite has significant incentives to extract and sell as much oil as possible as quickly as possible if they can bring the sales profits to safety.

The sanctions are costly for the Russian elite because they must postpone resource extraction to a future when they may no longer benefit from the proceeds. In this case, the sanctions do not affect world market prices for oil. The other exporter countries simply compensate the exports of the sanctioned country. Hence, there is no damage to the consumer countries. Since the Hotelling path of oil prices does not change, the other exporter countries' resource rents are unaffected by the sanctions, the only party impacted being the Russian resource owners. The damage from the export sanctions is considerable if the probability of remaining in power is low and the financial havens are safe.

Instead of an export sanction, a shift in Russian oil flows into the future can also be achieved via hindering access to financial safe havens. The West does not have to stop oil exports at all. It is enough to deprive the oligarchs of the safe havens to which they shift their profits. If the Russian oligarchs can no longer safely invest their funds in Western banks, their incentive to sell quickly as many resources as possible on the world market will also dwindle.

However, combining the resource sanctions with restrictions on access to financial safe havens is not advisable. Attacking the financial safe havens for oligarchs makes immediate resource extraction less attractive, thereby reducing the economic impact of export sanctions. Here, the insight from the Hotelling model is that inflicting economic damage on Russia requires focusing on one instrument only. If an export sanction is imposed, the financial assets should be left untouched to maximize the damage of the sanctions. Conversely, if the policy aims at financial safe havens, then sanctions are unnecessary and useless. The latter policy has the advantage of reducing the Russian oligarchs' wealth from the oil still in the ground at the same time as targeting the wealth accumulated from previous extraction.

FRICTIONS IN THE SHORT RUN

The Hotelling argument and the considerations on incomplete property rights abstract from features of the energy resource markets in the short run. Due to frictions in the means of transport of such energy resources and well as in the way extraction rates can be adjusted in the short run, a halt in oil supplies may have adjustment costs. These can be very high for both Russia and the West.

Nevertheless, the Hotelling argument and the considerations on incomplete property rights distin-

---

[3]   The community prediction over time, for instance, for a Russian coup or regime change by 2024 can be found at https://www.metaculus.com/questions/10246/russian-coup-or-regime-change-by-2024/.

guish export embargoes on fossil energy resources from embargoes on produced goods. Applying the Hotelling logic reveals that the design of effective sanctions crucially depends on the structure of the resource market (in particular, on market power) and the security differential between political power and the safety of offshore savings. This reduces the attractiveness of embargoes on energy resources, compared to other means to increase Russia's cost flow from the ongoing war.

POLICY CONCLUSIONS

The threat of sanctions has failed in its primary purpose, as it did not deter Russia from invading Ukraine. Nevertheless, the sanctions still have a function. They can increase pressure to end the conflict and favorably influence a negotiated outcome. To do so, the costs of sanctions must last throughout the conflict phase and end when the conflict ends. Furthermore, sanctions should primarily harm the sanctioned conflict party during the continuation of the conflict. This applies less to energy export embargoes than to many other sanctions. Indeed, falling sales revenues today are not a good gauge of the effectiveness of resource export embargoes, since oil not sold today does not vanish and can be sold in the future. A substantial sanctioning effect will result if—in the absence of

sanctions—the ruling elite in Russia wants to extract energy resources as quickly as possible and safely invest the proceeds abroad. Paradoxically, if this safe opportunity to invest the proceeds offshore ceases, it can also reduce the effectiveness of export sanctions on natural resources.

REFERENCES

Bohn, H. and R. T. Deacon (2000), "Ownership Risk, Investment, and the Use of Natural Resources", *American Economic Review* 90, 526-549.

Coase, R. (1960), "The Problem of Social Cost", *Journal of Law & Economics* 3, 1-44.

Hotelling, H. (1931), "The Economics of Exhaustible Resources", *Journal of Political Economy* 39, 137-175.

Konrad K. A., T. E. Olsen and R. Schöb (1994), "Resource Extraction and the Threat of Possible Expropriation: The Role of Swiss Bank Accounts", *Journal of Environmental Economics and Management* 26, 149-162.

Konrad, K. A. and M. Thum (2023), "Elusive Effects of Export Embargoes for Fossil Energy Resources", *Energy Economics* 117, 106441, https://doi.org/10.1016/j.eneco.2022.106441.

Long, N. V. (1975), "Resource Extraction under the Uncertainty about Possible Nationalization", *Journal of Economic Theory* 10, 42-53.

Merrill, R. K. and A. W. Orlando (2020), "Oil at Risk: Political Violence and Accelerated Carbon Extraction in the Middle East and North Africa", *Energy Economics* 92, 104935, DOI10.1016/j.eneco.2020.104935.

Powell, R. (2004), "Bargaining and Learning While Fighting", *American Journal of Political Science* 48, 344-361.

Powell, R. (2006), "War as a Commitment Problem", *International Organization* 60, 169-203.

Stiglitz, J. E. (1976), "Monopoly and the Rate of Extraction of Exhaustible Resources", *American Economic Review* 66, 655-661.

Dario Laudati

Evidence and Policy Implications of Sanctions in the Long Run: The Case of Iran

Sanctions are an increasingly prevalent tool in international policymaking. Their relevance stems from the need to respect national sovereignty while curbing the potentially destabilizing effects of local government policies. The case of sanctions against Iran is particularly interesting to understand the effects and propagation of economic sanctions. First, Iran has been sanctioned for over forty years, thus allowing for a long-run analysis of the phenomenon; in addition, given its relevance in the Middle East, it makes it possible to assess the impact of sanctions on a small—but economically relevant—open economy, levering on high-quality historical data.

Over the past forty years, Iran has been subject to a host of international measures that has led to the progressive isolation of the country from the rest of the world. In November 1979, the so-called "Tehran hostage crisis" ended a period of positive economic and diplomatic relationships between Iran and Western powers. The hostage crisis occurred in the aftermath of the regime change in February 1979—when the Islamic revolution took place—and affected 52 US citizens. In order to secure the release of the hostages, the US imposed a severe set of economic and financial measures against Iran, such as an oil embargo and asset freeze amounting to USD12 billion. Even though the Algiers Accords signed on January 1981 put an end to the crisis, thereby easing the intensity of sanctions, the relations between Iran and the US remained negatively affected by such event. Since then, Iran has been subject to varying degrees of economic sanctions as a result of the strategic decisions made over the political cycles in both countries and in Europe, and the geopolitical considerations regarding the stability of the Middle East.

In a recent study (Laudati and Pesaran, forthcoming), we assess the long-run implications of economic sanctions by developing a novel newspapers-based sanctions index and expanding the time-series literature on the matter. The study focuses on economic sanctions only, thus excluding political measures such as boycotts. Given our identification strategy, it is possible to establish both the impact in terms of total output losses and the relevant channels that can help to explain such losses. Economic sanctions have lowered output growth rates from the potential 4-5 percent to the realized 3 percent per year over the period 1989-2019. Such losses stem from an initial decrease in oil export revenues, which then lead to a substantial depreciation of the Iranian rial, followed by increases in inflation before being reflected in out-

put growth declines. A single quarter of sanctions shocks can explain only a small portion of the overall forecast error variance for the output variable, while a period of two years of protracted sanctions can explain up to 60 percent of the total decline in output growth, when keeping the other shocks fixed.

The current article describes the research design and the main findings of the aforementioned article and of a companion working paper (Laudati and Pesaran 2021). It concludes by providing some policy implications that may help foster the debate on international sanctions, also in light of additional evidence from the literature.

DATA AND RESEARCH STRATEGY

There are two major challenges when assessing the impact of sanctions on the Iranian economy in the long run. On the one hand, sanctions effects are usually estimated by using a dichotomous variable and taking an arbitrary position on the period in which they started ("sanctions on") and ended ("sanctions off") based on the knowledge of historical events—e.g., Gharehgozli (2017).

However, sanctions against Iran have not been imposed in a uniform way over time. Therefore, it is desirable to construct a continuous index of sanctions inten-

Dario Laudati

is a PhD candidate at the University of Southern California. His research focuses on macro-finance, financial intermediation, and international macroeconomics.

KEY MESSAGES

- Periods of prolonged sanctions can lead to large cumulated economic losses
- Oil revenue falls, exchange rate depreciations, and inflation may be key pass-through mechanisms to explain lower output growth
- Direct and indirect effects of sanctions may become entrenched over time, leading to resource misallocation
- Exclusion from foreign markets pushed Iran to develop in-house innovations and domestic product substitutes
- Sanctions may lead to additional socio-economic effects, such as gender-biased policies and reduction of education resources
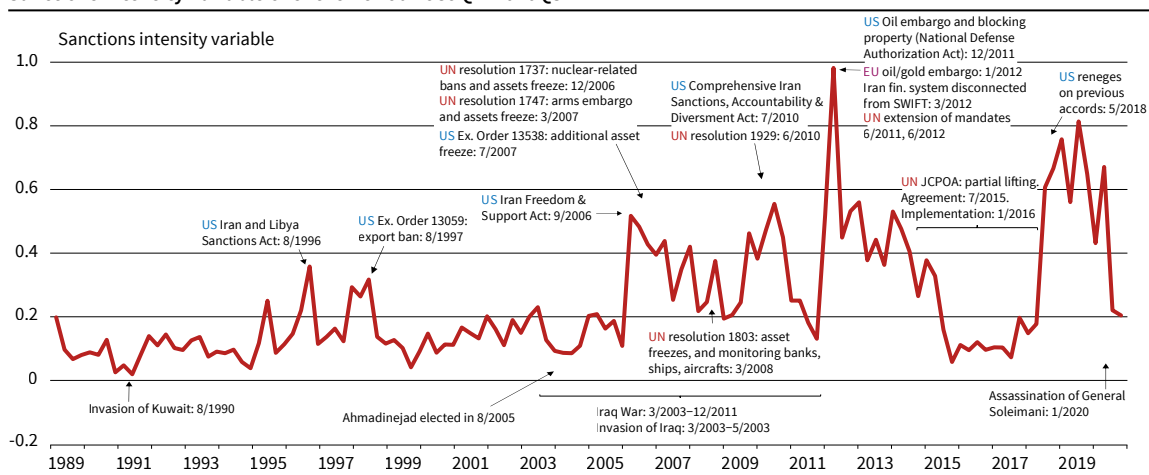
Figure 1

Sanctions Intensity Variable over the Period 1989Q1–2020Q3

Sanctions intensity variable

Note: The index is constructed by pooling sanctions-related news on Iran from six leading newspapers: The New York Times, the Wall Street Journal, the Washington Post, the Los Angeles Times, the Financial Times, and the Guardian. See Laudati and Pesaran (forthcoming) for further details on variable construction.   © ifo Institute

sity to overcome the limitations of dummy variables. We do so by collecting information on newspaper coverage of sanctions against Iran from six leading outlets spanning both the generalist and economic press. To our knowledge, this represents a contribution to the literature on sanctions' assessment. Figure 1 plots the results and shows that the indicator seems to track remarkably well the actual evolution of major historical and diplomatic events.[1] Sanctions were relatively mild before 2006 and intensified thereafter as a response to Iran's President Ahmadinejad's uranium enrichment program. The highest level of sanctions intensity occurred over 2012-2014, when the US and the UN joined forces to curb such uranium enrichment efforts. This led eventually to the nuclear deal (JCPOA) in 2015—followed by a consequent drop in sanctions—, before the US withdrew from the accord to enact a strategy of "maximum pressure" under US President Trump in 2018.

The second challenge of the study is given by the limitations of comparative approaches used in the policy evaluation literature, such as difference-in-differences, synthetic control methods (Abadie and Gardeazabal 2003), and panel data approach (Hsiao et al. 2012). Such limitations stem from the fact that sanctions began in a phase of structural change for the national institutions due to the Islamic revolution, thus preventing the use of the economic period before 1979. Furthermore, the specific characteristics of Iran make it hard to construct a reliable measure of a "synthetic" Iran variable. Consequently, we build a structural time series model to identify the effects and channels through which sanctions have been affecting the Iranian economy, as proxied by the sanctions intensity indicator.

The paper estimates the total impact of sanctions (direct and indirect losses) for the period 1989-2019 in order to exclude confounding effects from the 1979

[1] The same exercise can be extended in the future to study the effect of sanctions on other economies.

Revolution, the subsequent Iran-Iraq War of 1980-1988, and the Covid-19 shock of 2020. The Statistics Agency of Iran and the Central Bank of Iran provide excellent historical data at quarterly frequency. Additional global variables were retrieved from the usual international institutions such as the World Bank.

THE IMPACT OF SANCTIONS

Main Economic Effects

The time series model focuses on the economic impacts of sanctions on oil export revenues, Iran's rial/USD depreciation, inflation, money supply growth, and real output growth, whilst controlling for several global factors such as oil price changes, world output growth, equity market volatility and more. These estimates proved to be robust to alternative specifications and after allowing for a host of control variables. Our results also show that falls in oil export revenues, strong currency depreciations (with substantial overshooting), and high inflation rates are important channels through which sanctions affect the real economy. On the other hand, the over-expansion of the money supply used to compensate underdeveloped capital and money markets does not seem to affect the path of other domestic variables once we control for inflation and exchange-rate depreciation.

Using impulse response analysis techniques, we also find a significant short-term collapse of oil revenues, an over-reaction of the rial to sanctions, and a subsequent rise in inflation and a fall in output thereafter (Figure 2). The economy adapts reasonably quickly to the new sanction shocks, a property that has already been documented in the literature (Esfahani et al. 2013). The forecast error variance decompositions (FEVDs) with a single quarter shock to sanctions also show that around 80 percent of variations in foreign exchange and 82 percent of variations in output growth remain un-

explained, and most likely relate to many other latent factors that drive the Iranian economy. These results suggest that removal of sanctions on their own is unlikely to ensure a period of sustained growth and low and stable inflation, and many policy reforms are needed to address sanctions-induced price distortions as well as other distortions due to general economic mismanagement, poor governance, and the ambiguities that surround the relative roles of semi-government agencies in the economy.

The outcome of FEVDs is different if we consider the effects of a prolonged period of sanctions. When sanctions are imposed with the same intensity for about two years, keeping all other shocks fixed, they can explain more than 70 percent of the forecast error variance of inflation and around 60 percent of the forecast error variance of output growth. Figure 3 provides a visual representation.

Other Economic and Socio-demographic Effects

In a complementary working paper (Laudati and Pesaran 2021), we expand the scope of the analysis by using the same strategy in order to identify the negative effects of sanctions on the labor market. The employment rate has systematically decreased with respect to other countries in the Middle East and the North Africa region after sanctions were imposed, and women seem to have paid the higher price, with significant declines in female labor force participation.

We also find that sanctions have negatively affected secondary school education, with the number of schools and teachers both negatively affected by sanctions. Again, gender effects seem to be at play here.

The structural transformation pattern of the economy also seems to have been affected by sanctions. The agricultural sector has become more important as a share of the overall economy, while manufacturing has shrunk; the services sector shows no statistically significant change. The latter finding might also be explained as the result of the banking and financial system being hit by sanctions at the same time as the overall knowledge-based economy expanded.

Sanctions have also had a number of interesting unintended consequences for the Iranian economy. At the onset of sanctions, Iran was heavily dependent on oil exports, just as for countries such as Saudi Arabia. Restricting oil exports over a relatively long time has led to important structural transformations of the economy, with significant increases in non-oil exports, most notably petrochemicals, light-manufacturing products and agricultural goods. There have also been significant successes in internet access and the associated rise of high-tech and digital companies in Iran. It is likely that international sanctions have been partly responsible for the rapid rise of high-tech

Figure 2

Impulse Responses of the Effects of One Positive Standard Error Shock to the Sanctions Intensity Variable
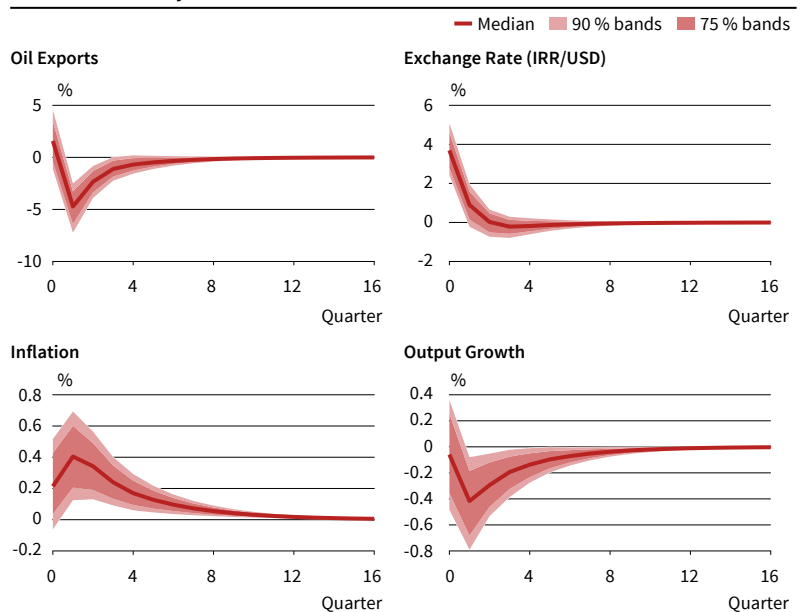
Note: See the online appendix in Laudati and Pesaran (forthcoming) for details of variables sources and construction.

© ifo Institute

Figure 3

Forecast Error Variance Decomposition for Domestic Variables in the Svar Model with a Cumulative Shock to Sanctions, and Domestic Variables Ordered
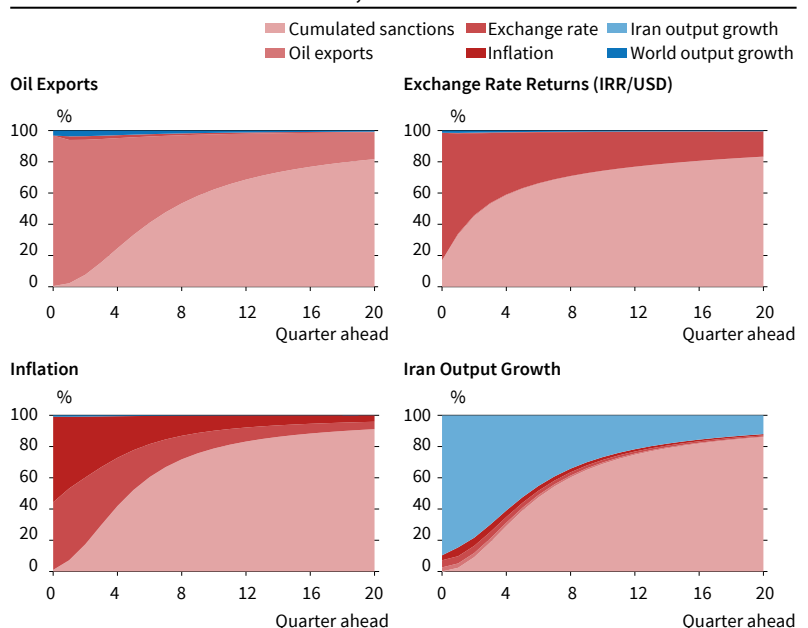
Note: See the online appendix in Laudati and Pesaran (forthcoming) for details of variables sources and construction.

© ifo Institute

companies in Iran over the past decade although more research is needed on the matter.

POLICY CONCLUSIONS

The recurrent challenge to derive policy conclusions with respect to sanctions lies in understanding what the sanctions' policy aims are in the first place. One fact that emerges from the Iran case is that a nuclear deal was reached as a result of a *multilateral* effort

to engage and negotiate. Between 2012 and 2014, a coalition of countries led to measures that eventually ended with the JCPOA agreement in 2015. This allowed Iran's nuclear enrichment process to be placed under control and ensured international agencies' access to Iran's nuclear facilities, while the country could experience economic and social relief from sanctions lifting. A similar result was not achieved before or thereafter when unilateral strategies were attempted, or when multilateral majorities were fragmented.

When considering the imposition of sanctions, there is no doubt that economic sanctions have harmed the Iranian economy. By considering similar emerging economies, and bearing in mind Iran's economic potential, it seems plausible that Iran could have grown at rates between 4 and 5 percent per year rather than the annual 3 percent rate experienced on average over the past thirty years. In this respect, it is remarkable that, even though sanctions were effective in isolating Iran from the world economy, the country was able to still grow in a semi-autarkic fashion and produce domestically generated innovations and high-tech product substitutes. Furthermore, sanctions have often been used as a rhetorical device by the élite to foster a sense of danger from the outside, thus buttressing the theocracy (e.g., "the resistance economy").

Economically, when sanctions extend over many years, their direct impact on output losses (e.g., from lower oil exports) tends to become increasingly entrenched, with indirect effects such as rent-seeking, resource allocation distortions, and general costs associated with efforts to mitigate and circumvent the sanctions regimes. Furthermore, sanctions may have significant political and socio-demographic reverberations, as we show for the case of gender-biased policies and reallocation away from educational resources. It is generally agreed that, at times of increased sanctions intensity, governments fearful of political consequences are reluctant to curtail distortionary policies, such as large subsidies on food and energy, and they might even accentuate them, or resort to multiple exchange rates to reduce the inflationary effects of sanctions.

The humanitarian aspect of sanctions should also be considered (Kokabisaghi 2018). Regulatory complexity acts as a major barrier to ensure the respect of human rights: trading in products technically allowed by the sanctioning environment (say, to satisfy key drugs' needs) may conflict with financial sanctions (when obtaining payments), thereby inducing excessive uncertainty for international partners to engage in any transactions. In this respect, the effects of the Covid-19 shock should be further studied.

However, Iran's low output growth relative to its potential, high inflation and excess output growth volatility cannot all be traced to sanctions alone: they also have domestic roots stemming from prolonged periods of distorted relative prices, corruption (Farzanegan and Zamani 2022), a weak banking system and under-developed financial institutions (Mazarei 2019). Therefore, when considering lifting the sanctions, global partners may need to keep in mind the adverse effects of years of economic mismanagement. Transparency in government policies is important to induce greater openness to private sector initiatives and foreign investments. Insulating the economy against oil revenue volatility will also become an urgent policy issue if sanctions are removed. Regional development policies should be initiated by giving priority to remote regions that have been left behind.

Finally, it is essential to consider not only the economic and social effects of any agreement, but also the stability of the agreements themselves. Forty years of diplomatic tension have engendered mutual distrust that has to be counteracted with appropriate contractual conditions to prevent an arbitrary and uncalled-for withdrawal from either side.

REFERENCES

Abadie, A. and J. Gardeazabal (2003), "The Economic Costs of Conflict: A Case Study of the Basque Country", *American Economic Review* 93, 113–132.

Esfahani, H. S., K. Mohaddes and M. H. Pesaran (2013), "Oil Exports and the Iranian Economy", *The Quarterly Review of Economics and Finance* 53, 221–237.

Farzanegan, M. R. and R. Zamani (2022), "The Effect of Corruption on Internal Conflict in Iran Using Newspaper Coverage", *Defence and Peace Economics*, 1-20.

Gharehgozli, O. (2017), "An Estimation of the Economic Cost of Recent Sanctions on Iran Using the Synthetic Control Method", *Economics Letters* 157, 141–144.

Hsiao, C., H. S. Ching and S. K. Wan (2012), "A Panel Data Approach for Program Evaluation: Measuring the Benefits of Political and Economic Integration of Hong Kong with Mainland China", *Journal of Applied Econometrics* 27, 705–740.

Kokabisaghi, F. (2018), "Assessment of the Effects of Economic Sanctions on Iranians' Right to Health by Using Human Rights Impact Assessment Tool: A Systematic Review", *International Journal of Health Policy and Management* 7, 374–393.

Laudati, D. and M. H. Pesaran (2021), "Identifying the Effects of Sanctions on the Iranian Economy Using Newspaper Coverage", *CESifo Working Paper* 9217.

Laudati, D and M. H. Pesaran (forthcoming), "Identifying the Effects of Sanctions on the Iranian Economy Using Newspaper Coverage", *Journal of Applied Econometrics*.

Mazarei, A. (2019), "Iran Has a Slow Motion Banking Crisis", *Peterson Institute for International Economics Policy Brief* 19-8.

Mohammad Reza Farzanegan

Economic Sanctions and Military Expenditure in Iran: A Brief Survey

The history of economic sanctions imposed on Iran begins with the Islamic revolution in 1978-79 and the establishment of the Islamic Republic. It was triggered by the seizure of hostages at the US embassy in Tehran by a group of political activists in 1979. In response, the US froze Iranian government assets in US banks. The unilateral sanctions of the US against Iran gained momentum under the Clinton administration, when sanctions against foreign businesses investing in the Iranian oil and gas industry were issued. Nuclear-related sanctions began to take shape when, for the first time in 2002, the existence of secret nuclear sites in Iran was revealed. The UN imposed nuclear- and ballistic missile-related sanctions on Iran in 2006, 2007, 2008, and 2010, mainly targeting specific individuals, arms sales, and financial assets.

In 2012, there was another surge in international sanctions when the EU joined the US in imposing an oil embargo against Iran. Furthermore, Iranian central bank assets and bank-to-bank transactions were also affected by sanctions. The key difference from earlier sanctions was the focus on Iranian crude oil exports and the cooperation of the EU in imposing the sanctions. The painful years continued until 2015, when Iran reached an agreement with the P5+1 (the five permanent members of the United Nations Security Council—China, France, Russia, United Kingdom, United States—plus Germany), which was implemented on January 16, 2016, resulting in the removal of nuclear-related sanctions. However, this period was short-lived; following the election of Donald Trump and his clear opposition toward the Iran deal, the sanctions were reimposed in 2018.

Under these sanctions, the senders hoped to force the Iranian government to revise its nuclear program and reduce its financial capacity to invest in military projects. It also aimed at discouraging other countries in the Middle East and North Africa (MENA) region from following the example of Iran and at mitigating nuclear competition in the region. Under the maximum economic pressure campaign of the Trump administration, the desire for change in the political system was also a significant reason behind imposing the sanctions. The idea was simple: increase economic pressure, and it would become less costly for people to rebel against the system. As an alternative to military intervention, economic sanctions were seen as an effective tool in foreign diplomacy to achieve the goals. In practice, however, the longer that a country is under sanctions, the less effective the sanctions will be (Hakimian 2019). This is due to the adjustment

KEY MESSAGES

- The effects of sanctions on military spending depend on the relative weight of income and security effects for the target country. If the income effect is larger than the security, then the country is more likely to observe a decline in military spending

- Economic sanctions have been shown to decrease military spending in Iran, as supported by time series models (VAR & ARLD) and counterfactual analysis. Therefore, it can be inferred that in this case the income effects of sanctions were stronger than the security effects

- By cutting the flow of oil rents, sanctions may force the government to increase taxes and may prompt political reforms

- Political reforms may lead to an increase in the share of non-military spending, thereby decreasing military expenditures

- The military industry in Iran has significant linkages with the country's economy, so sanctions may reduce military spending, but they may also decrease economic growth due to the aforementioned linkages

process in the target economy and its ability to find alternative ways of doing business locally and internationally. Iran was not an exception. A recent study by Cheratian et al. (2023) identifies the strategies that small and medium-sized firms in Iran use to neutralize the effects of sanctions, such as cutting marketing costs, overhead expenses, research and development (R&D) expenditure, and increasing investment in information technology. However, resistance against sanctions is associated with lower welfare in the economy, both at the aggregated formal and informal levels (Khabbazan and Farzanegan 2016; Farzanegan et al. 2016; Ghomi 2022; Laudati and Pesaran 2022; Farzanegan and Hayo 2019). The survival under sanctions is also associated with the expansion of the black market in foreign exchange transactions, rent-seeking, and informal economy (Zamani et al. 2021; Farzanegan 2013). The Control of Corruption indicator for Iran, published
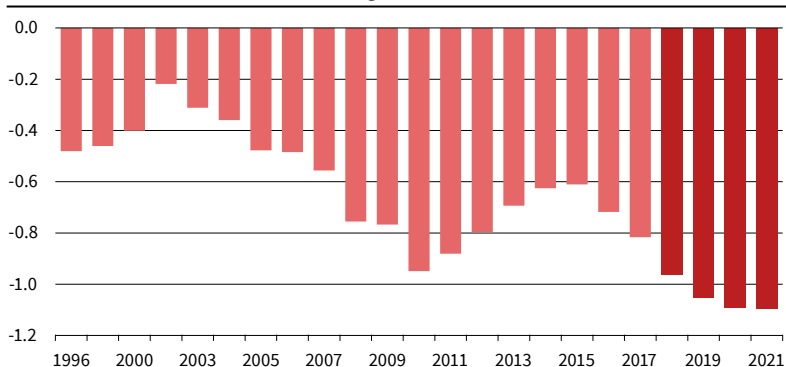
Mohammad Reza Farzanegan

is a Professor of Economics of the Middle East at the Center for Near and Middle Eastern Studies (CNMS) and the School of Business and Economics at Philipps-Universität Marburg in Germany.

Figure 1

Control of Corruption[a] in Iran: Worsening under Sanctions

[a] In units of a standard normal distribution, i.e. ranging from approximately -2.5 to 2.5.
Source: World Bank (2023).   © ifo Institute

from 1959 to 2007. The impulse response analysis shows that there are strong forward and backward connections between the military industry of Iran and economic growth. The study finds that the response of economic growth to a positive shock in military spending is positive and statistically significant in the short run. The analysis shows one-way Granger causality from military spending to economic growth. In other words, the earlier records of military spending and its development in Iran have strong explanatory power to forecast the future trend of economic growth in Iran.

DO ECONOMIC SANCTIONS REDUCE MILITARY SPENDING OF IRAN?

In various studies, I have examined this question with different methodological approaches. The study of Chun (2010) was one of the first investigations on the nexus between the development of oil rents and military spending, using 10 years of data from 1997-2007. He calculated the elasticity of demand of military spending in five oil-rich economies, including Iran. His goal was to examine the response of military spending given a specific change in oil revenues. He mainly found inelastic demand for military spending in these countries, concluding that "attempts to limit defense spending by tinkering with a producer of oil revenues are likely to fail." He was against using economic sanctions to reduce the military spending of Iran, since it was shown that the demand for military spending is inelastic with respect to changes in oil rents. He concludes that "we should constantly remind ourselves that in cases where oil revenue did shrink, defense budgets increased, or decreased at a lower rate than the fall in revenues."

Chun's study motivated me to explore further the dynamic relationship between oil rents changes and Iran's military spending. In Farzanegan (2011), I used a longer time series data on Iran (from 1959 to 2007) and employed the vector autoregressive (VAR) model to analyze the dynamic association between oil rents and different types of government spending in Iran. The VAR model is stronger in identifying the dynamic interaction between variables and provides the necessary inputs to simulate the responses of the variables of interest to a shock in other variables. Stock and Watson (2001) refer to this advantage of VAR: "since VARs involve current and lagged values of multiple time series, they capture comovements that cannot be detected in univariate or bivariate models." I used both symmetric and asymmetric changes in Iran's oil rents. The issue of economic sanctions was captured by the increase in the negative changes of oil rents. Using an asymmetric approach to measure changes in Iran's oil and gas rents, the results show that the response of military and domestic security spending to a positive shock in "negative changes" of oil rents is negative and statistically significant. This shows the

by the World Bank (2023), captures perceptions of the misuse of public power for private benefits at both petty and grand levels, as well as the capture of the state by private interests. This index shows a continuous negative trend (worsening of corruption) in Iran since 2015, with low records achieved after the Trump administration reactivated sanctions in 2018. Figure 1 presents the development of Iran's estimated score for control of corruption from 1996 to 2021.

Economic sanctions and resistance against it in Iran have also exerted a higher burden on women. In other words, sanctions are shown not to be gender-blind and place additional pressure on employed women in a country like Iran, where female labor force participation was already low (Demir and Tabrizy 2022).

In this brief overview, I will examine studies that have focused on the effect of sanctions on Iranian military spending.

RELEVANCE OF MILITARY SPENDING FOR GROWTH: THEORY AND EVIDENCE FROM IRAN

Understanding the effects of economic sanctions on military spending is important because of the established links between the latter and economic growth. Of course, this link can be positive or negative, depending on the country and the military's forward and backward linkages with the rest of the economy. The positive effect of military spending on the economy is often discussed through its influence on the provision of education, medical care, job opportunities, and scientific and technological innovations. The proponents of military spending see it through the Keynesian theory. However, other studies argue for the negative effects of military spending on growth through channels such as in the reduction of saving rates and investment, decrease in other productive spending in the education and health sectors, increase in the budget deficit and pressure on debt and tax rates, and an increase in corruption.

In a case study of Iran, Farzanegan (2014) examined the dynamic relationship between military spending and economic growth in Iran, using data

reaction of the Iranian government in cutting military spending in response to unexpected declines in oil and gas rents, which can be caused by oil and banking sanctions. The response of non-military spending, including education and health, to such negative shocks was initially negative but then changed to a positive and statistically significant trend. On the other hand, the response of military and security spending to negative changes in energy rents remained negative for five years after the shock.

One possible channel through which sanctions may affect the composition of government spending is through the quality of political institutions. If economic sanctions, by cutting oil rent flows, increase the dependency of the state on tax revenues, then one may expect, in theory, an improvement in the quality of democratic institutions. The greater the fiscal dependency of the state on its people, the higher its accountability to the citizenry and the higher the political participation of individuals. Dizaji and van Bergeijk (2013) provide some evidence on the positive short-term response of democracy to negative changes in Iran's oil rents.

What would be the response of military and non-military spending to a positive shock in democratic institutions? In Dizaji et al. (2016), we examined this question in a theoretical and empirical study, using annual data from 1960 to 2006. Our theoretical model suggests that "in an autocracy, the state considers only its self-interest and makes decisions to maximize rents and secure its assets against potential losses. A democratic government acts as a representative voice of the people, choosing policies that maximize the well-being of the population, i.e., workers." We applied a VAR model and estimated the impulse response and variance decompositions with collected data from Iran. We show that the response of military spending to a positive shock in the quality of democratic institutions is negative and significant for 3 years after the shock. The response of education spending to a positive shock in democratic institutions is positive and significant for the first 4 years following the shock. In short, economic sanctions may also reduce the target economy's military spending if they manage to increase the voice of the country's people in the policymaking process and increase the government's financial dependency on its people. If sanctions result in a worsening of political institutions due to a higher security risk to the political regime, the Dizaji et al. study shows a positive response of military spending and a negative response of non-military ones.

In the studies discussed, identification of the economic sanctions on Iran are based on negative changes in oil rents. A more direct approach is to use sanction binary variables, which capture their types (unilateral versus multilateral sanctions) and intensity. This approach was used in Dizaji and Farzanegan (2021). We used annual data from 1960 to 2017 and

the autoregressive distributed lag (ARDL) model. The model is helpful in establishing a long-run relationship in small samples. Military spending is the outcome of interest in the study and the established covariates include population size, economic development, non-military spending, total trade, average of military spending of MENA countries (excluding Iran), quality of political institutions, and a binary variable for Iran-Iraq war period (1980-1988). The key addition is the inclusion of sanction binary variables. We add a sanction binary variable that captures the intensity of sanctions and is coded as an ordinal variable (0–3), categorized as no sanctions (0), limited sanctions (1), moderate sanctions (2), and extensive sanctions (3). We also look at this issue from a different perspective and define the sanction binary variables based on the number of states involved.

The unilateral sanction binary variable captures the impact of unilateral US sanctions on Iran and is coded as 1 if sanctions are unilaterally imposed, such as in the periods of 1979-2005 and 2016-2017, and 0 in other years. The multilateral sanction binary variable is coded as 1 if sanctions are imposed by a group of countries, such as in the 2006-2015 period, and 0 in other years. We show that the intensity of sanctions imposed on Iran has a crucial impact on its military expenditure. Per our results, each increment in sanction intensity reduces military spending by roughly 33 percent in the long term, all else constant. Notably, our research reveals that only multilateral sanctions can effectively impede Iran's military aspirations. Implementation of multilateral sanctions brings about a remarkable 77 percent decrease in Iran's military spending over the long term, controlling for other factors, including GDP, oil rents, population, trade, non-military expenditure, average military spending in the Middle East, quality of democratic institutions, and the Iran-Iraq war.

None of the earlier studies could show the possible causal effect of sanctions on Iran's military spending. To do this, one needs a counterfactual Iran that is similar to the Iran before the imposition of sanctions and that can reproduce the actual Iran, especially with reference to its military spending, by that point. Once this counterfactual is found or estimated, we can trace development of military spending in both Iran and its synthetic version after the imposition of sanctions. If the sanctions have a significant effect, then we should be able to observe it by estimating the gap in military spending between Iran and its counterfactual.

I applied the synthetic control method (SCM) for the first time to measure the possible causal effect of the significant sanctions imposed during the Obama administration (after 2011) on Iran's military spending. The results, shown in Farzanegan (2022), address the question: What would Iran's military spending have looked like in the absence of international sanctions?

Figure 2

Military Spending per Capita: Iran versus Synthetic Iran
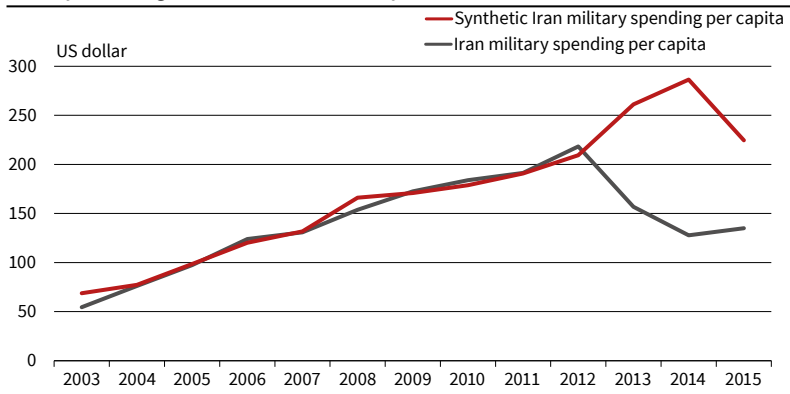
Source: Farzanegan (2022).   © ifo Institute

Figure 3

Per Capita Military Spending Gap between Iran and Synthetic Iran
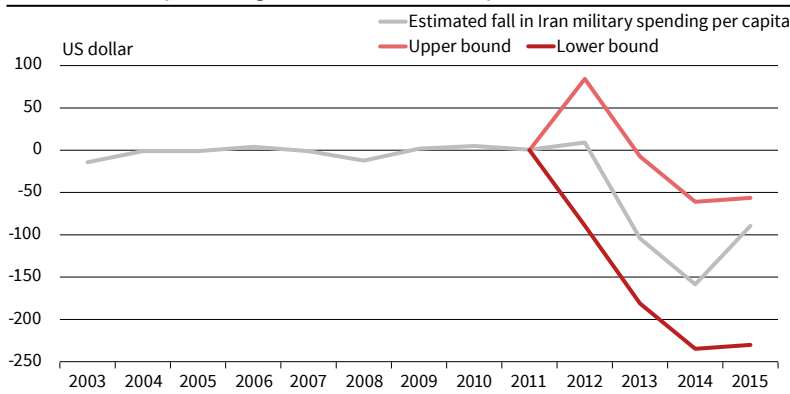
Source: Farzanegan (2022).   © ifo Institute

I find that over the entire 2013–2015 period of international sanctions, the average per capita military spending was reduced by approximately $117 per year. To get this result, I used annual country-level panel data from 2003 to 2015. The treatment year is 2012, when the EU and the US started the oil embargoes on Iran. Nuclear-related sanctions such as oil embargoes were lifted in January 2016. To create a simulated version of Iran, I utilized a weighted average of comparable countries in the donor pool. The donor pool included a sample of 12 countries that are members of the Organization of the Petroleum Exporting Countries (OPEC) and/or located in the MENA region. These countries are Algeria, Angola, Bahrain, Ecuador, Iran, Israel, Jordan, Lebanon, Morocco, Nigeria, Oman, and Saudi Arabia, after excluding any countries with missing data.

For an impartial assessment of Iran's post-2012 sanction trajectory, it is essential that the control countries that were used to generate the simulated Iran did not experience any significant exogenous shocks, such as sanctions, wars, or revolutions, from 2003 to 2015. Notable events in the MENA region during this time period include the military occupation of Iraq in 2003 and the Arab Spring of 2011-12, which led to political changes in some MENA countries. As a result, I have excluded Iraq, Kuwait, Libya, Tuni-

sia, Egypt, Yemen, and Syria from the list of control countries.

To generate the most accurate version of the simulated Iran, I found that a weighted average of four countries provides the best match. Angola, Nigeria, Ecuador, and Saudi Arabia are the countries with the highest weights in this average, at 44 percent, 33 percent, 18 percent, and 5 percent, respectively. The simulated model of Iran accurately mimics Iran's per capita military expenditures prior to the imposition of international sanctions. However, after 2012, the two trends start to diverge markedly. While per capita military spending in the actual Iran slows down, the synthetic Iran continues to experience a similar pace of increase in military spending as before the sanctions. Towards the end of the sample period, the gap between the two trends widens, suggesting a noteworthy adverse impact of the international sanctions on Iran's military expenditure (Figures 2 and 3).

CONCLUSIONS AND POLICY IMPLICATIONS

In this brief survey, I reviewed the evidence on the significant relationship between Iran's military spending and economic growth, implying forward and backward linkages of the military industry with the rest of the Iranian economy. I also examined studies that focused on the effect of economic sanctions on Iran's military spending. Some of these studies identified sanctions by using negative changes in Iran's oil rents, while others used a more direct approach to generate a variety of binary variables to capture the sanctions' type and intensity. Finally, I discussed how the synthetic control method can help identify the possible causal effects of sanctions on military spending, using the case study of Iran.

The possible effect of sanctions on military spending depends on the relative dominance of income effects versus security effects of sanctions. If the negative income effects of sanctions outweigh the security risks, then a decline in military spending is more likely to be observed. Otherwise, an increase is expected. Additionally, a possible channel through which sanctions may affect the military budget is by cutting oil income, which may influence the quality of the target's democratic institutions and increase the state's dependency on taxation and contributions from individuals and the private sector. However, the outcome of negative oil rent shocks on taxation depends on the size of the informal economy (Ishak and Farzanegan 2020). The higher the dependency and engagement of individuals in financing the state, the greater the pressure on the system for more accountability and wiser policymaking, especially in the domain of international relations. The positive effect of sanctions on democratic institutions might have positive consequences in substituting military spending with non-military spending, such as on the education and health sectors. However, evidence of the positive

effects of sanctions on democratic institutions is limited and fragile.

Economic sanctions, by cutting oil rents, may force the state to revise its subsidy programs and increase the tax burden, which can increase internal conflict (Ishak and Farzanegan 2022). The latter outcome is more likely if the informal economy is also under pressure from sanctions, as shown by Farzanegan and Hayo (2019). In this case, security risks may outweigh the income effects of sanctions and force the autocratic state to increase its military and security spending to protect its power against internal and external risks.

REFERENCES

Cheratian, I., S. Goltabar and M. R. Farzanegan (2023), "Firms Persistence under Sanctions: Microlevel Evidence from Iran", *The World Economy*, https://onlinelibrary.wiley.com/doi/10.1111/twec.13378.

Chun, C. K. S. (2010), *Do Oil Exports Fuel Defense Spending?*, Strategic Studies Institute, https://ssi.armywarcollege.edu/2010/pubs/do-oil-exports-fuel-defense-spending/.

Demir, F. and S. S. Tabrizy (2022), "Gendered Effects of Sanctions on Manufacturing Employment: Evidence from Iran", *Review of Development Economics* 26, 2040–2069.

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, 721–736.

Dizaji, S. F. and M. R. Farzanegan (2021), "Do Sanctions Constrain Military Spending of Iran?", *Defence and Peace Economics* 32, 125–150.

Dizaji, S. F., M. R. Farzanegan and A. Naghavi (2016), "Political Institutions and Government Spending Behavior: Theory and Evidence from Iran", *International Tax and Public Finance* 23, 522–549.

Eichenberger, R. and D. Stadelmann (2022), "Sanctions Are Costly for Citizens but Beneficial for Autocrats: A Political-Economic Perspective", *The Economists' Voice* 19, 109–123.

Farzanegan, M. R. (2011), "Oil Revenue Shocks and Government Spending Behavior in Iran", *Energy Economics* 33, 1055–1069.

Farzanegan, M. R. (2013), "Effects of International Financial and Energy Sanctions on Iran's Informal Economy", *SAIS Review of International Affairs* 33, 13–36.

Farzanegan, M. R. (2014), "Military Spending and Economic Growth: The Case of Iran", *Defence and Peace Economics* 25, 247–269.

Farzanegan, M. R. (2022), "The Effects of International Sanctions on Iran's Military Spending: A Synthetic Control Analysis", *Defence and Peace Economics* 33, 767–778.

Farzanegan, M. R. and B. Hayo (2019), "Sanctions and the Shadow Economy: Empirical Evidence from Iranian Provinces", *Applied Economics Letters* 26, 501–505.

Farzanegan, M. R., M. M. Khabbazan and H. Sadeghi (2016), "Effects of Oil Sanctions on Iran's Economy and Household Welfare: New Evidence from A CGE Model", in M. R. Farzanegan and P. Alaedini, eds., *Economic Welfare and Inequality in Iran: Developments since the Revolution*, Palgrave Macmillan US, New York, 185-211.

Ghomi, M. (2022), "Who Is Afraid of Sanctions? The Macroeconomic and Distributional Effects of the Sanctions against Iran", *Economics & Politics* 34, 395–428.

Hakimian, H. (2019), "Seven Fallacies of Economic Sanctions", 7 May, https://www.project-syndicate.org/commentary/economic-sanctions-seven-fallacies-by-hassan-hakimian-2019-05.

Ishak, P. W. and M. R. Farzanegan (2020), "The Impact of Declining Oil Rents on Tax Revenues: Does the Shadow Economy Matter?", *Energy Economics* 92, 104925, https://doi.org/10.1016/j.eneco.2020.104925.

Ishak, P. W. and M. R. Farzanegan (2022), "Oil Price Shocks, Protest, and the Shadow Economy: Is There a Mitigation Effect?", *Economics & Politics* 34, 298–321.

Khabbazan, M. M. and M. R. Farzanegan (2016), "Household Welfare in Iran Under Banking Sanctions: From Open Economy Toward Autarchy", in M. R. Farzanegan and P. Alaedini, eds., *Economic Welfare and Inequality in Iran: Developments since the Revolution*, Palgrave Macmillan US, New York, 213–232.

Laudati, D. and M. H. Pesaran (2022), "Identifying the Effects of Sanctions on the Iranian Economy Using Newspaper Coverage", *Journal of Applied Econometrics*, https://doi.org/10.1002/jae.2947.

Stock, J. H. and M. W. Watson (2001), "Vector Autoregressions", *Journal of Economic Perspectives* 15, 101–115.

World Bank (2023), *Worldwide Governance Indicators | DataBank 2023*, https://databank.worldbank.org/source/worldwide-governance-indicators.

Zamani, O., M. R. Farzanegan, J. P. Loy and M. Einian (2021), "The Impacts of Energy Sanctions on the Black-Market Premium: Evidence from Iran", *Economics Bulletin* 41, 432–443.

Mehmet Ayaz, Lea Fricke, Clemens Fuest and *Dominik Sachs*

Who Should Bear the Burden of Increasing Fiscal Pressure? An Optimal Income Taxation Perspective

KEY MESSAGES

■ **Governments need to either cut other spending or raise more tax revenue to service the additional debt resulting from shocks like the Covid-19 pandemic. This paper considers the case when governments decide to raise additional revenue**

■ **A key policy issue is how the additional tax burden should and will be distributed between households with different incomes. Generally, tax systems are progressive, but should they become more or less progressive in response to the shock?**

■ **Generally, governments that maximize welfare in a society with given preferences for redistribution face a trade-off between raising tax revenue and redistributing between households. If they need to raise more, there is less room for redistribution**

■ **To effectively raise additional tax revenues, governments should increase taxes and cut transfers for all taxpayers. Measured in euros, the additional burden on rich households is higher than that on poor households, but marginal and average tax rates rise more for households with lower incomes. Thus, optimal tax progressivity should decrease in response to growing fiscal pressure**

■ **The difference between the actual and the revenue-maximizing marginal tax rates is a key statistic for the size of the increase in marginal tax rates across the income distribution. We find that this difference is highest for low incomes**

The Covid-19 pandemic has had a profound impact on the global economy, leaving us with a significant stock of additional debt. For example, net government lending dropped from 1.5 percent (-2.3 percent) of GDP to -4.2 percent (-13.4 percent) in Germany (the UK) at the beginning of the Covid-19 pandemic. In addition, the economic fallout of the Russia-Ukraine war will increase the stock of government debt further. Servicing this debt will likely force governments to spend less or raise more revenue, probably a combination of both.

A widespread view is that the burden of servicing this debt should be distributed fairly, suggesting that tax systems should become more progressive. For example, the IMF proposes that "countries have multiple options to enhance the effective progressivity of their tax system" (de Mooij et al. 2020, 1), including "options [that] include more progressive personal income tax systems" (de Mooij et al. 2020, 3). However, the IMF also emphasizes that "the optimal degree of progressivity should strike a balance between equity and efficiency" (de Mooij et al. 2020, 4).

How should the optimal degree of income tax progression change if governments need to raise more revenues? In a new paper (Ayaz et al. 2023), we use the workhorse model of optimal income taxation to analyze the change in the degree of tax progressivity in response to the fiscal pressure caused by the Covid-19 pandemic. We bring our model to the data of five European countries (France, Germany, Italy, Spain, and the UK). Importantly, we use an inverse-optimum approach, which has the advantage that our results do not depend on a particular social welfare function. We find that total tax liabilities should increase more strongly for richer households than for poorer households. However, marginal and average tax rates should increase more strongly for poorer households than for richer households, implying that the progressivity of the tax schedule should decrease. We explain this decrease in optimal tax progressivity by the fact that the additional leeway governments have for raising marginal tax rates is significantly higher for low incomes. This is conceptualized by comparing current marginal tax rates with estimates of the revenue-maximizing marginal tax rate at different income levels.

INVERSE OPTIMUM APPROACH

To calculate the optimal tax-transfer system in a particular setting, it is necessary to make certain assumptions about the objective function guiding tax policy. This function may be interpreted as a welfare function or as a function of political influence. In the following, we use the term welfare function. A commonly used approach is to assign a welfare weight to each skill level. However, instead of taking such a normative stance and assuming society's preferences, we adopt the inverse-optimum approach, as outlined by Bourguignon and Spadaro (2012). This approach assumes that the current tax-transfer system is the result of

Table 1

Parameters for Calibration

	France	Germany	Italy	Spain	UK
Mass of people with zero earnings (percent)	5.6	4.4	3.2	3.8	7.0
Lump-sum transfer (€)	13,347	20,763	2,540	6,991	15,037
Measure of fiscal pressure (percent)	2.65	2.96	3.52	3.58	4.90

Notes: The mass of people with zero earnings corresponds to the shares of recipients of disability benefits reported by OECD (2009). For France, the average across OECD countries is used. The values of the lump-sum transfer are set to the average minimum income protection from the 2017 Social Assistance and Minimum Income Protection Interim Dataset. We convert all values into euros. The measure for fiscal pressure is expressed as a percentage of GDP and refers to the scenario where governments need to repay the additional stock of debt in five years.

Source: Authors' compilation.

optimal policy design by the government, where they possess knowledge about the economy's distribution of productivities and labor supply elasticities. It involves taking the observed tax-transfer system as optimal and then reversing the optimal taxation problem to uncover the underlying welfare criterion for society. By doing so, we replace a normative decision question with a positive inference question.

In our study, we calibrate the welfare weights for the five countries in our sample by assuming that the tax-transfer systems that were in place before the pandemic were optimal. This enables us to answer the following question: How should the optimal tax-transfer systems change when governments are under fiscal pressure due to the additional debt that has been incurred as a result of the pandemic?

BRINGING THE MODEL TO THE DATA

We bring our model to the data of the pre-pandemic economy of five European countries (France, Germany, Italy, Spain, and the UK). For this purpose, we need information about income distributions, income tax systems, a measure for fiscal pressure, and welfare weights for different households within each country. Table 1 gives an overview of the country-specific values used for the calibration of the model.

First, we approximate income distributions based on income data from the 2018 European Union Statistics on Income and Living Conditions (EU-SILC). The EU-SILC is a cross-sectional household survey containing annual income data in a harmonized framework allowing cross-country comparisons. To obtain smooth income distributions, we apply a standard kernel density estimation and assume that a fixed mass of the population earns an income of zero. We choose this mass such that it corresponds to the share of recipients of disability benefits reported by the Employment Outlook of the OECD (OECD 2009).

Second, we use the tax-benefit microsimulation model EUROMOD with input data from EU-SILC to approximate the current income tax systems. This gives us effective marginal tax rates that include taxes, means-tested benefits, pensions, and social insurance contributions. Further, we set the lump-sum transfers such that they correspond to the average minimum income protection

from the 2017 Social Assistance and Minimum Income Protection Interim Dataset.

Third, we compute a measure of fiscal pressure that governments face as a result of the Covid-19 pandemic using data on government debt from the OECD (OECD 2019) and the IMF World Economic Outlook (IMF 2021). Specifically, we calculate the total amount of additional debt that governments have accumulated between 2020 and 2022, compared to pre-pandemic average deficit levels. Then, we assume that governments must repay this additional stock of debt within five years, placing a considerable burden on government spending.[1] The strain on government expenditure ranges from 2 percent of GDP for France to 4.9 percent of GDP for the UK. An additional stock of debt may not have a strong effect on the balance between expenditures and revenue in governments' budgets in a low-interest-rate environment. However, with higher interest rates an additional stock of debt matters for the balance between expenditures and revenues.

Lastly, we calibrate the welfare weights such that the approximated income tax system from EUROMOD is optimal. This approach ensures that we use the welfare weights that governments were implicitly using before the pandemic.

TOTAL TAX LIABILITIES SHOULD INCREASE MORE FOR RICHER HOUSEHOLDS

In Figure 1, we present our findings on the optimal increase in total tax liabilities for different income quartiles in the five countries in our sample. Our results indicate that governments should primarily focus on collecting more tax revenues from the highest income quartiles in all countries to service their additional

---

[1] In our paper (Ayaz et al. 2023), we also consider a period of ten years for paying back the additional stock of debt.
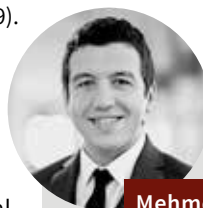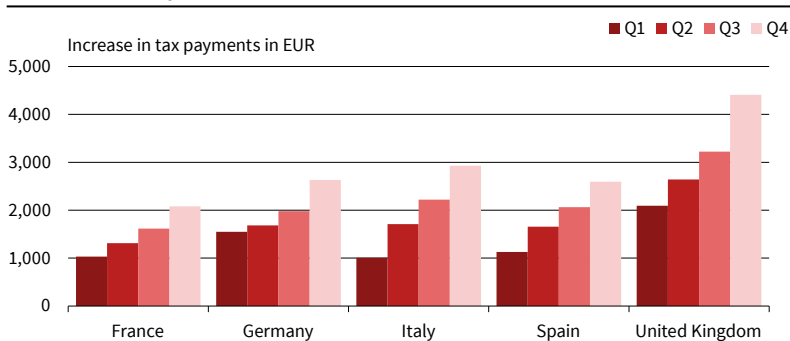
Mehmet Ayaz

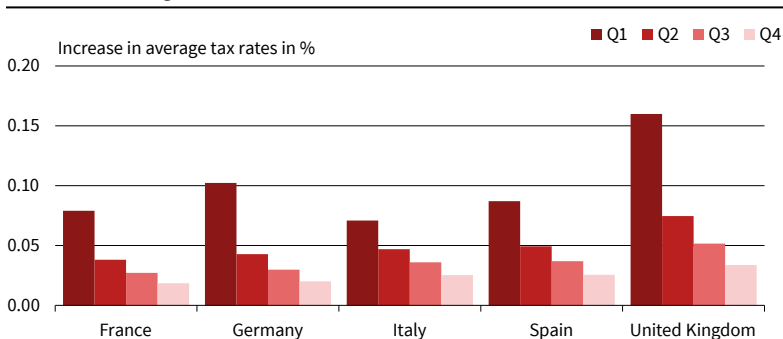is a doctoral student at the University of Munich.

Lea Fricke

is a doctoral student at the University of St. Gallen.

Figure 1

Increase in Tax Payments for Different Income Quartiles

Note: The figure shows the average change in absolute tax payments due to fiscal pressure for all quartiles of the income distribution.
Source: Authors' calculation.

© ifo Institute

Figure 2

Increase in Average Tax Rates for Different Income Quartiles

Note: The figure shows the average change in optimal average tax rates in percentage points due to fiscal pressure for all quartiles of the income distribution.
Source: Authors' calculation.

© ifo Institute

Clemens Fuest

is the President of the ifo Institute and Professor of Economics and Director of the Center for Economic Studies (CES) of the University of Munich.

Dominik Sachs

is a Professor of Macroeconomics and Public Finance at the University of St. Gallen.

France (EUR 3,000 vs. EUR 2,000). This disparity can be attributed to Italy's low initial lump-sum payment in our calibration. Conversely, our findings demonstrate that British households will face significantly higher increases in their tax liability compared to other countries, primarily due to the UK government's highest fiscal pressure in our calibration, estimated at 4.9 percent of GDP.

AVERAGE TAX RATES SHOULD INCREASE MORE FOR POORER HOUSEHOLDS

In Figure 2, we provide a presentation of our results in terms of average tax rates. In other words, we show the optimal change in average tax rates for different income quartiles. Our analysis reveals that the optimal increase in average tax rates is regressive. That is, the increase for lower-income households is higher than that for higher-income households. This result appears to contradict our finding on tax liability; however, the two results can be reconciled easily. Average tax rates are computed as the percentage of income that taxpayers pay in taxes, obtained by dividing the total tax paid by the taxpayer's income. Although higher-income households experience a greater increase in their tax liability, their higher income reduces their average tax rate. This explains why the optimal change in average tax rates is higher for lower-income households, even though the increase in tax liability is greater for higher-income households.

We find that the increase in average tax rates is significant, particularly for the lowest quartile of the income distributions. For example, in Germany, the average tax rates for the lowest quartile should increase by 10.2 percentage points, while the optimal increase for the highest income quartile is only 2.0 percentage points. Consistent with our findings on tax liability, the variation in average tax rate changes across countries can be attributed to the differences in the fiscal pressure faced by their respective governments. For example, the lowest quartile in the UK, whose government faces the highest fiscal pressure, is expected to experience a considerably higher increase, of 16.0 percentage points, in their average tax rates.

MARGINAL TAX RATES SHOULD INCREASE MORE FOR POORER HOUSEHOLDS

Figure 3 shows how the marginal tax rates should optimally change for different income quartiles. As in our result for average tax rates, we find that the optimal increase in marginal tax rates is regressive. They should increase at a higher rate for lower-income households compared to higher-income households.

The differences in our results across countries can be attributed to variations in initial

debt obligations. For instance, households in the highest income quartile in France should pay more than EUR 2,000 in additional taxes, whereas households in the lowest income quartile should only contribute about EUR 1,000 more.

The extent to which tax liability increases across different income quartiles varies across countries, as it is influenced by the initial tax-transfer systems in place and the magnitude of the fiscal pressure shock. Our analysis reveals that households within the first quartiles of the income distribution in France and Italy are projected to experience a similar amount (EUR 1,000) of tax liability increase, while the increase in the highest quartile is 50 percent more in Italy than in

circumstances and the level of fiscal pressure. Specifically, we find that the UK has the highest increase in marginal tax rates due to it having the highest fiscal pressure in our calibration. The lowest quartile of the income distribution in the UK is expected to face a 5.4 percentage point increase, while the highest quartile is expected to face only a 0.9 percentage point increase.

Italy is another country with a high increase in marginal tax rates. Even though Italy faces lower fiscal pressure than Spain (3.5 percent vs. 3.6 percent of GDP), the marginal tax rates should increase more in Italy. This is due to the low level of the lump-sum payment in Italy in our calibration. Since the Italian government cannot decrease the lump-sum payments, which are already low, it responds by increasing marginal tax rates more.

Finally, note that the comparative statics that marginal tax rates should increase more strongly for low-income levels due to fiscal pressure is not an artifact of our inverse-optimum approach. In a recent paper, Heathcote and Tsujiyama (2021) have explored optimal nonlinear income taxation in a model calibrated to the United States. They found that the optimal utilitarian tax schedules feature higher marginal tax rates at the bottom, the higher fiscal pressure is. In the following, we provide an interpretation of such comparative statics in terms of the well-known concept of the Laffer curve.

UNDERSTANDING THE MECHANISMS: THE LAFFER CURVE

In Figure 4, we illustrate the change in marginal tax rates in a more granular way. As can be seen, the increase in marginal tax rates follows a U-shape: the increase is highest for low-income levels, then decreases for intermediate and high incomes, before it increases again for incomes above EUR 150,000. To understand this pattern, it is useful to look at the Laffer bounds for marginal tax rates.

In Figure 5, the red curve illustrates these Laffer bounds for Germany. The concept goes back to Lorenz and Sachs (2016) and it measures which value of the marginal tax rate at a given income level would maximize tax revenue, holding all other marginal tax rates fixed. We can see that these Laffer values follow a U-shape. This has its roots in the shape of the inverse Pareto coefficient of the earnings distribution, which usually has such a U-shape (Saez 2001). This is also in line with the often-found optimal U-shape of marginal tax rates (Diamond 1998).

The blue curve illustrates the current marginal tax rates that we have calibrated. The pink curve shows the optimal marginal tax rates after the fiscal pressure shock. As can be clearly seen, the increase in marginal tax rates is proportional to the difference in the Laffer bounds and the current marginal tax rates.

Figure 3

Increase in Marginal Tax Rates for Different Income Quartiles
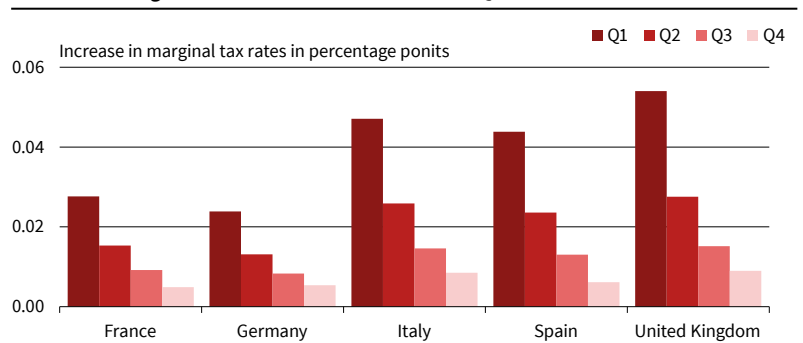
Note: The figure shows the average change in marginal tax payments in percentage points due to fiscal pressure for all quartiles of the income distribution.
Source: Authors' calculation.

© ifo Institute

Figure 4

Increase in Marginal Tax Rates
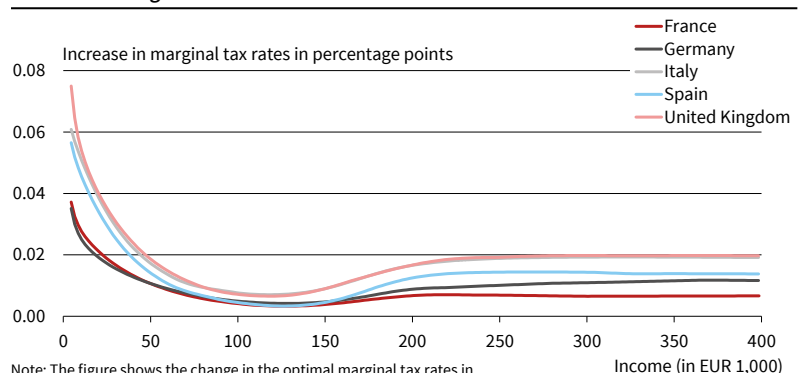
Note: The figure shows the change in the optimal marginal tax rates in percentage points due to fiscal pressure up to an income level of EUR 400,000.
Source: Authors' calculation.

© ifo Institute

POLICY CONCLUSIONS

How governments should respond to rising fiscal pressure resulting from current crises including the aftermath of the Covid-19 pandemic, the Russian attack on Ukraine, and medium- to long-term issues like climate change and population aging is a policy question of growing importance. Intuitively, many politicians and economists argue that the burden of this fiscal pressure should be distributed fairly, implying that tax and transfer systems should become more progressive.

The difficulty with this conclusion is that even before these crises governments had to deal with the tradeoff between redistribution and other tax policy objectives like avoiding distortions and raising revenue. So, the question is how the optimal response to these trade-offs is affected by a shock forcing governments to collect more revenue or spend less. Our analysis shows that, for a given welfare function, the optimal degree of tax progressivity declines in response to fiscal pressure. This does not mean that households with higher incomes do not contribute. Measured in absolute terms, that is in euros, their tax burden rises more than that of households with lower incomes. But relative to income, the increase in the tax burden is higher for low incomes. The progressivity of the tax and transfer system declines.

Figure 5

Laffer Bound, Current Tax Schedule and Adjusted Tax Schedule for Germany
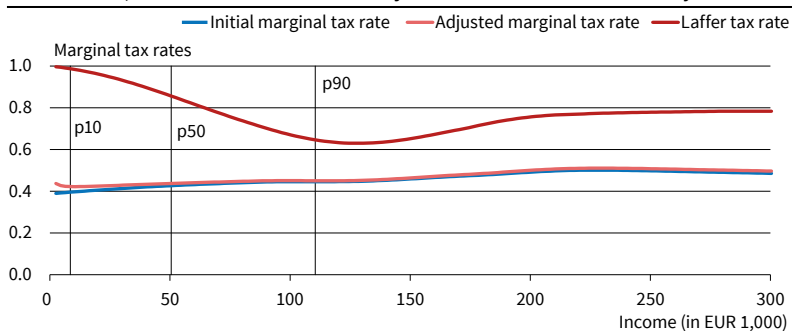
Note: The red curve shows the Laffer bound. The blue curve shows the current schedule of marginal tax rates based on a EUROMOD simulation of effective marginal tax rates. The pink curve shows the optimal marginal tax rates adjusted for fiscal pressure.
Source: Authors' calculation.   © ifo Institute

One interpretation of this finding is a normative one, suggesting that governments should respond by raising taxes in a way that reduces tax progression. This is based on the assumption that normative considerations were a key driver of tax policy before the shock. An alternative interpretation of our findings is a positive one. If we interpret the objective function as a function reflecting political influence of different groups, our analysis predicts that governments will reduce tax progression.

To generate the result that optimal tax progression increases in response to rising fiscal pressure, one would have to argue that the shock changes the preferences of society or, respectively, the political influence of different groups. That may well be the case. But whether the current crises shift political power towards lower income groups, or the opposite, is an open question, albeit a fascinating one for future research.

REFERENCES

Ayaz, M., L. Fricke, C. Fuest and D. Sachs (2023), "Who Should Bear the Burden of COVID-19 Related Fiscal Pressure? An Optimal Income Taxation Perspective", *European Economic Review* 153: 104381.

Bourguignon, F. and A. Spadaro (2012), "Tax-benefit Revealed Social Preferences", *Journal of Economic Inequality* 10, 75–108.

de Mooij, R., R. Fenochietto, S. Hebous, S. Leduc and C. Osorio-Buitron (2020), "Tax Policy for Inclusive Growth after the Pandemic", *IMF COVID-19 Special Notes*, International Monetary Fund, Washington DC.

Diamond, P. (1998), "Optimal Income Taxation: An Example with U-shaped Pattern of Optimal Marginal Tax Rates", *American Economic Review* 88, 83–95.

Heathcote, J. and H. Tsujiyama (2021), "Practical Optimal Income Taxation", *Staff Report* 626, Federal Reserve Bank of Minneapolis, https://www.minneapolisfed.org/research/staff-reports/practical-optimal-income-taxation.

IMF (2021), "World Economic Outlook", *IMF Occasional Papers*, International Monetary Fund, Washington DC.

Lorenz, N. and D. Sachs (2016), "Identifying Laffer Bounds: A Sufficient-statistics Approach with an Application to Germany", *Scandinavian Journal of Economics* 118, 646–665.

OECD (2009), *OECD Employment Outlook 2009: Tackling the Job Crisis*, OECD Publishing, Paris.

OECD (2019), *Government at a Glance 2019*, OECD Publishing, Paris.

Saez, E. (2001), "Using Elasticities to Derive Optimal Income Tax Rates", *The Review of Economic Studies* 68, 205–229.

*Cevat Giray Aksoy, Christopher S. Carpenter, Ralph De Haas,
Mathias Dolls* and *Lisa Windsteiger*

Discrimination of Sexual Minorities in Emerging Markets: Can the Needle Be Moved?*

Recent advances in rights for lesbians, gay men, and bisexual individuals (LGB) have varied substantially across the world. In the United States, for example, LGB rights have increased at a rapid pace: same-sex sexual activity was fully decriminalized in 2003, legal access to same-sex marriage was granted in 2015, and employment discrimination protections were granted in 2020. Likewise, India decriminalized same-sex sexual acts in 2018 while Taiwan granted same-sex marriage in 2019. Yet, in many other parts of the world, LGB rights have advanced more slowly or not at all. As of 2019, 70 United Nations member states (35 percent of all members) still criminalize same-sex sexual conduct. In six UN member states, same-sex sexual activity is even punishable by death. Anti-LGB attitudes are particularly strong in Africa, the Middle East, and Eastern Europe, and anti-LGB policies have recently been adopted in Hungary, Poland, Russia, Tanzania, and Uganda (Mendos 2019).

In Aksoy et al. (2023) we provide new evidence on the determinants of support for sexual minorities in Serbia, Turkey, and Ukraine—three emerging markets with some of the lowest rates of social acceptance of sexual minorities in Europe. Figure 1 shows the share of respondents in 33 countries who agree that gay men and lesbians should be free to live their lives as they wish. Serbia, Ukraine, and Turkey score the 29th, 30th, and 31st lowest shares of agreement, respectively. These countries also have highly restrictive LGBT equality laws and policies. They score just 33, 4, and 18, respectively, on a scale where zero indicates gross human rights violations and 100 represents the greatest degree of legal equality (ILGA 2019).

SIMPLE INFORMATION TREATMENTS TO REDUCE DISCRIMINATION

To investigate whether and how LGB discrimination can be reduced, even in such strongly homophobic environments, we designed an information-treatment experiment that tests several theories. First, we are interested in whether rational economic self-inter-

KEY MESSAGES

■ **Providing information about the economic cost of sexual orientation discrimination significantly increases support for measures to safeguard equal employment opportunities for lesbians and gays**

■ **Treatment effect spills over to support for equal employment opportunities based on ethnic origin, religious beliefs, nationality, gender, and disability, but not to LGB support in other aspects of life**

■ **Informing people that according to the WHO homosexuality is not a mental disease does not cause more support for equal employment opportunities, but does result in improved attitudes about sexual minorities in non-economic aspects of life. Effects are concentrated among those individuals who trust the WHO**

■ **Political actors wanting to achieve the policy goal of expanding non-discrimination employment protections should consider information campaigns that stress the costs of discrimination as opposed to trying to change more fundamental views about homosexuality**

est might overcome personal distaste for LGB people. Thus, in one arm of our experiment we inform people about the direct economic costs to their country from discrimination against sexual minorities, using estimates of per capita income changes from Badgett et al. (2019). We hypothesize that this information induces some self-interested individuals to set aside

Cevat Giray Aksoy

is Associate Director of Research at the European Bank for Reconstruction and Development, Research Associate at the Institute for the Study of Labor, and Assistant Professor of Economics at King's College.
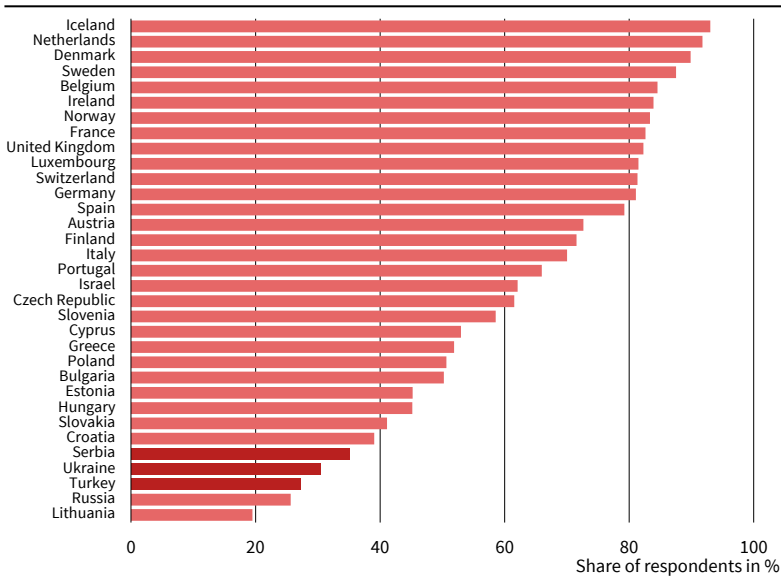
Christopher S. Carpenter

is E. Bronson Ingram Chair and Professor of Economics at Vanderbilt University, founder and director of the Vanderbilt LGBT Policy Lab and director of the Vanderbilt Program in Public Policy Studies.

Figure 1

Support for Sexual Minorities across Countries

Note: Share of respondents that agree or strongly agree that "Gay men and lesbians should be free to live their own life as they wish".
Source: European Social Survey, 2002–2018.

© ifo Institute

negative personal views to support non-discrimination in LGB employment.

Second, we want to understand whether narratives about homosexuality being a mental illness drive anti-gay sentiment. In another treatment arm we try to 'debunk' this narrative by informing individuals that the World Health Organization (WHO) does not consider homosexuality to be a mental illness. We hypothesize that this information induces more favorable views about homosexuality. We test these hypotheses through a randomized survey experiment in which one-third of respondents receive the "discrimination cost" information, another third receive the "myth debunking" information, and the final third receive placebo information unrelated to LGB people.

MAIN FINDINGS

Our experiment yields four main results. First, providing information about the economic cost of sexual orientation discrimination significantly increases support for measures to safeguard equal employment opportunities for lesbians and gays. Individuals who

received the discrimination cost treatment were 1.49 times more likely to support such equal opportunities compared with individuals randomly assigned to the control group.

Second, we find that this discrimination cost treatment spills over to support for equal employment opportunities based on ethnic origin, religious beliefs, nationality, gender, and disability (the left panel of Figure 2). However, each of the discrimination cost treatment effects in these other domains is quantitatively smaller than the effect for sexual orientation-based employment equality—although they are all statistically significant.

Third, the impact of the discrimination cost treatment does not spill over to LGB support in other aspects of life. After adjusting for false discovery rates, there are no effects on opinions concerning the moral acceptability and justifiability of homosexuality, as well as on whether sexual minorities should be able to live their lives freely, or whether sexual minorities bring shame on their families (the right panel of Figure 2).

Fourth, informing people that according to the WHO homosexuality is not a mental disease does not cause more support for equal employment opportunities, but does result in improved attitudes about sexual minorities in non-economic aspects of life. Specifically, this myth-debunking treatment increases support regarding the moral acceptability and justifiability of homosexuality and the idea that sexual minorities should be able to live their lives freely. It also reduces the likelihood that individuals report that a gay or lesbian relative would bring shame on their family. Interestingly, these effects are concentrated among those individuals who trust the WHO.

POLICY IMPLICATIONS

Our results have two important implications for the expansion of LGB rights in parts of the world where anti-LGB attitudes are widely held and deeply ingrained. First, they clearly suggest that individuals in countries with strong views about the immorality of homosexuality can—when informed about the economic costs of sexual-orientation discrimination—still voice support for non-discrimination policies. This

Ralph De Haas

is the Director of Research at the European Bank for Reconstruction and Development (EBRD) and a part-time Professor of Finance at KU Leuven.

Mathias Dolls

is Deputy Director of the Center for Macroeconomics and Surveys at the ifo Institute.

Lisa Windsteiger

is an assistant professor at the Department of Economics of the Paris Lodron University of Salzburg.

Figure 2

Effects of Information Treatments on Support for Equal Employment Opportunities and LGB-Related Views in Non-Economic Domains

■ Myth debunking treatment ■ Discrimination cost treatment
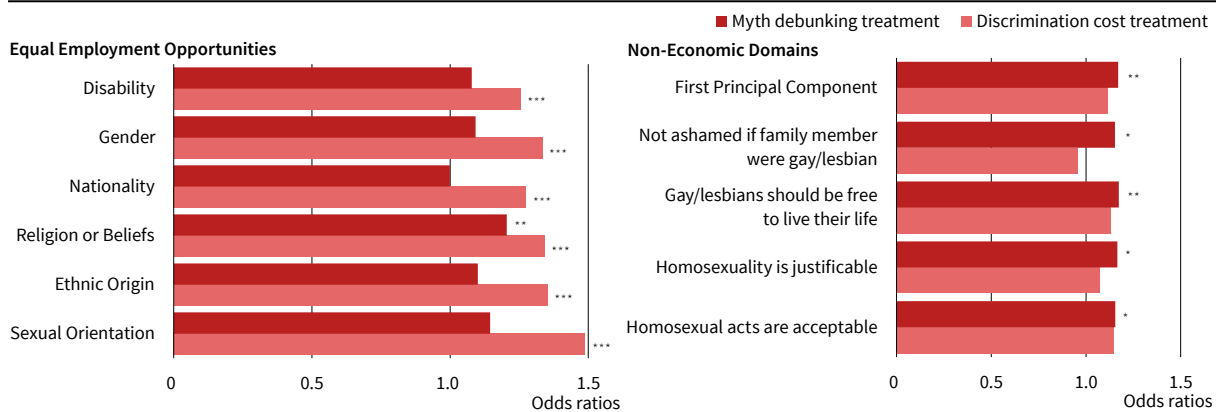
Note: Odds ratios are displayed. All models include controls for age and its square; a male dummy, dummy variables for terti ary education, secondary education; a dummy for being in any kind of partnership; a dummy for living in an urban area; survey date dummies; survey country dummies; number of adults above and below 65; religion dummies (Catholic, Muslim, Orthodox, other religion) and labour market-related controls (whether the individual works at a state-owned enterprise, foreign firm or international organization, and unemployed dummy). * p < 0.1, ** p < 0.05, *** p < 0.01.
Source: Aksoy et al. (2023).

© ifo Institute

indicates that advances in LGB rights in socially conservative places may be more effective if they appeal to the economic costs of anti-LGB discrimination instead of trying to change the underlying views themselves. Second, our results also indicate that views about the acceptability of homosexuality itself can be modestly affected by the provision of basic information, particularly when framed in the context of institutions that people trust.

REFERENCES

Aksoy, C. G., C. S. Carpenter, R. De Haas, M. Dolls and L. Windsteiger (2023), "Reducing Sexual-Orientation Discrimination: Experimental Evidence from Basic Information Treatments", *Journal of Policy Analysis and Management* 42, 35-59.

Badgett, M. V. L., K. Waaldijk and Y. van der Meulen Rodgers (2019), "The Relationship between LGBT Inclusion and Economic Development: Macro-level Evidence", *World Development* 120, 1-14.

ILGA (2019), *Country Ranking in Europe*, https://rainbow-europe.org/country-ranking.

Mendos, L. R. (2019), *State-Sponsored Homophobia* 2019, International Lesbian, Gay, Bisexual, Trans and Intersex Association (ILGA), Geneva.

Peter John Lambert

Measuring Remote Work Using a Large Language Model (LLM)

KEY MESSAGES

■ **Large Language Models (LLMs) can dramatically improve upon traditional text-based measurement tools used by economists**

■ **We fit, test and train the "Work-from-Home Algorithmic Measure" (WHAM) model to detect new online job postings offering remote/hybrid arrangements. The WHAM model has near-human accuracy. We deploy this model at scale, processing hundreds of millions of job ads collected across five countries and thousands of cities**

■ **The share of new ads offering remote/hybrid jobs increased four-fold in the US and more than five-fold in the UK, Australia, Canada, and New Zealand, between 2019 and 2023. These data and more are available for researchers at wfhmap.com**

■ **The "remote work gap" across cities, occupations, and high/low salary workers continues to widen, and the hare of advertised remote/hybrid work is highly skewed towards white-collar workers and cities which are hubs for government, business, technology, and higher education**

■ **LLMs offer massive potential for empirical research using text data, but one should adhere to best practices and understand the "do's and don'ts" of these technologies. Generative AI offers immense promise, with some significant limitations**

The Covid-19 pandemic propelled an enormous uptake in hybrid and fully remote work. Over time, it has become clear that this shift will endure long after the initial forcing event. There are few modern precedents for such an abrupt, large-scale shift in working arrangements.

Peter John Lambert

is a PhD student at the London School of Economics and Political Science.

Most previous efforts to quantify and characterize this shift rely on surveys of workers and employers or assessments of remote work feasibility by occupation. In our paper, "Remote Work across Jobs, Companies, and Space" by Hansen et al. (2023), we use the information contained in job vacancy postings, which are readily available and have massive geographic coverage.

We analyze the full text of hundreds of millions of job postings in five English-speaking countries. In doing so, we apply a state-of-the-art Large Language Model (LLM) to analyze the text and determine whether the job allows remote/hybrid work. We fit, test, and refine this LLM using 30,000 classifications generated by human readings. We also identify each job vacancy's city, employer, industry, occupation, and other attributes.

Our approach to studying the remote work phenomenon has several noteworthy strengths:

1. Our data cover all vacancies posted online by job boards, employer websites, and vacancy aggregators across five countries. Coverage on this scale is infeasible with survey methods.
2. Postings typically describe the job and its attributes in detail, as suggested by a median posting length of 347 words. It also reflects a legal right and represents a future-looking organizational commitment rather than temporary arrangements.
3. We develop the WHAM model (our own LLM) that reads and classifies postings in an automated manner. The model achieves a 99 percent accuracy rate in flagging jobs that allow for remote/hybrid work, significantly outperforming other methods for text-based measurement.
4. The combination of scale, rich text data, and automation lets us characterize the shift to remote work in a highly granular manner. We track the evolution of remote work monthly in hundreds of occupations, thousands of cities, tens of thousands of employers, and city-by-occupation and employer-by-occupation cells. We continuously update and post many of these statistics at wfhmap.com.

The remainder of this article is split into three sections. In the next section, I discuss our research paper's data and measurement approach. I also provide some detail on our approach's performance compared to widely used methods in text-based measurement. The third section documents several patterns in the diffusion of advertised remote/hybrid jobs. Lastly, I discuss the potential for text-based measurement using LLMs. I share some "do's and don'ts" when using these technologies and discuss the potential benefits and drawbacks of the new wave of Generative AI for empirical text-based-measurement in economics.

CONTENT

DATA AND MEASUREMENT

Data

We examine over 250 million online vacancy postings collected by Lightcast (formerly Emsi Burning Glass), an employment analytics and labor market information firm. Lightcast scrapes postings from over fifty thousand online sources, including vacancy aggregators, government job boards, and employer websites. Lightcast claims to cover a "near-universe" of online postings in our five countries during the period covered by our analysis.

For each online vacancy posting in our dataset, we can access a plain text document scraped from the job listing. We also observe the posting date, employer name, occupation, location of the employer, industry, and more. We consider postings listed from January 2014 to February 2023.

The resulting dataset covers hundreds of millions of online vacancy postings in five countries, spanning 5.2 million employers and nearly 40 thousand cities.

For our baseline results, we re-weight the postings in each country-month cell to match the US occupational distribution of new online vacancy postings in 2019.

Measurement

The measurement problem we face is determining whether each job posting allows a new hire to work remotely, understood here to encompass both fully remote and hybrid positions. We adopt a binary classification approach and refer to a "positive" posting as one that mentions the ability to work remotely and a "negative" posting as one that does not.

For positions that offer hybrid working arrangements, we use a threshold of at least one day per week for our positive classification. This approach effectively measures an employer's willingness to offer flexibility in work-location.

The most precise way of classifying postings is arguably via direct human reading. Given the size of our data, however, this approach is not feasible at scale, and some means of automated classification is required. The most standard approach adopted in the text-as-data literature in economics is to use a dictionary of keywords whose presence is assumed to indicate a positive classification.

We found that a "keywords" approach was immediately problematic, due to high prevalence of (i) negation, (ii) context-dependent language, and (iii) wide array of language used to refer to remote work arrangements. To overcome this, we instead relied on a large-language model (LLM) which we call the "Work-from-Home Algorithmic Measurement," or WHAM model.

We build our WHAM model using the following steps:

1. *Partition the set of all text documents using coarse keyword measures:* In order to inform a sampling strategy of which text extracts to send to human auditors, we first partitioned the set of all documents. To do this, we relied on keyword search methods–which can be implemented with low cost. We constructed a set of very broad keywords, such as "remote," "job," "work," and so on.
2. *Collect 30,000 human labels:* We asked humans on the Amazon Mechanical Turk platform to classify whether a passage of text constituted an offer of remote/hybrid work arrangements. We used a sample of 10,000 text passages and asked three auditors to evaluate each passage. This forms the basis for our training data and provides a set of labels to evaluate model performance.
3. *Take an existing pre-trained LLM:* We took the DistilBERT language model, which comes pre-trained on the complete English-language Wikipedia and thousands of unpublished books. This model has shown in industrial applications to already have a very high grade of performance at understanding the rich context-dependencies between words in a sequence.
4. *Further pre-training the LLM:* We further pre-trained this model by exposing it to millions of passages from online job vacancies in our corpus. This ensures the resulting model understands context-dependencies between words in the context of job advertisements.
5. *Fine-tune the LLM to predict remote/hybrid work:* We next deployed the fully pre-trained model on the task of predicting whether a passage of text constitutes an explicit offer of remote work. We did this by embedding a final prediction layer in the neural network structure of the model.

These steps result in our WHAM model, which we use to predict remote/hybrid arrangements across the full set of job ads. We show in the next section that this model produces a 99 percent accuracy rate—relative to human auditors—greatly outperforming other text-measurement technologies. It even shows a five-fold higher accuracy rate compared to GPT-3.

Evaluating Performance

To evaluate the performance of our WHAM model, we remove a portion of our human-labelled text passages from the training stage and evaluate performance on this held-out sample. As well as measuring the overall performance of WHAM, we also assess performance of a variety of other measurement technologies.

We first take a dictionary of keywords used in the literature to measure remote work arrangements (Adrajan et al. 2021), and classify remote work based on the presence of these terms ("Dictionary"). We next augment this dictionary with a negation adjust-

Table 1

WHAM Outperforms Other Classification Methods

	(1)	(2)	(3)
Prediction technology:	Error rate	Precision	F1 score
Dictionary	0.14	0.15	0.25
Dictionary w/ negation	0.07	0.28	0.40
Logistic regression	0.07	0.26	0.40
Logistic regression w/ negation	0.05	0.36	0.50
GPT-3	0.05	0.36	0.52
WHAM (Baseline)	0.01	0.75	0.85

Note: This table reports classification performance metrics, which we calculate using a hold-out sample of human-classified text sequences. "Error rate" is the overall rate of misclassifications (relative to humans). "Precision" is the ratio of true-positive classifications to the sum of true positives and false positives.
"F1 score" is the harmonic mean of Precision and "Recall", where Recall is the fraction of true positives divided by the sum of true positives and false negatives – i.e., the denominator is the true number of positives, according to human classifications.

Source: Author's own calculation.

ment, whereby the keyword match is only taken as a positive classification in the absence of nearby negation terms (our set of negation terms comes from the VADER sentiment analysis dictionary). Next, we implement a Logistic regression approach, following the methodology used in Adams-Prassl (2020). We also extend this to include a negated implementation. Finally, we implement a zero-shot classification method using GPT-3.

Table 1 shows the performance of the above prediction technologies. We see that our baseline WHAM model delivers the highest accuracy, with an error rate of just 1 percent relative to human predictions. This is a fourteen-fold improvement relative to the Dictionary of keywords approach. The WHAM model also outperforms our GPT-3 implementation, which has an error rate of 5 percent. The performance gains of our WHAM model are even more impressive in terms of the F1 score[1], which assigns more weight in the performance evaluation to the class of positive values.

The key difference between our approach and others is that WHAM considers surrounding words, which may change the meaning of the text. To illustrate this, we show in Figure 2 some examples where the dictionary leads to spurious classifications (see below). We also illustrate how the attention mechanism of WHAM understands the context surrounding each passage, overcoming the limitations of the dictionary/keyword measurement.

In sum, our approach to measuring remote/hybrid work arrangements has substantial performance improvements relative to widely used algorithms in the economics literature. A key contribution of the paper is to provide a concrete case study, and document in detail the relative performance improvements in this context.

[1] The F1 score is a metric used to evaluate the performance of binary classification models, which are models that distinguish between two classes or categories. It is a measure that combines both precision and recall, giving equal weight to both. Precision is the fraction of true positive predictions out of all positive predictions, while recall is the fraction of true positive predictions out of all actual positive instances. The F1 score is calculated using the harmonic mean of precision and recall.

PATTERNS IN ADVERTISED REMOTE WORK

Advertised Remote Work Diffusion across Countries

How did the share of advertised hybrid and fully remote work differ across countries prior to, during and after the pandemic? Figure 1 shows the monthly time series of the share of advertised remote/hybrid work for the US, the UK, Canada, Australia and New Zealand. For each country and in each month, this figure reports the weighted-mean of the percent of remote work vacancies across nearly 800 narrow occupation groups. We weight each group based on the share of vacancies in this group in the US during 2019. Three high-level facts emerge:

– *Unprecedented and sharp increase of advertised remote work at the onset of Covid-19.* In March-April 2020, the share of new job vacancies which advertised remote work saw a sharp rise across all countries. On average, the increase from February 2020 to April 2020 was 200 percent. While this immediate increase occurred across all five countries, the level-change was most pronounced in countries with a more severe initial Covid outbreak (US, UK and Canada)

– *Sustained growth thereafter.* Since the large spike in March-April 2020, there has been sustained growth in the percentage of advertised remote work. In level-terms, this growth has been most pronounced in the UK (here Covid lockdowns lingered longest and were most severe relative to the other countries in the sample). We also see evidence of higher growth rates in Australia and New Zealand as their pandemic experience worsened during 2021. In all countries, the growth in advertised remote work has continued long after the forcing event of the pandemic subsided. An additional reason for this high and persistent growth is that our measure of new job vacancies lags the stock of employees working from home,

possibly because employers were slow to accept this as a permanent practice.

– *Substantial heterogeneity across countries, even before the pandemic.* The US had nearly 4 percent advertised remote work share in 2019, the highest of any country. The UK was marginally lower, whereas Australia, Canada and New Zealand had respectively half, a third, and a tenth the share of the US. By mid-2022 the spread in levels is much greater, but proportional differences have diminished.

Remote Work across Jobs

Figure 2 shows the share of advertised remote work by broad occupation groups (based on two-digit SOC 2010 classifications). The differences across broad occupation groups varies greatly. In 2019, we see that just one-in-twenty job ads in "Computer and Mathematical" occupations explicitly offered remote work arrangements in their postings, whereas in 2022 this share raises to a more one-third of new ads offering remote work.

As one might expect, the share of advertised remote work correlates positively with computer use, education, and earnings and is lower in occupation groups which require specialized equipment or customer interactions.

Remote Work across Cities and the "Remote Work Gap"

We next turn to more granular monthly time series for selected "US ciU.S.es," shown in Figure 3. As well as illustrating the granularity of our data, several interesting features emerge from these time series:

– Cities from the North-East and West regions (e.g., San Francisco (SF), Boston, New York (NYC)) all experience similar increases at the outset of the pandemic but have very different growth levels subsequently. By 2023, these differential growth rates result in very dispersed levels.

– We see substantial fluctuations over time in these North-East and Western cities. These fluctuations appear to be correlated across series, for example the July 2021 dip occurs in SF, Boston, Colorado, and to a lesser extent NYC.

– By contrast, cities from the South show far less growth since Covid and far less volatility. Savannah and Miami Beach appear to have partially reverted to pre-pandemic shares of advertised remote work.

Other Patterns and Trends

In our research paper, as well as in the data available at wfhmap.com, we document several other facts about the discussion of advertised remote/

Figure 1

Vacancy Postings That Explicitly Offer Hybrid or Fully Remote Work Rose Sharply in All Five Countries from 2020
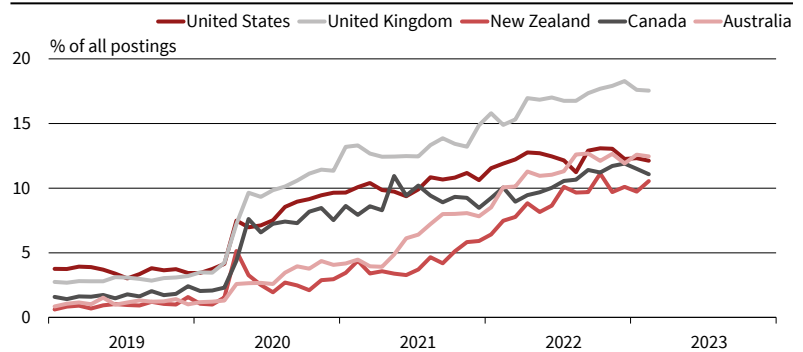
Note: This figure shows the percent of vacancy postings that say the job allows one or more remote workdays per week, encompassing both hybrid and fully-remote working arrangements). We compute these monthly, country-level shares as the weighted mean of the own-country occupation-level shares, with weights given by the US vacancy distribution in 2019. Our occupation-level granularity is roughly equivalent to six-digit SOC codes.
Source: Authors' calculation. © ifo Institute

Figure 2

Professional, Scientific and Computer-Related Occupations Have the Highest Shares of Postings That Offer Hybrid or Fully-Remote Work, US Data
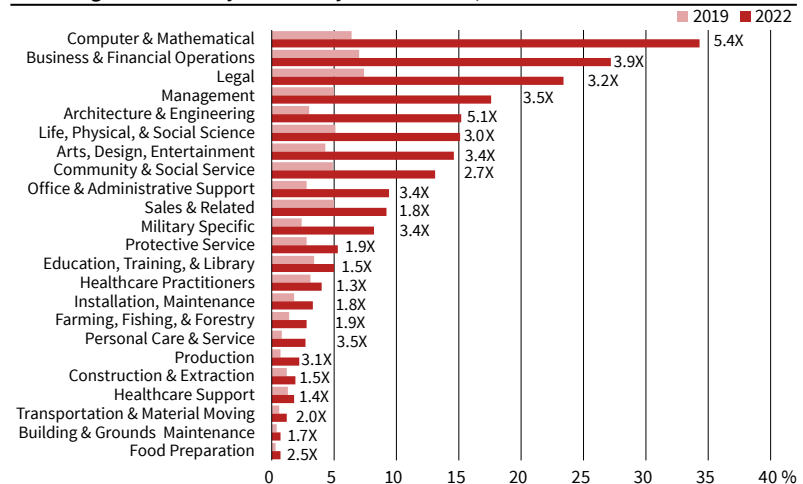
Note: Each bar reports the percent of vacancy postings that say the job allows one or more remote workdays per week in the indicated period and occupation group (two-digit SOC).
Source: Authors' calculation. © ifo Institute

hybrid work in online job vacancies postings. These include:

– Wide dispersion in occupation-level shares of advertised remote/hybrid work.

– A lot of within-occupation heterogeneity, even for occupations with very high shares of overall remote work.

– Measure of task-feasibility at the occupation level can vary a great deal from actual advertised remote work, for example due to varying worker and firm preferences.

– Pre-pandemic share of remote/hybrid is a strong predictor of 2022-23 remote work share for occupations, but a worse predictor for cities.

– This suggests confounding city-level factors are salient, such as institutions, pandemic experience, transport and internet infrastructure, and cultural norms.

Share of Postings Offering Hybrid or Fully Remote Work Vary across US cities
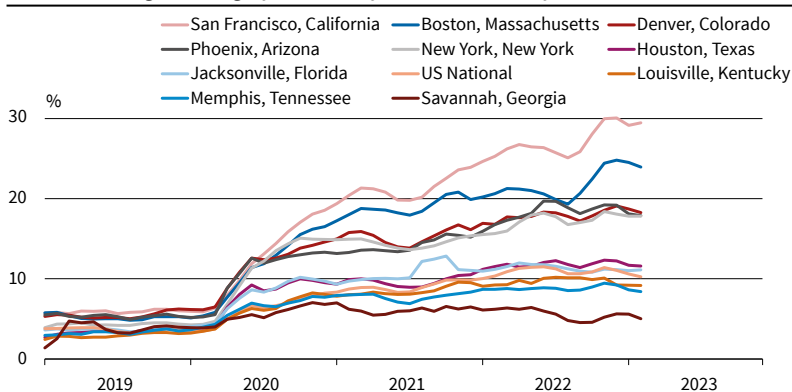
Note: We calculate the monthly share of all new job vacancy postings which explicitly advertise remote working arrangements (i.e. both hybrid and fully-remote), by selected cities. Prior to aggregation at the monthly level, we employ a jackknife filter to remove a small number of outlier days. This figure shows the 3-month moving average. Cities chosen above are selected examples to illustrate the wide cross-city spread.
Source: Authors' calculation.   © ifo Institute

– Our measure of advertised hybrid/remote work from new job postings correlates strongly with the American Community Survey (ACS)'s measure of the proportion of employed who "mostly work from home."

In sum, our research paper provides a measurement approach which leverages a huge corpus of text and provides near-human classification accuracy at scale. We use this to document patterns in advertised remote work at a fine spatial granularity and do so with monthly real-time updates. These data can be accessed by researchers at wfhmap.com.

SOME DO'S AND DON'TS OF USING LARGE LANGUAGE MODELS

Our paper shows that LLMs offer huge potential for economists seeking to measure information from text data sources. If properly implemented, these models can deliver near-human accuracy at huge scale. With text data already a mainstay of empirical analysis, these technological advancements offer huge opportunity to researchers. Here are five quick do's and don'ts which other researchers might find helpful:

– Do: Invest in high quality "ground truth" measures of the feature of interest. In our case, we used humans to label a sizable set of text extracts. Any model will only ever be as good as your initial training data. Platforms like Amazon Mechanical Turk (AMT) are hugely useful and cost effective for extracting these labels. When using these platforms, screen auditors carefully. It helps to pay an efficiency wage premium to ensure quality work. It's also useful to have at least some of the labels processed by multiple auditors, to add an intensive margin to the training data in the case of disagreement.

– Don't: Refrain from working with very lengthy documents. In our application, we split job ads roughly into paragraphs. This increased the number of documents to process but offers two important benefits. First, it reduces the cognitive cost of humans conducting audits. Second, it reduces the potential for over-fitting, ensuring the language model identifies the correct linguistic features.

– Do: Ensure the training data is well balanced, especially when the feature of interest is very unbalanced. In our case, there were vastly more negative (not WFH) text extracts. Even a single job ad which offers remote work typically mentions this in a single paragraph. A good sampling strategy will over-weight documents likely to contain the feature of interest, while still allowing for many random draws from the full population to enter the training data.

– Don't always think you need the latest-and-greatest tools! For a great many applications, classification based on a set of key terms will work brilliantly. For other use-cases, a trained classifier using word-vectors as inputs will also work great. No matter the technology employed, always test performance on labelled data. Applications that work well with keywords are typically cases where attrition bias is stable both over time and cross-sectionally.

– Do: Consider fine-tuning the LLM. If a large language model is warranted, it is very helpful to fine-tune the model for your specific classification task (e.g., by adding a prediction layer at the end of a neural network). The alternative is to collect generic vector embeddings of passages, and then fit a prediction algorithm using these vectors as inputs. Fine-tuning the model will help the huge number of parameters in these models work towards your specific measurement question.

GENERATIVE AI AND TEXT-BASED MEASUREMENT IN ECONOMICS

Perhaps the most transformational breakthrough in LLMs is the recent mainstream adoption of "Generative AI" tools such as OpenAI's ChatGPT. These technologies will have far reaching and profound impacts, not least of which will be on empirical research using text. Nonetheless, there are some important limitations which users ought to be aware of.

Chat Bots Are Zero-shot Measurement Technologies

As a measurement technology, the currently available set of Generative AI tools is inherently "zero-shot," meaning that the output provided by the model is the final measurement, with no opportunity for further refinement based on feedback.

This is due to their extensive size and reliance on specialized computational resources, and because the models themselves are proprietary technology. Consequently, researchers must rely on web or API-based interfaces to interact with these models, which restricts their ability to further optimize the model for performance in a specific context.

In our work, we found that GPT-3 was approximately five times less accurate than our WHAM model. This is despite our model relying on 44 million parameters in comparison to the 175 billion parameters powering GPT-3.

The superior performance of our model is almost wholly attributed to the fine-tuning process, whereby a significant proportion of the model's parameters were optimized for the specific task of predicting offers of remote/hybrid work.

It remains uncertain whether the development of increasingly larger and more refined models will eventually render fine-tuning obsolete. For more bespoke measurement exercises, the value of fine-tuning is likely to remain a key reason for sticking with publicly available LLMs instead of using generative AI for direct measurement.

Training Data: AI vs Humans

Even if the Generative AI tools exhibit superior measurement performance, the cost of implementing this at scale is another reason to favor deploying earlier generation LLMs. One way to utilize these technologies in a cost-effective way is to use them to develop the training data on which a smaller more cost-effective model is trained.

The evidence on whether this is a good idea is mixed. We found that humans performed better at a binary classification exercise when we exposed them to small text-extracts. More generally, the larger the text extract, or the more classification categories presented to humans, the less reliable they become (as measured by disagreement rates). A recent paper by Galard et al (2023) found that ChatGPT outperformed human auditors when processing five separate categories.

In some sense, with a large enough set of well-intentioned auditors, humans can never be collectively "wrong." After all, we are typically measuring a feature that has salience through human interpretation. If no human recognized that a document offered remote work, well, did it?

Philosophy aside, the practical question is whether, on a given budget, a small sample of human audits will be as informationally useful to training a model as a potentially larger set of labels extracted from a generative AI. For limited budgets, longer documents, and many features of interest, this is likely to be true. Finally, consider that a model trained on any set of labels will be constrained by the quality of these labels, so if the Generative AI lacks accuracy, the final model will too.

REFERENCES

Adams-Prassl, A., M. Balgova and M. Qian (2020), "Flexible Work Arrangements in Low Wage Jobs: Evidence from Job Vacancy Data", *SSRN Electronic Journal*.

Adrjan, P., G. Ciminelli, A. Judes, M. Koelle, C. Schwellnus and T. Sinclair (2021), "Will It Stay or Will It Go? Analysing Developments in Telework during COVID-19 Using Online Job Postings Data", *OECD Productivity Working Paper* 30.

Gilardi, F., M. Alizadeh and M. Kubli (2023), "ChatGPT Outperforms Crowd-Workers for Text-Annotation Tasks", *arXiv*:2303.15056.

Hansen, S., P. J. Lambert, N. Bloom, S. J. Davis, R. Sadun and B. Taska (2023), "Remote Work across Jobs, Companies, and Space", *NBER Working Paper* 31007.

econPOL
EXPERT OPINIONS

In the EconPol Expert Opinions, CESifo President Clemens Fuest and other experts from the CESifo network comment on current economic policy issues. The EconPol Expert Opinions are published as guest contributions in various leading media outlets. They provide an insight into economic analysis on current topics in the public debate and offer suggestions for how to solve economic issues. They inform the public and serve as a basis for decision-making in politics and business.

April 13

The Current Banking Quake: Where Does It Come from and What Should Policy Makers Do?

The crises at Silicon Valley Bank and Credit Suisse have shaken the world of finance. While policymakers and central banks are being placatory, the markets are not calming down. Banks that very recently seemed healthy are running into liquidity problems. Interest rate hikes by central banks are a major driver of the crisis.

April 03

Higher Wages May Help Overcome the Shortage of Skilled Workers!

There is currently intense debate in many countries about a shortage of skilled workers. For instance in Germany, despite record employment figures, according to surveys by the ifo Institute, close to 50 percent of companies say they are constrained by a shortage of skilled workers – also an all-time high.

March 21

Europe's Industrial Policy and the Response to IRA

Europe is seeing a renaissance in industrial policy. Industrial policy usually involves influencing an economy's sectoral development by means of subsidies, partial state ownership of companies, or regulations.

Online available here:
https://www.econpol.eu/opinions

econpol FORUM

1 2023
January
Vol. 24

ECONOMIC POLICY AND ITS IMPACT

Do School Curricula Matter to Students in the Long Run? The Case of Teaching the Theory of Evolution or Creationism in the United States
Benjamin W. Arold

INSTITUTIONS ACROSS THE WORLD

How to Incentivize Tax Compliance when Households Demand Services? What Works (Better) and General Limitations
Lilith Burgstaller and Sarah Necker

BIG-DATA-BASED ECONOMIC INSIGHTS

Narratives in ECB Press Conferences: A Textual Analysis
Justyna Klejdysz

POLICY DEBATE OF THE HOUR

Climate Change: Greening the Economy by Green Finance?

Claudio Borio, Stijn Claessens and Nikola Tarashev, Jan Krahnen, Jörg Rocholl and Marcel Thum, Jacob Baylon Schumacher, Rainer Haselmann, Sebastian Steuer and Tobias H. Tröger, Florian Be... Jason Jay, Julian Kölbel and Roberto Rigobon, Emanuela Benincasa, Gazi Kabas and Steven O... Hans Degryse, Tarik Roukny and Joris Tielens...

CES ifo ifo INSTITUTE

econpol FORUM

2023 2
March
Vol. 24

ECONOMIC POLICY AND ITS IMPACT

The Closure of Police Stations Leads to an Increase in Theft Crime
Sebastian Blesse and André Diegmann

INSTITUTIONS ACROSS THE WORLD

Regional Income Inequality in Germany
Immo Frieden, Andreas Peichl and Paul Schüle

BIG-DATA-BASED ECONOMIC INSIGHTS

The Demand for Data Skills in German Companies: Evidence from Online Job Advertisements
Jan Büchel, Jan Engler and Armin Mertens

POLICY DEBATE OF THE HOUR

How to Reconstruct Ukraine? Challenges, Plans and the Role of the EU

Anna Bjerde, Romina Bandura, Marek Dabrowski, Christopher A. Hartwell, Anders Åslund, Dmytro Boyarchuk, Barry Eichengreen, Stephan von Cramon-Taubadel and Oleg Nivievskyi, Jaap Adema, Yvonne Giesing, Tetyana Panchenko and Panu Poutvaara

CES ifo ifo INSTITUTE

POLICY DEBATE OF THE HOUR IN THE NEXT ECONPOL FORUM:

The Reform of EU Economic Governance

EconPol FORUM 4/2023 will be published in July 2023