RESEARCH
PAPER
1
February 2025

Measuring geoeconomic power

An index for 41 major economies

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Research Council of Finland

FIIA RESEARCH PAPER 1 / February 2025

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Summary

This Research Paper presents a set of methodologies and concepts for measuring the geoeconomic power of states – the potential to exert power over other states through economic means – and applies them to publicly available data covering 41 major economies from 2010 to 2022. This analysis leads to the development of a combined index of geoeconomic power, designed to reflect the supplier power of states in the areas of trade in goods, oil and oil products, and international finance.

The main finding is that the United States is the world's leading geoeconomic power, although it falls far short of being in a hegemonic position. Its lead over the second-largest geoeconomic power, the European Union, has grown in recent years. However, China's geoeconomic power has expanded rapidly, almost matching that of the European Union in 2022. These recent shifts point to a more competitive and contested global order.

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Introduction

This Research Paper presents a set of methodologies and concepts for measuring the geoeconomic power of states, applies them to publicly available data for a selection of 41 major economies across the world, and outlines a discussion for future extensions and refinements.

The working definition of geoeconomics is *the exercise of power by states upon other states through the use of economic means*. This definition has wide-ranging validity. It is agnostic as to the purpose of the exercise of power. States may resort to economic means to increase or sustain economic benefits, or to gain influence over the foreign policy decisions of other states outside the realm of economics, or to increase or sustain actual or potential military power. Contrary to the earliest writings on geoeconomics, this Research Paper sees no benefit in assuming that geoeconomic competition between states necessarily relates to a contest *for* economic resources; it merely states that it is a contest *using* economic resources.[1] This makes it easy to distinguish geoeconomics as a strategic practice from geopolitics, with the latter referring to the exercise of power using military means.[2]

Geoeconomics is a rapidly growing research topic among scholars and analysts in the fields of international relations, law, and economics. Dedicated academic journals are only now coming into existence, with *Law & Geoeconomics* and the *Journal of Geoeconomics* set to launch in 2025. This rapid surge in interest and across disciplines reflects recent international events and trajectories in external economic policies that challenge the previously dominant view of the role and place of economics in international relations.[3]

While there is now a widespread conviction among scholars and policy practitioners that the rules of the game of international economics have changed and will continue to change, there is a considerable road ahead in terms of understanding what a more contested international economic playing field actually means in terms of power politics. The questions that remain are as numerous as they are fundamental. For example, is there a clear understanding of geoeconomic power at the conceptual level? Which states have more or less of it? What would it take for a particular state to enhance its geoeconomic power? How might geoeconomic power differ from other forms of power, and should geoeconomic power be seen as complementary to, or as a substitute for, other forms of power?

Whatever directions geoeconomic research may take, it stands to reason that it will require empirical research efforts alongside theoretical ones, and that both theory testing and exploratory empirical work will naturally include significant efforts towards quantification and the leveraging of quantitative research methods. Conceptualising geoeconomic power is therefore only the first step; it is also necessary to quantify and measure it.

Geoeconomics is primarily concerned with how economic means, potential, and outcomes may support foreign policy goals and lead to specific foreign policy outcomes. As such, quantification is bound to be feasible to a significant extent, given the

1 For example, in his seminal work on geoeconomics, Edward Luttwak had stated that "the goal of geo-economics (aggrandizement of the state aside) could only be to provide the best possible employment for the largest proportion of the population", see Luttwak 1990, 17–23.

2 For a discussion, see Scholvin and Wigell 2018.

3 Christie and Wigell 2023, 1–13.

inherently quantitative nature of economic activity and the very wide range of existing economic data collection efforts. However, measuring geoeconomic power is also bound to be a complex endeavour, involving choices, trade-offs, prioritisation, and a regular back-and-forth movement between theory and empirics. This process is essential for developing a sound understanding of exactly what is being measured and how it should be interpreted in order to derive clear insights.

This Research Paper seeks to make a foundational contribution to these efforts by developing an index of geoeconomic power based on three core areas of international economic exchange: trade in goods, trade in oil and oil products, and international finance. Before developing and presenting the index, the paper also aims to spur further discussion and reflection on the nature of geoeconomic power, particularly in relation to international economic networks. It explores how different types of economic networks may warrant distinct empirical strategies both for the measurement as well as the exercise of power.

Common expectations about key properties of networks – such as "hubs" or "chokehold effects" – only hold true for certain types of economic networks. This paper posits a typology of economic networks, differentiating between densely and sparsely connected networks, and provides preliminary lists of goods and services across the main types of economic activity that exist. The suggestion is that there is a wide variety of economic networks and that this is a topic that merits further study.

The empirical part of this research provides indicators of geoeconomic power for 41 major economies from 2010 to 2022. The paper develops sub-indicators for goods trade, energy trade, and financial leverage, as well as a combined indicator of geoeconomic power encompassing all three areas. The ability to quantify geoeconomic power means the ability to compare the geoeconomic power of multiple states at a given point in time, to track the evolution of the geoeconomic power of a given state over time, and to assess relative shifts in power between states over time.

The results confirm certain widely held views while challenging others. The United States (US) is identified as the world's pre-eminent geoeconomic power, followed by the European Union (EU) and China. The leading position of the US is driven specifically by its exceptional financial leverage, notably thanks to the role of the US dollar. China's geoeconomic power is rooted overwhelmingly in trade rather than finance and has grown substantially over the period. The EU's relative position has declined; while it was close to parity with the US in 2010, it is now on the cusp of being overtaken by China. Importantly, although the US is the world's leading geoeconomic power, its index value – which by design is comparable to a global market share – is only around 20%. In other words, the position of the US is by no means hegemonic (the role of the US dollar aside). In parallel, although this is co-determined by the methodological choices, net oil exporters such as Saudi Arabia and Russia obtain higher geoeconomic power scores than their GDP levels alone would imply, while remaining significantly below the scores for the US, the EU, or China.

1. Conceptualising geoeconomic power

Power is the most frequently used concept in international relations, yet its definition remains "one of the most difficult and controversial problems".[4] David Baldwin identifies two dominant traditions of power analysis in international relations: "the elements of national power approach, which depicts power as resources, and the relational power approach, which depicts power as an actual or potential relationship".[5] This Research Paper draws on both approaches as a starting point for geoeconomic theorizing.[6]

In the power-as-resource approach, power is equated with the possession of specific resources and capabilities associated with the ability to exercise influence, including gross domestic product (GDP) and natural resource endowments.[7] For example, the widely used measure of power contained in the *National Material Capabilities* dataset of the *Correlates of War* (COW) project includes indicators of military power as well as energy consumption

4 Morgenthau 1963, 27.
5 Baldwin 2002, 185.
6 For a discussion, see Schmidt 2005, 523–549, and Schmidt and Juneau 2012, 61–78.
7 See e.g., Blackwill and Harris 2016 and Diesen 2019.

and iron and steel production.[8] The limitation of this approach is that it largely overlooks how power in the international system is derived not only from the resource bases of states, but also from the nature and structure of relationships of dependence between states and how these may be leveraged. This is particularly relevant given the highly interconnected nature of today's global economy.

The relational power approach is attuned to the way that economic interdependence underpins power by depicting it as a type of interaction between two actors, rather than a property of either one. According to Dahl, the most influential advocate of the relational definition of power, "A has power over B to the extent that he can get B to do something that B would otherwise not do".[9] From this perspective, power is an outcome to be judged *ex-post*, rather than a means to be used towards a desired outcome that can be judged *ex-ante*. Dahl's formulation also implies a dyadic (bilateral) focus on relationships, to the implicit detriment of more complex patterns of interconnection between multiple actors, namely networks.

The field of network analysis is currently highly popular among international relations scholars, as it suggests the ability to uncover properties inherent to how actors are interconnected, as opposed to the individual properties of each actor. Social scientists naturally expect the whole to be more than the sum of its parts, which may explain the strength of current interest. However, as discussed further in this paper, intuitive concepts derived from network analysis such as "hubs", "chokeholds", or "centrality" do not always map neatly onto the real world of economic exchange.

What can be said with general validity is that an actor's power depends on its underlying capabilities as well as on the entire set of relations that exist, not only between itself and other actors in the international system but also between those other actors.

Network structure, then, is a relevant factor in power analysis. However, it is important to recognize that there is more than one network. Actual international economic exchange is made up of overlapping networks, each relating to particular economic flows, and each with different characteristics. One should not expect the network(s) for international trade in agricultural goods to resemble the network(s) for international financial messaging. Nor should international economic networks be expected to have fixed properties over time, or even to have particularly clear structural features such as hubs or chokeholds. Economic actors may adapt and respond to constraints within a given network and develop strategies that mitigate, circumvent, or even modify or abolish those constraints.

Economic networks are also interconnected and interdependent to varying degrees, but such relations between networks can change or fade over time. For example, major reserve currencies have historically emerged based on a nation's importance in global trade.[10] What is less clear is when, how, and how quickly the currency of a major trading nation may gain prominence as a reserve currency, and conversely, when, how, and how quickly the currency of a nation declining in trade importance should lose its prominence.

Overall, a state's geoeconomic power can be expected to be rooted in its natural resource endowments and productive capabilities and capacities, and to be mediated – attenuated, amplified, or otherwise modified – by international economic networks. The chosen focus will therefore be on indicators of international economic activity (such as trade flows), rather than on indicators of national economic power (such as GDP or industrial production), with the understanding that the latter drives the former. This choice does not preclude future research efforts into measurement and modelling frameworks that would explore the connection between national economic power, geoeconomic power, and outcomes.

It is also important to underscore that this Research Paper favours a supplier-oriented view of economic power – for example, a net exporter of oil such as Saudi Arabia, a major exporter of non-oil goods such as China, or a nation with a globally attractive and convenient national currency such as the United States. A complementary exercise would be to assess the countervailing power of states that do not benefit from such advantages.

8 Singer, Bremer and Stuckey 1972.

9 Dahl 1957, 202–203.

10 Kalstroem 1967.

As noted above, a state's geoeconomic power is expected to depend not only on its underlying capabilities, but also on the entire set of relations that exist. To operationalize this insight, three methodological frames of reference are posited:

- Unilateral – a state's net position in relation to the rest of the world
- Bilateral – the specific leverage of one state over another
- Multilateral – the leverage of any given state over a wide set of states

These frames of reference allow discussions to be linked to existing strands of literature and are posited in order to provide conceptual clarity regarding the empirical strategies that can be chosen to measure geoeconomic power, depending on the chosen thematic focus as well as the availability of, and requirements for, specific types of empirical data.

1.1. Unilateral frame: A state's net position in relation to the rest of the world

A unilateral level of analysis is best suited for studies that seek to assess either the vulnerability or power potential of a single identified state. This is a common concern in applied analyses of security of supply, and there is steady demand for such assessments from governments. Every government naturally wants to know what it can do with the resources it has and how much risk the nation faces with respect to resources it lacks.

The unilateral approach is best illustrated by the case of extractable raw materials. The following problem statement can be made without loss of generality: There is an unequal distribution of natural endowments of a given extractable raw material, such as crude oil, across states. Assuming that the commodity is in substantial demand in all states, international trade will arise, with some states as net exporters and others as net importers. The net exporters have leverage over the net importers, and that leverage constitutes a form of geoeconomic power. It is the net trading position of each state that forms the basis of the net exporters' power and the net importers' vulnerability.

For net exporters, the extent of their power in a unilateral sense (i.e., their power over the set of net importer states in general) depends primarily on their share of the international market. On the other hand, a net exporter's ratio of net export volume to its consumption may be a relatively unimportant consideration. Consider two net exporters, A and B. A produces 1,000 units per year and consumes 200 domestically. B produces 2,800 units per year and consumes 2,000 domestically. Both states export 800 units per year and therefore have equal shares in the international market. Assuming production and consumption volumes are fixed, there is no difference in how much power the two states may exert. In a dynamic setting, one net exporter may be more powerful than the other to the extent that it has the ability to modulate how much it supplies to the international market in absolute terms. This may arise from an ability to modulate production volumes, to modulate domestic consumption, or to build up and release stored volumes over time. In the simplest case, however, the net exporter's share of the international market provides a good starting point for measuring power.

For net importers, the extent of their vulnerability (towards the set of net exporter states in general) depends on the extent of their net import dependence, in both relative and absolute terms, with possible countervailing effects based on buyer power.

For net non-traders, a state with a perfectly balanced position – producing exactly as much as it consumes – is neither vulnerable nor powerful. Whether that state engages in some international trade, in which case it would export as much as it imports over time, or whether it is in autarky with respect to the commodity, it has no net effect on the international market. Its actions, or lack thereof, will make no difference to the power relations between net exporters and net importers (except in scenarios involving deliberate temporary deviations from a balanced position).

For net importers, this discussion naturally connects to the extensive literature on the measurement of security of supply, most notably the security of energy supply.[11] Import dependence is a central variable that appears, directly or indirectly, in country-level indices of security of energy supply.

11 For reviews of this literature, see e.g., Månsson et al. 2014 and Gasser 2020.

Given its energy policy context, the literature often encompasses a wide range of additional considerations, from climate policy goals to domestic energy system characteristics. While the former shifts the focus away from considerations of power and security, the latter may be useful for assessing the resilience of a given country to ideal-type energy supply disruptions.

The measurement of the power of net exporters has generated considerably less attention. From first principles, the greater the international market share, the greater the power. Additionally, the concept of "swing producer" (or "swing supplier") is used by energy economists and oil market analysts. A swing producer "must have both the physical and economic capacity to increase or decrease production quickly (...) in order to absorb unexpected variations in demand".[12] Over time, this has "typically been taken to mean a supplier that can increase oil production substantially (say, 1 million barrels per day) in a short period of time (within 30 to 90 days)".[13]

However, the concept of swing producer is framed as an economic question, rather than one of power. Having the ability to shift the global market equilibrium – for example, to act on the market so as to successfully defend a desired price level – is unquestionably a form of power. However, this framing suffers from the implicit discarding of worst-case, lose-lose strategies that could be pursued by suppliers with less flexibility to adjust their production volumes.

Consider Saudi Arabia versus Russia. Saudi Arabia is widely recognised as having been the world's swing supplier in recent decades. Russia has less flexibility for technical reasons and is generally not seen as a swing supplier. Yet its power in the oil market is evident from a counterfactual perspective: against the backdrop of Russia's war of aggression against Ukraine, Western states had every incentive to find ways of exerting economic leverage against Russia. However, preventing Russia from exporting oil was never an option, as its large export volumes were indispensable for the global market. Had Russia been a small net exporter (say, one million barrels per day), sanctions could conceivably have aimed at severely limiting or even prohibiting Russian oil exports. From that perspective, the concept of swing producer remains interesting, but seems relatively much less important than sheer market size when seeking a broad measure of power that also reflects what could occur in scenarios of extreme disruption.

Methodologically, at any rate, quantifying each net exporter's ability to act as a swing supplier and then incorporating such a measure into each net exporter's market share would be no trivial matter. Hence, while acknowledging the significance of swing suppliers, this paper will proceed with the simpler approach of using international market share as the base measurement of supplier power.

1.2. Bilateral frame: The specific leverage of one state over another

A bilateral level of analysis is applicable for case studies or scenario analyses of geoeconomic power exercised between two identified states, such as Chinese trade restrictions on Australia or Lithuania, or a Russian disruption of natural gas supplies to Germany. As these examples suggest, the clearest cases concern economic coercion, more specifically the deliberate cessation of trade in specific goods or services. Both *ex-ante* scenario analyses and *ex-post* empirical assessments can draw on quantitative methods and modelling.[14]

Bilateral case studies are naturally of great interest to governments, to the extent that it is politically palatable to consider the scenarios in question. In some cases, such studies may be carried out in a simplified form within the machinery of government and treated as sensitive, potentially classified, and subject to limited distribution. This will not prevent the emergence of independent analyses, especially if

12 Morecroft and van der Heijden 1992, 109.

13 Newell and Prest 2017, 1.

14 Studies that focus on inducements rather than coercion are considerably less common. From a quantitative modelling perspective, it is typically more difficult to define or identify a discrete event that would allow for a clear before-and-after study. Separately, inducements by their very nature may have a wide range of effects, from merely entrenching a status quo situation to triggering shifts that may not be immediate or rapid, nor easy to measure. Policy commentary is often the only type of literature that may arise in the case of known inducements, typically with only qualitative analyses of some of the risks and opportunities of a given development.

there are particularly obvious negative-case scenarios to be considered.

For example, after Russia's full-scale attack against Ukraine but before the complete interruption of Russian natural gas exports to Germany in August 2022, *ex-ante* modelling analyses were conducted on the impact of such a complete interruption on the German economy.[15] Given that this event actually occurred, researchers were also able to follow up with *ex-post* assessments.[16]

Bilateral studies allow for and require a more detailed depiction of the characteristics of the target state and the nature of the attack that may be launched against it. This increases the precision of such studies, but comes at the cost of a loss of generality. Each potential target state may be vulnerable in different ways and to varying degrees in the face of an otherwise identical attack. This, in turn, begs the question of how to measure the power of the (potential) sending state.

For the purpose of measuring the geoeconomic power of a large number of states – the goal of this Research Paper – the bilateral approach is not directly applicable. However, explicitly discussing it provides a useful conceptual benchmark: when defining a generally applicable methodology to measure the geoeconomic power (or vulnerability) of a sample of states, certain implicit assumptions are inherently made regarding the ideal-type adverse events that matter most. Effectively, bilateral studies of geoeconomic power can inform how researchers should measure the geoeconomic power of states across a large sample, in the same way that case studies contribute to any kind of large-sample statistical analysis: an awareness of the former is necessary to understand the meaning and limitations of the latter.

1.3. Multilateral frame: The leverage of any given state on a wide set of states

The power that a state has over a wide set of other states may differ from the aggregate power it exerts over each of them bilaterally. This may be due to the structural effects of the way in which states are interconnected – in other words, network effects.

In a highly cited and influential article,[17] Henry Farrell and Abraham Newman explored "how the topography of the economic networks of interdependence intersects with domestic institutions and norms to shape coercive authority". Taking the SWIFT financial messaging system and the internet as case studies, Farrell and Newman posited two forms of power that may emerge from certain types of economic networks: the *panopticon effect* and the *chokepoint effect*. The panopticon effect refers to the informational advantage of a major hub, while the chokepoint effect refers to the ability to cut flows that other actors depend on.

For these effects to arise, it must be assumed, implicitly or explicitly, that networks are unequally distributed in terms of each actor's importance or power, and that a small number of "hubs" are present from the outset or emerge over time as a result of "rich-get-richer effects", namely self-reinforcing power concentration dynamics that may be due to increasing returns to scale or other network effects.

It is notable that the two case studies chosen by Farrell and Newman are as much *information networks* as they are economic networks. This is a decisive feature that holds for some economic networks but considerably less so for others. In such networks, insights from graph theory – also known as network analysis – are relevant for empirical analysis. This has encouraged scholars to tap into the rich literature devoted to the analysis of social networks and, among other insights, to pay particular attention to the concept of network centrality. [18]

These insights, while useful, only hold true for certain types of economic networks. The aim of this paper is to develop a broader conceptual framework that allows for a typology of economic networks capable of addressing a wider variety of forms of geoeconomic power.

The contention in this Research Paper is that network analysis is not a particularly relevant modelling framework for a large proportion of international trade. Graph theory is a field of discrete mathematics that, in its simplest formulations, focuses on binary connections (also called edges)

15 Notably Bachmann et al. 2022 and Lan, Sher, and Zhou 2022.
16 Notably Moll, Schularick, and Zachmann 2023.
17 Farrell and Newman 2019.
18 Freeman 1978.

between nodes (also called points or vertices). Graph theory is well-suited to the study of diffusion or contagion processes in a natural or technical system where the principal function of a node is merely the onward transmission of flows. It is with this framing that the concepts of hub and of network centrality are properly understood. In a particularly simple network configuration, it may be impossible to transmit flows without going through a single specific node. In a more interconnected network, alternative routes exist, even though some nodes may be more interconnected than others. The notion of a chokehold, which is implicit in simple applications of graph theory, would refer to indispensable nodes (hubs) that could be shut down, thereby stopping all flow through them.

But international trade is far more versatile and flexible. While graph theory does allow for weighted connections between nodes (which could represent trade volumes) as well as weighted nodes (which could represent GDP or some other measure of importance), a national economy does far more than merely transmit flows: it produces, consumes, and also transforms goods and services, in addition to importing and exporting them.

More importantly still, interdicting trade is a difficult endeavour even with the use of force, let alone without it. For goods trade, about three-quarters of the world's countries, which account for considerably more than three-quarters of global GDP and trade, have access to the sea, while the vast majority of landlocked countries have at least two neighbours. As for trade in services, it is mediated by transport and communication services (themselves also services), which are largely decentralized. It is therefore debatable whether chokeholds, understood in the binary sense of indispensable nodes for the trading of goods or services, are a particularly relevant phenomenon.

There are certainly dominant *producers* of certain goods or services, as well as countries that face greater impediments to trade than others. However, there is little in the way of a forced passage through intermediate nodes – this would imply a country acting as an indispensable transshipment or transmission facility, which is not at all typical. The transport sector provides ample illustration: whereas the Port of Rotterdam and Frankfurt Airport are respectively the largest seaport and the largest air cargo hub in continental Europe, their importance in no way prevents a maritime shipment or an air cargo shipment from outside Europe from being shipped directly to France, Spain, or Poland if that is the preference of the actors involved.

Similarly, the notion of distance in binary graphs, which is the number of connections a flow must traverse to connect any two given nodes, is a poor fit for the actual geographic or regulatory impediments that affect trade flows. In turn, the basic measure of network centrality for one node is the mean distance to all other nodes, namely the number of connections to be traversed, which is also a poor fit for actual centrality in international trade.

In the case of a sparsely interconnected network, which reflects certain narrowly defined commodities or areas of economic activity (e.g., oil, some highly specialized manufactured goods, and certain financial services), there may be a very small number of producers or hubs on which many other states depend. Moreover, those rare producers or hubs may be very difficult and costly to substitute. It is in that type of network that hubs of economic relations can offer advantages discussed in recent literature: more opportunities to influence other actors (brokering structural holes), fewer constraints (structural autonomy) resulting in better bargains, greater influence, and even deference and attention from those in less favoured positions. [19]

The other important configuration is where the network is densely interconnected. When considering international trade in the aggregate, most states trade with most others, and all of the major economies trade with one another. In such a configuration, there are no irreplaceable producers or hubs without which the entire trade system would cease to function, but a small number of trading nations may still be considerably more important in quantitative terms than all the others. In such a network, the concepts of hub and centrality are not helpful: there is no forced passage through one specific state to obtain a much-needed commodity or service, whether crude oil, rare earths, or financial services.

However, for any state in the network, should relations deteriorate with one of the major trading

19 See e.g., Hafner-Burton, Kahler, and Montgomery 2009, Maoz 2012, Burt 1992, Goddard 2009, Oatley et al. 2013, Norrlof 2019.

nations in the international system, economic damage would befall many different sectors of economic activity. Substitution efforts would likely be highly successful for most sectors within the state in question, but the overall damage could be seen as 'death by a thousand cuts', rather than from a single blow to a specific point of vulnerability. In a highly interconnected trade network, this would be true for all members within it, making the major trading nations objectively important for every other network member.

This discussion suggests that there are different types of economic networks, some more densely interconnected and some less so. Therefore, economic networks should be considered on a spectrum, ranging from sparsely interconnected to fully interconnected networks (see Table 1).

The first example is natural resources. If the global distribution of a natural resource is highly concentrated geographically, such that a few states have a large endowment and the majority of states have very low endowments, the resulting network will have a low degree of interconnectedness, in the sense that a large majority of country pairs have little to no mutual trade. This is a stylised view of real networks for commodities such as fossil fuels: there are, in fact, many trade flows of a secondary nature, for example due to arbitrage between locations or for logistical reasons. But the large and dominant flows, those that matter strategically, run from the small set of net exporters to the large set of net importers – that is, to (almost) every other country, whereas flows between net importers are secondary.

However, if the global distribution of a natural resource is much closer to uniformity, a more balanced network can be envisaged. For agricultural and food products, countries may specialise in line with their comparative advantage, but (almost) every country will likely retain significant domestic production in several commodity groups, and will be in a position to trade in both directions with multiple partners. In this case, the network is highly interconnected, corresponding to a low concentration of underlying resources.

For intermediate manufactured goods, a relevant example is highly specialised goods that require significant prior accumulations of both physical and human capital before being produced, such as microprocessors, aircraft engines, and (large) ship engines. In such cases, production is highly concentrated and dominated by a small number of leading manufacturers. While the latter may have complex

Table 1. A typology of economic networks

	Low interconnectedness (High concentration)	Intermediate interconnectedness (Intermediate concentration)	High interconnectedness (Low concentration)
Natural resources	Uranium, crude oil, cobalt, rare earths	Coal, arable land, timber	Dairy products, fruit and vegetables, sugar
Intermediate goods	Microprocessors, aircraft engines, ship engines	CNC machine tools	Steel tubes, copper wiring, basic chemicals and petrochemicals
Finished goods	Aircraft, smartphones	Road vehicles, pharmaceutical products, luxury goods	Manufactured food products, cosmetics
Software products	Computer operating systems, major social media platforms, web browsers, web search engines	Computer-Aided Design (CAD) software; Enterprise Resource Planning (ERP) software; graphic design software	Educational software ("EdTech"), computer games
ICT infrastructure and services	Global Navigation Satellite Systems	Digital network infrastructure provision; cloud computing services	Mobile service provision
Military goods	Major weapon systems	Small arms	Basic non-lethal equipment
Financial services	Reserve currencies	Capital markets for the purpose of international lending	Correspondent banking

Source: Author elaboration

international supply chains, final assembly may be limited to a small number of locations and countries and may lead to a sparsely interconnected network, with dominant trade flows from a small number of locations to a much larger number. The opposite pattern may arise at more basic levels of manufacturing know-how, such as semi-finished goods derived from common raw materials, which may be set up and sustained in a large number of countries. As with agricultural and food products, international patterns of specialisation may arise based on comparative advantage, but many states may be large enough in terms of their domestic markets to sustain some basic manufacturing capacity across several categories of semi-finished goods. In such cases, a highly interconnected international network is expected, corresponding to a low concentration of productive capacities.

These insights largely apply to finished manufactured goods as well, with examples of highly concentrated production, and hence sparsely connected networks, for specialised and complex goods such as aircraft or smartphones. However, intermediate levels of concentration and interconnectedness may occur for finished goods whose production is challenging, but somewhat more accessible to new entrants, such as road vehicles, pharmaceuticals, or luxury goods.

In the case of financial services, the more a nation's currency is used for international transactions, especially those between third countries, the greater the scope for that nation to gain leverage over the transactions of others. In the modern era, this is most clearly the case for the US dollar, whose share of international trade finance far exceeds the share of global trade involving the United States as a country. As documented by Gita Gopinath, based on SWIFT data, the US dollar accounts for over 80% of trade finance.[20]

The exceptional leverage of the US arises from a combination of two key factors. First, as highlighted above, third parties frequently prefer to trade with each other in US dollars. Second, the processing of US dollar payments inevitably implies that the payments will pass through US financial institutions in one form or another, which in turn ensures that US financial sanctions extend to all global entities using the US dollar. This is due to the need for clearing, namely "the process of transmitting, reconciling, and in some cases confirming payment orders or security transfer instructions prior to settlement".[21]

Crucially, US dollar clearing can only be carried out either within the US and with the involvement of its financial institutions (onshore clearing) or in a limited number of Asian jurisdictions (Singapore, Hong Kong, the Philippines, and Japan, offshore clearing), all of which involve the participation of a US financial institution.[22] This dependence is leveraged in the context of US financial sanctions, which may apply to any person, of any nationality, in any location, who causes a US person to violate US sanctions.[23] In the words of one legal scholar, "as it stands, OFAC[24] jurisdiction extends even to foreign transactions routed through the United States by virtue solely of their currency designation".[25]

The examples of software products, ICT infrastructure and services, and military goods in Table 1 are provided for further reflection and research. They could form the basis of additional sub-components for a more comprehensive indicator of geoeconomic power.

A combination of factors is at play across all sectors. From an economic perspective, global competitive forces drive concentration and specialisation, with certain activities tending towards natural monopoly or natural oligopoly equilibria. In parallel, public policy interventions can be deployed to mitigate or, on the contrary, to enhance or cement market outcomes based on power considerations. Particularly intuitive examples include military goods and certain activities that are viewed as clearly strategic, such as space-based capabilities.

20 Gopinath 2024.

21 Abely 2019, 57.

22 Abely 2019, 57–64.

23 Under relevant US case law, if a non-US entity carries out a transaction that is prohibited for US persons, and does so in US dollars, because this causes a US entity to provide services such as clearing, that in turn causes the US entity to violate the prohibition. If the sanction in question prohibits such causation, then the non-US entity will also be deemed to have violated US law. See Abely 2019.

24 The Office of Foreign Assets Control (OFAC) is part of the US Department of the Treasury. It is the entity within the US government that is responsible for administering and enforcing financial sanctions.

25 Van Genugten 2019, 145. The same conclusion is reached in Abely 2019.

Securitisation is hence a major factor in structuring international economic networks.

1.4. Measuring power in dense versus sparse networks

The nature of the network should determine the type of analysis. The difference between unilateral and multilateral forms of geoeconomic power and its measurement was discussed earlier. As Table 1 shows, highly concentrated economic activities correspond to sparsely connected networks. For such networks, insights from the security of supply literature provide a useable starting point for measuring the vulnerability of net importers, while international market shares provide a starting point for measuring the power of net exporters. In this context, the concept of "hub" from a network analysis perspective seems valid.

In the case of goods, *production* hubs are more relevant, such as the world's largest oil producers. In the case of services, benefits and leverage may accrue to a particular country for hosting or otherwise controlling a hub – for example, the US benefits from the fact that the US dollar is the dominant currency for trade finance, while Belgium has leverage over international financial messaging as the host country of SWIFT. In such cases, the simplest approach to measuring power would remain rooted in market shares, such as Saudi Arabia's share of crude oil, the US dollar's share in trade finance, or the proportion of international financial messaging that goes through SWIFT.

For dense networks, this discussion suggests the need to move away from the concept of centrality and to focus instead on aggregate importance or weight. In the case of aggregate trade in goods, there are no hubs and every sizeable country trades with every other sizeable country, but a few countries account for considerably larger volumes of trade than others. Here, too, market shares offer a natural starting point. However, to the extent that a measure of power across multiple product groups is sought, certain technical choices should be made regarding the level of aggregation of the data and how to account for multiple measurements of market shares across multiple corresponding markets or product groups.

2. Empirical strategy

2.1 Sample selection

The study covers the period from 2010 to 2022. The selection of countries was initially aimed at capturing the 44 largest economies in the world by GDP in US dollars at current prices and exchange rates, with the EU treated as a single country.[26] Due to data limitations, the focus was narrowed down to 41 major economies.[27] To ensure consistency, the EU country grouping was set to encompass the 27 member states that were in the Union as of 1 February 2020, namely excluding the United Kingdom, which is included separately. For China, unless otherwise specified, China, Hong Kong, and Macao are treated as a single economy, but Taiwan as a separate economy. The final selection of countries, sorted by continent and in alphabetical order, is shown in Table 2. By way of background, the ranking of countries according to their 2021 GDP levels is provided in Annex 1. This sample accounts for 96% of world GDP.

2.2 Aggregate trade: methodology and data

From first principles, the possible uses of trade data to define an index for measuring the trading power or importance of various nations range from trivial to increasingly complex, depending on the structure and level of aggregation of the data available or selected. To guide the discussion of possible approaches, and with the aim of being as exhaustive as possible, this section begins from the highest level of aggregation and shows how each further step in the granularity of the data enables a broader range

26 The reference year was set at 2021 at the beginning of the research work to obtain a ranking by GDP that would be recent but nonetheless robust to ex-post data revisions. The latter are a common occurrence up to two years after the end of a given year. Whereas such revisions are generally small as a percentage of any country's GDP, they could influence a country ranking. The use of current prices and exchange rates reflects the chosen focus on each country's importance in international markets. The initial cut-off point of 44 countries was a practical compromise to ensure a more balanced representation of each continent, while also limiting the sample to economies that would be expected to be well covered across relevant data sources and over the entire period under review.

27 The countries excluded due to data limitations are Bangladesh, Iraq, and Algeria.

Table 2. Selected countries by continent

Americas	Europe	Africa	Middle East	Asia	Oceania
Argentina	EU	Egypt	Iran	China	Australia
Brazil	United Kingdom	Kenya	Israel	Indonesia	New Zealand
Canada	Norway	Morocco	Kuwait	India	
Chile	Russia	Nigeria	Qatar	Japan	
Colombia	Switzerland	South Africa	Saudi Arabia	Kazakhstan	
Mexico	Turkey		UAE	Korea	
Peru	Ukraine			Malaysia	
United States				Taiwan	
				Pakistan	
				Philippines	
				Singapore	
				Thailand	
				Vietnam	

of choices. As stated in the introduction, the perspective is focused on export positions as a source of power, as opposed to import positions as a source of (countervailing) power.

1. If only total exports for each nation are available, with neither bilateral breakdowns nor commodity group breakdown, then countries can only be ranked by total exports. The world's largest exporter will be deemed the most powerful, followed by the second largest exporter, then the third, and so on.

2. If bilateral export data is available, it forms a bilateral matrix of dimension N x N for N nations. The total number of distinct observations will equal $N^2 - N$, as countries do not export to themselves. In this case, the most natural option is to compute a weighted sum of each country i's exports to its N-1 partners, which then serves as the index.

An alternative approach is to compute the share of each country j in the total imports of country i. A weighted sum of these shares can then be calculated or, alternatively, the shares can first be transformed before summation. The most common option for the latter is the Herfindahl-Hirschman Index, whereby every share is squared and then the sum of the squared shares serves as a measure of concentration. If this is done for every country j over its N-1 partners, then the maximum value of this measure will be N-1. This would be the case where one country accounts for 100% of the imports of every other country. This measure could be further weighted, for instance, to take account of the fact that some destination markets (partner countries) are more important than others. This could be done by using total imports, GDP, or another measure of importance.

Another option is to consider each country's ranking as an exporter to every partner country in the sample. Using this approach, the simplest method – which is also the one that disregards the most information from the dataset – is to focus only on rank 1 relationships. This involves counting how often each country in the sample is another country's largest source of imports. In this case, the measure will have a maximum value of N-1 (where one country is the top supplier for every other country). This measure can also be weighted to reflect the importance of each destination market (partner country), again using either total imports, GDP, or another measure of importance.

This general approach can be enriched by also accounting for rank 2 occurrences, rank 3 occurrences, or even all ranks. In this case, a weighting scheme is necessary to avoid obtaining a trivial result. The weighting scheme for taking account of different ranks may be arbitrarily set as a function that decreases with rank – for example, a rank 1 position is associated with a weight of 3, a rank 2 position with a weight of 2, and a rank 3 position with a weight of 1. Of course, if all ranks weighted by actual trade shares are combined, the result is then the same measure as the sum of shares.

3. If bilateral export data is disaggregated by commodity group, there will be K bilateral matrices, each with dimensions N x N for N nations and K commodity groups. The total number of distinct observations will equal K x (N^2 – N). All of the approaches described under point 2 can be developed for each matrix (for each commodity group), yielding indices specific to each commodity group. Furthermore, any of the measures described under point 2 can be computed across the entire sample.

In this case, a Herfindahl-Hirschman Index approach could be applied. Without further weighting, it would yield a maximum value of K x (N-1), which occurs when a single country supplies the entirety of every partner country's imports in every single commodity group. For rank 1 measures, all occurrences in which a given country is the top supplier for any given country and commodity group combination can be counted. The maximum value of this measure would likewise be K x (N-1), which occurs if a given country is the leading supplier for every other country across all commodity groups.

While further weighting and/or the inclusion of ranks lower than 1 are also possible, the two approaches described in the preceding paragraph are pursued, namely:

- The unweighted sum of squares of the shares that each exporter (i=1,...,N) holds in every destination market (j=1,...,N; i≠j) in every commodity group k=1,...,K. This sum is a Herfindahl-Hirschmann Index, with a value that will range between 0 (shares of zero in all commodity groups in all destination markets) and K x (N-1) (a share of 1 in every commodity group in every destination market).
- The unweighted sum of the number of occurrences where each exporter (i=1,...,N) ranks as the highest source of imports across the K x (N-1) country-commodity pairs, divided by K x (N-1). This represents the share of all possible country-commodity pairs for which the exporter has the first rank. Hence, the minimum value is zero and the maximum value is 1.

Data sources

The UN COMTRADE database is used to extract annual datasets on imports for all commodity groups according to the SITC nomenclature, Revision 3, at the 3-digit level. The data covers 42 selected countries and country groupings (the 41 countries in the sample, with the rest of the world grouped as a fictional 42nd country). The number of commodity groups at the 3-digit level is 261. However, the actual extracted data includes 260 commodity groups, as SITC Rev. 3 code 972 (monetary gold) is systematically missing.

2.3 Energy trade: methodology and data

The chosen focus within the energy trade is petroleum, given its long-standing strategic importance. To date, in spite of recent growth in the manufacturing and sale of electric vehicles, transportation worldwide remains overwhelmingly dependent on petroleum products. As a result, what has been true for many decades still holds today: being a net exporter of petroleum is undisputably a source of geoeconomic power.

Power measurement should encompass both crude oil and refined petroleum products. These two commodity groups should be viewed in aggregate, as net importers differ in terms of their refining capacities, such that each net importer purchases a different mix of crude oil and refined products to meet its needs. As many net importers also export small quantities of either crude or refined products (for various reasons), it is the net import position that matters. Conversely, for net exporters, it is the net export position across both crude oil and refined products that matters – certain net exporters (such as Russia) have excess refining capacity and are also net exporters of refined products.

The data source is the International Energy Agency's energy balance statistics, which provide a clear picture of production, exports, imports, domestic transformation and final consumption for each country. The IEA's database has worldwide coverage. The methodological choice for measuring the power of net exporters is to start from each country's net exports, measured in thousands of tonnes of oil equivalent (ktoe) across both crude oil and refined products, and then to compute each country's share of the internationally supplied volume, defined as the sum of all positive net exports.

This measure is then multiplied by the global average dependence on petroleum products in

the transportation sector (all modes of transport, namely road, rail, maritime, inland waterways, and aviation). This is to account for changes over time in transportation's dependence on petroleum products, as declines in the latter should be viewed as reductions in the power of net exporters. To illustrate that this is not trivial, Figure 1 shows the evolution of the share of petroleum products in transportation for Norway and for the world average. Norway is chosen for illustration as it has experienced a larger reduction than most states. However, for the computation of the index, the world average will be used.

2.4 Financial leverage: methodology and data

The financial power or leverage of states is inherently multi-dimensional. The importance of national currencies is considered first, followed by that of each country's capital markets.

Reserve currencies

Figure 2 shows the shares of reported national currencies in the foreign exchange reserves of the world's central banks, as reported in the IMF's COFER database. COFER data has worldwide coverage, with 149 monetary authorities reporting to it. In the database, only eight national currencies are identified,

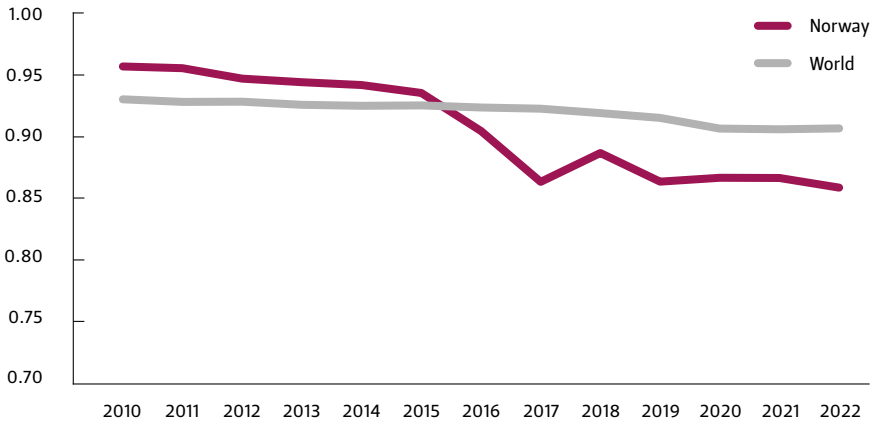

Figure 1. Share of petroleum products in transportation, 2010–2022
Source: IEA Energy Balances, author calculations

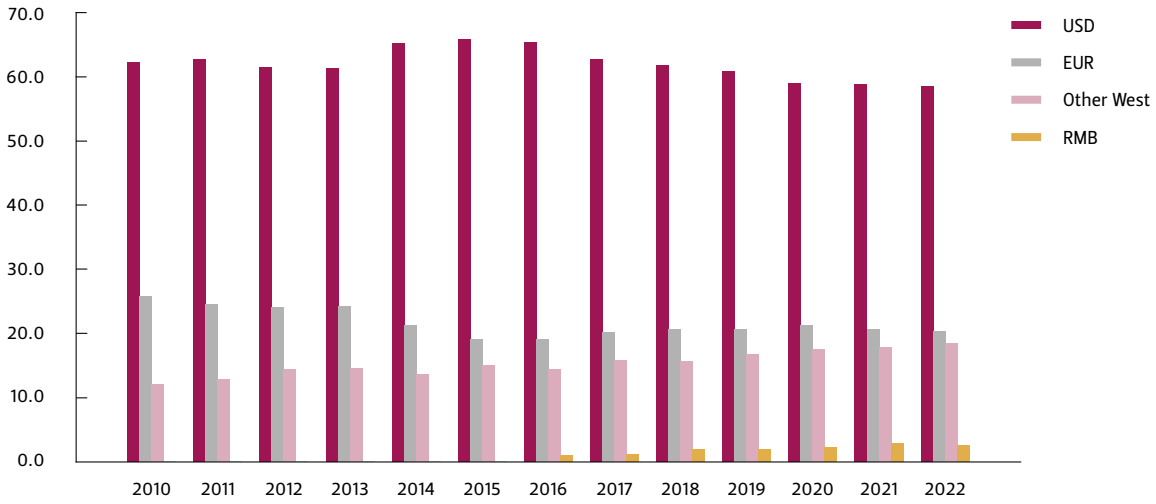

Figure 2. Share of national currencies in worldwide central bank foreign exchange reserves
Source: IMF COFER, author calculations

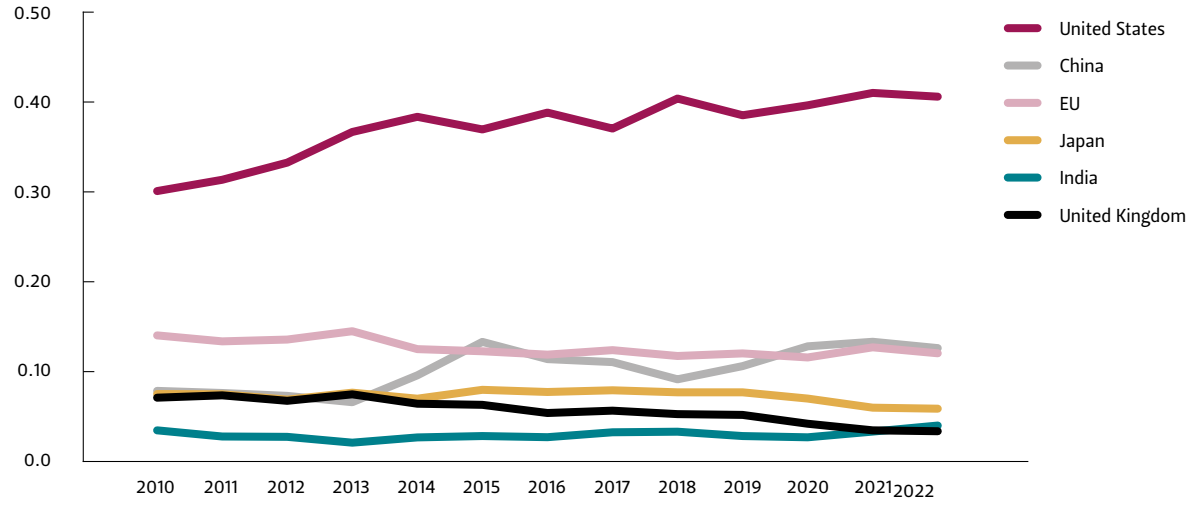

Figure 3. Share of global equity market capitalization
Source: World Bank WDI, CEIC, SIFMA, author calculations
Note: Based on equity market capitalization in US dollars at current prices

while the rest are grouped as "other", accounting for about 3% of the total allocated foreign exchange reserves on average over the period of observation. The eight currencies are the US dollar (USD), euro (EUR), Japanese yen (JPY), British pound (GBP), Canadian dollar (CAD), Australian dollar (AUD), Swiss franc (CHF), and Chinese renminbi (RMB).[28]

The distribution remains heavily dominated by the USD, with shares fluctuating between 58% and 65% over the period. The EUR is a distant second, with shares ranging from 19% to 26%, but still far ahead of the JPY and GBP, which ranged from 3.5% to 6% over the period.[29] Prior to 2016, the world's central banks did not report holding any reserves in RMB. Towards the end of the period, the RMB reached shares of between 2% and 3%, comparable to those held by the CAD and the AUD.

In terms of trends, the clearest developments over the period are the appearance of the RMB as the only non-Western reserve currency, a relative shift away from the EUR in favour of smaller Western currencies, and the persistent dominance of the USD.

Capital markets

Western economies, especially the US, continue to dominate in terms of capital market size. The chosen measure here is equity market capitalization in US dollars at current prices. This measure is chosen for pragmatic reasons, as it is relatively easier to collect across a wide range of countries over multiple recent years. A useful extension would be to measure the size of fixed-income markets.

The World Bank's World Development Indicators database provides equity market capitalization in US dollars at current prices for a broad selection of countries. However, there are missing observations for several countries, including (surprisingly) the EU and Norway. Two other data sources are therefore used: the annual factbooks of the Securities Industry and Financial Markets Association (SIFMA), and purchased data series from CEIC Data, a commercial data provider. Further data is presented in Annex 2.

Figure 3 shows the shares of the top six economies in global equity market capitalization. Notably, the US has significantly increased its lead in recent years, rising from around 30% to around 40% of the global total between 2010 and 2022. In parallel, China's share has recently overtaken that of the EU, and India has surpassed the UK. China's actual share is likely higher than shown, as the capitalization of the Hong Kong Stock Exchange is excluded to avoid any risk of double counting due to dual-listed companies.

28 See https://data.imf.org/?sk=e6a5f467-c14b-4aa8-9f6d-5a09ec4e62a4&sid=1408202647052.
29 For a more detailed analysis based on the same data, see Laser, Mihailov, and Weidner 2024.

3. Empirical results

3.1 Empirical results: aggregate trade

The computed indices for selected years for the top 15 economies (based on their 2022 results) are shown in Tables 3 and 4.

The two methodologies provide broadly similar rankings, with the EU and China strongly dominating the distribution, and the US in a distant third place according to both rankings. Further down the rankings, Brazil, India, Japan, and Russia occupy the fourth to seventh positions in different orders depending on the chosen methodology and year.

A major development is that China has overtaken the EU as the world's most important source of imports according to the Rank-1 measure (see Figure 4). At the beginning of the observation period, the EU was still far ahead of China according to both methodologies. As for the HHI ranking, the gap between the EU and China has narrowed considerably over time (see Figure 5).

3.2 Empirical results: energy

The resulting index for net exporters is shown in Table 5. Of the 41 countries in the sample, 16 had net positive exports in 2022 and are therefore included in the table, ranked in decreasing order of their power index for 2022. Country-year cases with strictly positive net imports are marked as Not Applicable ("NA").

Saudi Arabia and Russia strongly dominate the ranking, with average index values of 0.166 and 0.153, respectively, followed – after a large gap – by three countries: the UAE, Canada, and Kuwait, with average scores ranging from 0.054 to 0.058. All other states have average index values of less than 0.04. Until very recently, the US was a net importer, but in 2022, it achieved the status of net exporter, although its share of the international market remains very modest.

3.3 Empirical results: financial leverage

A combined indicator of financial leverage is constructed by calculating, for each country in each year, the arithmetic average of the national currency's share of global foreign exchange reserves and the country's share of global equity market capitalization. The results for the top five economies are shown in Figure 6.

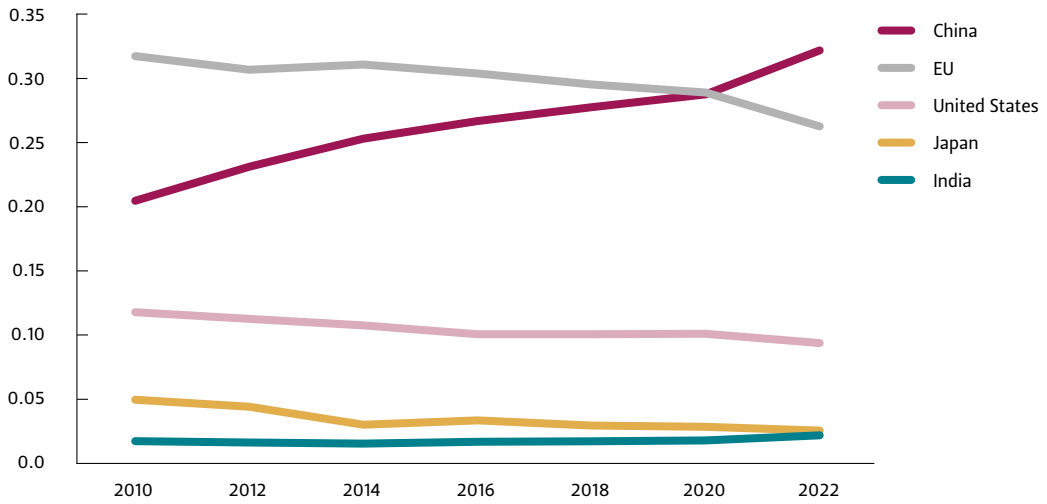

Figure 4. Rank-1 trade importance, top 5 countries
Source: Author calculations based on UN COMTRADE data

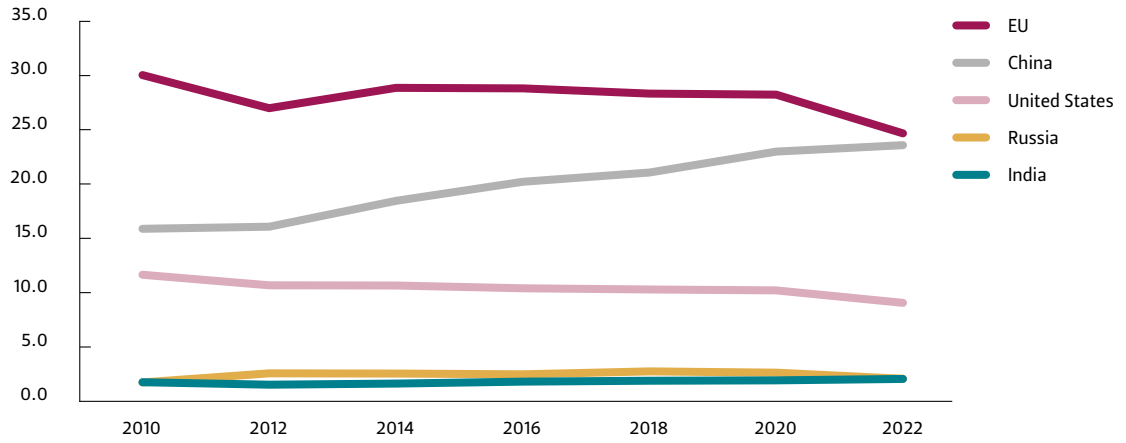

Figure 5. Herfindahl–Hirschmann Index trade importance, top 5 countries
Source: Author calculations based on UN COMTRADE data

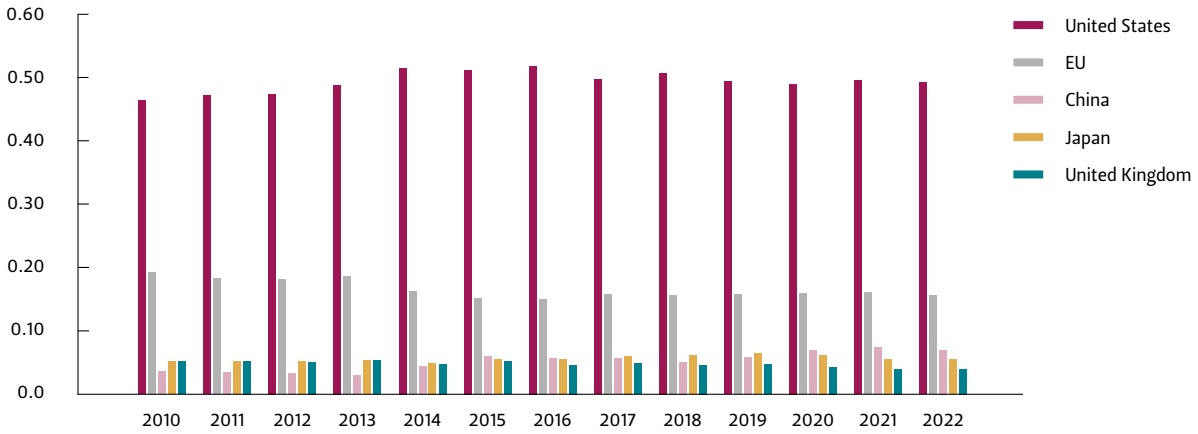

Figure 6. Combined financial leverage indicator
Source: Author calculations

Table 3. Rank–1 measure of trade importance, top 15 economies

Country	2010	2012	2014	2016	2018	2020	2022
China	0.2049	0.2313	0.2530	0.2667	0.2775	0.2874	0.3216
EU	0.3171	0.3066	0.3106	0.3037	0.2952	0.2890	0.2628
United States	0.1175	0.1124	0.1074	0.1007	0.1007	0.1011	0.0940
Japan	0.0493	0.0439	0.0302	0.0335	0.0296	0.0286	0.0257
India	0.0174	0.0164	0.0156	0.0169	0.0173	0.0179	0.0215
Brazil	0.0201	0.0214	0.0182	0.0187	0.0178	0.0186	0.0212
Russia	0.0165	0.0234	0.0238	0.0227	0.0265	0.0242	0.0190
Australia	0.0200	0.0214	0.0179	0.0178	0.0165	0.0154	0.0174
Indonesia	0.0110	0.0116	0.0118	0.0113	0.0128	0.0134	0.0162
Malaysia	0.0151	0.0132	0.0125	0.0125	0.0124	0.0126	0.0114
Thailand	0.0125	0.0120	0.0107	0.0102	0.0095	0.0102	0.0109
Korea	0.0108	0.0121	0.0135	0.0130	0.0126	0.0132	0.0107
Turkey	0.0062	0.0050	0.0080	0.0078	0.0096	0.0107	0.0103
Canada	0.0129	0.0125	0.0118	0.0108	0.0102	0.0104	0.0098
United Kingdom	0.0116	0.0107	0.0111	0.0091	0.0091	0.0089	0.0089

Source: Author calculations based on UN COMTRADE data

Table 4. Herfindahl–Hirschmann Index measure of trade importance, top 15 countries

Country	2010	2012	2014	2016	2018	2020	2022
EU	30.05	27.00	28.87	28.82	28.34	28.25	24.68
China	15.89	16.08	18.46	20.22	21.07	23.00	23.59
United States	11.66	10.68	10.66	10.41	10.30	10.22	9.07
Russia	1.74	2.58	2.55	2.49	2.75	2.64	2,07
India	1.76	1.53	1.64	1.82	1.90	1.93	2.06
Japan	3.31	2.79	2.29	2.52	2.28	2.25	1.94
Brazil	1.89	1.82	1.64	1.80	1.75	1.79	1.88
Australia	1.94	1.96	1.79	1.72	1.62	1.58	1.78
Indonesia	1.05	1.09	1.15	1.23	1.27	1.33	1.41
Turkey	0.65	0.46	0.83	0.78	1.06	1.19	1.05
Malaysia	1.35	1.18	1.11	1.15	1.14	1.08	1.05
Canada	1.34	1.24	1.25	1.17	1.05	1.20	0.94
United Kingdom	1.33	0.98	1.18	1.05	1.10	1.03	0.92
Korea	1.01	0.92	1.12	1.18	1.12	1.19	0.89
Thailand	1.04	0.96	1.00	1.02	0.95	0.88	089

Source: Author calculations based on UN COMTRADE data

The financial leverage of the US is by far the greatest in the world, well ahead of that of the EU. Moreover, US leverage increased slightly between 2010 and 2022. Whereas the US dollar's importance in global foreign exchange reserves decreased somewhat over the period, this was offset by an increase in the US's global share of equity market capitalization.

The EU remains a distant second throughout the period, although still far ahead of China and other major economies. The EU's leverage declined quite substantially during the period, owing to a decrease in both the euro's importance as a reserve currency and in the Union's share of global equity market capitalization.

China's leverage, while still a distant third in the distribution, grew significantly during the period, overtaking both Japan and the UK. As noted earlier, it is likely that the chosen measure of equity market capitalization understates China's true importance.

3.4 Combined geoeconomic index

The indicators computed earlier can now be combined into a single index of overall geoeconomic power that encompasses the three areas of exchange: trade in goods, petroleum and petroleum products, and financial leverage.

The aim is to reflect a notion of market share across all indicators while avoiding giving undue weight to any one of the three areas of exchange. Although some degree of arbitrariness is inevitable when combining multiple indicators into a single indicator, the reasoning is rooted in power potential. More specifically, a concept of "negative" power potential is posited, namely how much harm could result if key countries withdrew from the international market. This leads to formulating three extreme scenarios as boundary cases.

The first scenario assumes that there would be no international trade in (non-oil) goods. The second envisions no international trade in petroleum and petroleum products. The third considers the absence of an international financial system. Each of these scenarios would be enormously damaging for every country concerned.

Without international trade in oil, the trade in non-oil goods would largely cease, as goods could not be transported. Without international finance, trade in both oil and non-oil goods would largely cease because international payments would no longer be possible. Without trade in non-oil goods, trade in oil would also largely cease, as both the production and transportation of oil and oil products depend on a range of internationally traded manufactured goods, and the demand for international financial services would barely exist. In sum, each of

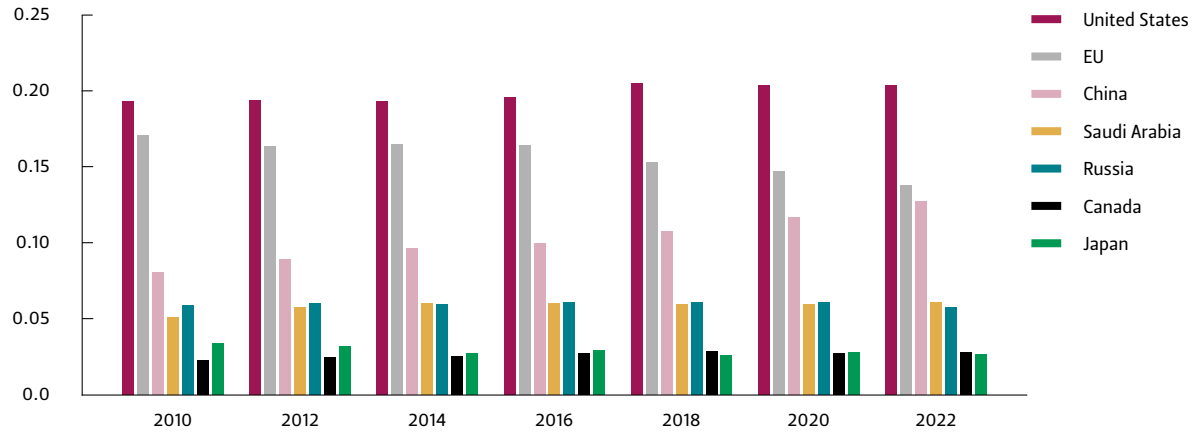

Figure 7. Geoeconomic Power Index, top 7 economies
Source: Author calculations

these three boundary cases would lead to a similar, overwhelming cessation of international economic activity.

From this conceptual basis, each of the three areas of exchange is given equal weight. For aggregate trade, a modified version of the Rank-1 indicator is computed, which removes trade in oil and oil products (SITC codes 333, 334, 335). For energy trade, the previously presented net exporter power indicator is applied. For financial leverage, the combined indicator introduced earlier is used. These three indicators are combined without further scaling into the final chosen indicator, which is the arithmetic average of the three. The final indicator has a theoretical maximum value of 1, which would occur if one country were simultaneously the Rank-1 supplier for every country-good pair across all non-oil goods, the sole net exporter of oil in the world, and both the holder of the only reserve currency in the world and the only equity market in the world.

The complete table of results, covering the years 2010, 2012, 2014, 2016, 2018, 2020, and 2022, is presented in Annex 3. The results for the top 7 and top 15 economies, ranked according to their score in 2022, are shown in Figure 7 and Table 6, respectively.

At the beginning of the period, the distribution of geoeconomic power is dominated by the US in first position and the EU in a close second, with other countries far behind. The distribution changes over time, with China almost catching up with the EU by the end of the period, while the US increases its initial lead due to a slight increase in its geoeconomic power combined with a significant decrease in the EU's.

Saudi Arabia and Russia, the world's two leading oil exporters, consistently occupy the fourth and fifth ranks throughout the period, although their overall scores remain much lower than those of the US and the EU. By the end of the period, China had also established a significant lead over both.

Canada and Japan follow in sixth and seventh place, well below Saudi Arabia and Russia. Canada overtakes Japan during the period, driven in small part by an increase in Canada's score, itself driven by an increase in Canada's share of the global oil market, and in larger part by a sharp decline in Japan's score, which reflects its diminishing role as a Rank-1 exporter of goods (see Table 5).

Further down the ranking, several mid-sized oil producers score comparatively well, notably the UAE, Kuwait, Iran, and Norway, which rank eighth, ninth, eleventh and twelfth, respectively, in 2022. It is relevant to note that their oil power index results remain substantial throughout the period thanks to their sizeable international oil market shares, which in 2022 were 7.1% (the UAE), 5.7% (Kuwait), 3.7% (Iran), and 3.9% (Norway). Iran also benefitted from strong growth in its equity market capitalization.

The index is designed to be interpretable as a composite market share. Notably, the sum of the scores for all 41 countries in the sample ranges from 0.85 to 0.86 over the period. This total is lower than 1 for a combination of reasons: the Rank-1 indicator for trade includes a synthetic "Rest of world" category, which results in a sum slightly below unity. The indicator for oil exporter power totals approximately 0.9, due to the effect of the oil intensity of transport variable. Some geoeconomic

Table 5. Net oil exporter power index

Country	2010	2012	2014	2016	2018	2020	2022
Saudi Arabia	0.142	0.169	0.168	0.173	0.170	0.165	0.179
Russia	0.152	0.148	0.153	0.150	0.153	0.156	0.152
Canada	0.029	0.039	0.051	0.050	0.063	0.073	0.078
UAE	0.049	0.058	0.057	0.055	0.054	0.061	0.064
Kuwait	0.045	0.058	0.060	0.056	0.052	0.052	0.052
Norway	0.037	0.032	0.034	0.033	0.029	0.037	0.035
Iran	0.056	0.032	0.027	0.051	0.045	0.021	0.033
Kazakhstan	0.030	0.029	0.030	0.025	0.029	0.032	0.029
Qatar	0.028	0.031	0.033	0.029	0.027	0.028	0.026
Brazil	NA	NA	NA	0.008	0.012	0.023	0.017
Nigeria	0.046	0.044	0.038	0.028	0.032	0.024	0.014
Colombia	0.012	0.015	0.015	0.011	0.013	0.013	0.010
Mexico	0.024	0.019	0.019	0.013	0.007	0.011	0.005
Malaysia	0.003	0.001	NA	0.001	0.001	0.001	0.002
United States	NA	NA	NA	NA	NA	NA	0.002
Argentina	0.002	0.001	NA	NA	0.001	0.002	0.001

Source: Author calculations based on IEA Energy Balances

Table 6. Geoeconomic Power Index, top 15 economies

Country	2010	2012	2014	2016	2018	2020	2022
United States	0.1933	0.1941	0.1933	0.1958	0.2048	0.2038	0.2035
European Union	0.1704	0.1636	0.1647	0.1639	0.1531	0.1473	0.1378
China	0.0808	0.0893	0.0961	0.0997	0.1077	0.1166	0.1271
Saudi Arabia	0.0509	0.0576	0.0602	0.0600	0.0594	0.0594	0.0610
Russia	0.0586	0.0603	0.0594	0.0606	0.0606	0.0608	0.0575
Canada	0.0228	0.0243	0.0252	0.0271	0.0283	0.0270	0.0278
Japan	0.0340	0.0320	0.0273	0.0291	0.0263	0.0277	0.0267
UAE	0.0213	0.0210	0.0236	0.0245	0.0226	0.0230	0.0213
Kuwait	0.0153	0.0179	0.0198	0.0198	0.0204	0.0191	0.0191
United Kingdom	0.0211	0.0209	0.0206	0.0208	0.0188	0.0202	0.0183
Iran	0.0192	0.0197	0.0109	0.0111	0.0100	0.0105	0.0176
Norway	0.0141	0.0132	0.0120	0.0117	0.0126	0.0133	0.0128
Australia	0.0134	0.0137	0.0126	0.0125	0.0113	0.0110	0.0116
Brazil	0.0113	0.0114	0.0098	0.0088	0.0080	0.0084	0.0113
India	0.0109	0.0097	0.0093	0.0088	0.0099	0.0103	0.0113

Source: Author calculations

power is also likely to be held by the roughly 150 economies not included in the sample, although this shortfall is expected to be minimal, as the sample of 41 countries accounts for 96% of global GDP (see Annex 1). Overall, this indicator accounts for an overwhelming share of global geoeconomic power and does so on a scale that is intuitive from a market share perspective.

Conclusions

The combined indicator reveals both continuity and change in the global distribution of geoeconomic power. The main finding is that the US is the world's leading geoeconomic power, with its lead over the second-ranked EU expanding in recent years. In parallel, China's geoeconomic power has grown rapidly in recent years, almost matching that of the EU in 2022. This growth is overwhelmingly driven by China's position as a leading exporter of non-oil goods across numerous countries and many categories of goods. On the latter measure alone, China recently overtook the EU and is far ahead of the US.

On the other hand, China's geoeconomic power in terms of financial leverage remains considerably lower than that of the US. It stands to reason that China's position would strengthen considerably if it opted for greater financial integration with the rest of the world, as this would both boost the size of its equity markets and encourage wider use of the renminbi for trade finance and, ultimately, as a reserve currency.

In terms of international power politics, the shift in the distribution of geoeconomic power over the period 2010–2022 suggests a more competitive and contested global order. Early in the period, it was almost possible to speak of a duopoly of geoeconomic power held by the US and the EU. At that time, the two economies acting in concert would have largely guaranteed very substantial geoeconomic leverage, apart from the oil trade. This picture is less clear today, given China's growing influence.

The indicator presented in this Research Paper also makes it clear that there is no single hegemon in the realm of geoeconomic power. While the US leads the ranking, its score is around 0.2, representing a composite "market share" of approximately 20%. Although the US holds a hegemonic (albeit not exclusive) position in terms of the importance of its national currency, its power is considerably lower in the goods trade and close to zero in the realm of oil, given its largely balanced position.

At the same time, an important structural feature of geoeconomic power, well reflected in the indicator, is the unique importance of oil. No other commodity is both so concentrated in the hands of a small minority of states and so vital to the global economy. This remains the case in spite of recent advances in the adoption of electric vehicles. However, the combined indicator incorporates a correction for this factor, such that the ongoing shift away from oil in transportation will be reflected in future calculations of the indicator.

Looking to possible future trends, a deeper analysis would be required to understand how national currencies that have come to dominate international finance, and trade finance in particular, could lose their importance. The exceptional role of the US dollar in trade finance was easier to understand in a world where the US was one of the largest buyers of oil on the international market. Now that that era is over, with the US effectively removing itself as a major actor thanks to its self-sufficiency in oil, it remains to be seen whether the oil trade will continue largely as before, or fragment according to the preferences of major buyers and sellers, in which case one could envisage a greater role for the renminbi and the euro in particular. However, this potential shift would be mitigated, or even outweighed over time, by the adoption of electric vehicles in the coming decades.

The indicators developed in this Research Paper pay attention to long-established realms of geoeconomic power – trade in goods, oil, and international finance. Extensions would be valuable in future work in order to capture emerging dynamics that could prove influential. A prime candidate would be the integration of indicators related to the digital economy as a source of power, as well as those reflecting technology supply chains (including critical minerals and rare earths). In Table 1, a typology of economic networks was introduced, highlighting examples of goods and services with a particularly high concentration of production. These examples could form the basis of broader-based efforts to measure and analyse geoeconomic power.

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Annex 1. Selected countries

Table A1.1 GDPs of sample countries at current prices, USD billions

Rank	Country	GDP (2021)
1	United States	23,681
2	China (all)	18,159
3	EU	17,494
4	Japan	5,040
5	India	3,167
6	United Kingdom	3,144
7	Canada	2,007
8	Korea	1,942
9	Russia	1,843
10	Brazil	1,671
11	Australia	1,658
12	Mexico	1,313
13	Indonesia	1,187
14	Saudi Arabia	874
15	Switzerland	815
16	Turkey	808
17	Taiwan	773
18	Thailand	506
19	Norway	503
20	Israel	493
21	Argentina	486
22	Nigeria	442
23	Singapore	434
24	Egypt	423
25	South Africa	421
26	UAE	415
27	Philippines	394
28	Malaysia	374
29	Vietnam	370
30	Pakistan	348
31	Colombia	319
32	Chile	316
33	Iran	289
34	New Zealand	250
35	Peru	226
36	Ukraine	200
37	Kazakhstan	197
38	Qatar	180
39	Kuwait	148
40	Morocco	142
41	Kenya	110

Source:IMF World Economic Outlook database, October 2024 edition
Note: World total: 97,403 bn USD. Total over the 41 countries: 93,563 bn USD (96.1%).

Annex 2. Financial indicators

Table A2.1 Share of national currencies in global foreign exchange reserves

Currency	2010	2012	2014	2016	2018	2020	2022
USD	62.2	61.5	65.2	65.4	61.8	58.9	58.5
EUR	25.8	24.1	21.2	19.1	20.7	21.3	20.4
RMB	0.0	0.0	0.0	1.1	1.9	2.3	2.6
JPY	3.7	4.1	3.5	4.0	5.2	6.0	5.5
GBP	3.9	4.0	3.7	4.3	4.4	4.7	4.9
AUD	1.5	1.5	1.6	1.7	1.6	1.8	2.0
CAD	1.4	1.4	1.8	1.9	1.8	2.1	2.4
CHF	0.1	0.2	0.2	0.2	0.1	0.2	0.2
Other	4.3	3.2	2.8	2.3	2.4	2.7	3.5

Source: IMF COFER (share in allocated reserves) and author assumptions
Note: For AUD and CAD, IMF COFER reports shares of zero in 2010 and 2011. The authors assume this is unlikely to be the case and is likely caused by reporting issues. For both currencies, the shares reported for 2012 are imputed to 2010 and 2011.

Table A2.2 Equity market capitalization, USD billions, top 25 economies

Country	2010	2012	2014	2016	2018	2020	2022
United States	17283.5	18668.3	26330.6	27352.2	30436.3	41569.9	40298.0
China	4027.8	3697.4	6004.9	7320.7	6324.9	12276.8	11469.3
EU	7160.9	6847.1	7844.3	7669.6	8136.0	11148.1	10988.4
Japan	3827.8	3478.8	4378.0	4955.3	5296.8	6718.2	5380.5
India	1762.5	1390.4	1686.7	1746.3	2282.3	2595.5	3603.5
United Kingdom	3613.1	3396.5	4012.9	3467.4	3638.0	4045.6	3096.0
Canada	2171.2	2060.0	2095.4	1993.5	1937.9	2641.5	2744.7
Saudi Arabia	353.4	373.4	483.1	448.8	496.4	2429.1	2638.6
Switzerland	1229.4	1233.4	1495.3	1403.4	1441.2	2001.6	1830.5
Australia	1454.5	1386.9	1288.7	1268.5	1262.8	1720.6	1679.2
Korea	1091.9	1179.4	1212.8	1254.5	1413.7	2176.2	1644.5
Iran	86.6	91.0	116.6	101.0	170.5	1539.6	1613.0
South Africa	925.0	907.7	933.9	951.3	865.3	1051.5	1171.7
UAE	131.5	101.3	201.6	213.2	231.4	294.8	873.6
Brazil	1545.6	1227.4	843.9	758.6	916.8	988.4	794.4
Singapore	647.2	765.1	752.8	640.4	687.3	652.6	619.4
Indonesia	360.4	428.2	422.1	425.8	486.8	496.1	610.3
Thailand	277.7	389.8	430.4	433.0	500.7	543.2	604.4
Russia	951.3	825.3	385.9	622.1	576.1	694.7	530.1
Mexico	454.3	525.1	480.2	350.8	385.1	399.6	454.4
Norway	2xx.x	2xx.x	2xx.x	2xx.x	2xx.x	3xx.x	4xx.x
Malaysia	408.7	466.6	459.0	359.8	398.0	436.5	381.2
Turkey	302.4	315.2	219.8	171.8	149.3	237.5	330.0
Chile	341.8	313.3	233.2	212.5	252.9	369.1	285.2
Israel	227.6	161.9	200.5	214.0	187.5	262.1	269.6

Source: World Bank, WDI, CEIC, SIFMA, author estimates
Note: Data points obtained from CEIC are truncated in this table as they constitute commercially obtained data. Data for China excludes Hong Kong so as to avoid the risk of double counting regarding corporations that are dual-listed on the Hong Kong and Shanghai stock exchanges.

Table A2.3 Combined financial leverage indicator, selected years, top 25 economies

Country	2010	2012	2014	2016	2018	2020	2022
United States	0.463	0.474	0.515	0.518	0.507	0.489	0.492
EU	0.192	0.181	0.162	0.149	0.156	0.159	0.156
China	0.035	0.033	0.043	0.057	0.051	0.069	0.070
Japan	0.052	0.051	0.049	0.054	0.060	0.062	0.054
United Kingdom	0.051	0.050	0.047	0.046	0.046	0.043	0.040
Canada	0.026	0.025	0.024	0.024	0.022	0.023	0.025
Australia	0.020	0.020	0.017	0.017	0.016	0.017	0.018
India	0.016	0.012	0.012	0.012	0.015	0.012	0.018
Saudi Arabia	0.003	0.003	0.003	0.003	0.003	0.011	0.013
Switzerland	0.011	0.012	0.012	0.011	0.010	0.010	0.010
Korea	0.010	0.011	0.009	0.009	0.009	0.010	0.008
Iran	0.001	0.001	0.001	0.001	0.001	0.007	0.008
Taiwan	0.007	0.007	0.006	0.006	0.006	0.007	0.007
South Africa	0.008	0.008	0.007	0.007	0.006	0.005	0.006
UAE	0.001	0.001	0.001	0.001	0.002	0.001	0.004
Brazil	0.014	0.011	0.006	0.005	0.006	0.005	0.004
Singapore	0.006	0.007	0.005	0.004	0.004	0.003	0.003
Indonesia	0.003	0.004	0.003	0.003	0.003	0.002	0.003
Thailand	0.002	0.003	0.003	0.003	0.003	0.003	0.003
Russia	0.008	0.007	0.003	0.004	0.004	0.003	0.003
Mexico	0.004	0.005	0.003	0.002	0.003	0.002	0.002
Norway	0.003	0.002	0.002	0.002	0.002	0.002	0.002
Malaysia	0.004	0.004	0.003	0.003	0.003	0.002	0.002
Turkey	0.003	0.003	0.002	0.001	0.001	0.001	0.002
Chile	0.003	0.003	0.002	0.001	0.002	0.002	0.001

Source: Author calculations

Annex 3. Overall results

Table A3.1 Geoeconomic Power Index, complete results

Country	2010	2012	2014	2016	2018	2020	2022
United States	0.1933	0.1941	0.1933	0.1958	0.2048	0.2038	0.2035
EU	0.1704	0.1636	0.1647	0.1639	0.1531	0.1473	0.1378
China	0.0808	0.0893	0.0961	0.0997	0.1077	0.1166	0.1271
Saudi Arabia	0.0509	0.0576	0.0602	0.0600	0.0594	0.0594	0.0610
Russia	0.0586	0.0603	0.0594	0.0606	0.0606	0.0608	0.0575
Canada	0.0228	0.0243	0.0252	0.0271	0.0283	0.0270	0.0278
Japan	0.0340	0.0320	0.0273	0.0291	0.0263	0.0277	0.0267
UAE	0.0213	0.0210	0.0236	0.0245	0.0226	0.0230	0.0213
Kuwait	0.0153	0.0179	0.0198	0.0198	0.0204	0.0191	0.0191
United Kingdom	0.0211	0.0209	0.0206	0.0208	0.0188	0.0202	0.0183
Iran	0.0192	0.0197	0.0109	0.0111	0.0100	0.0105	0.0176
Norway	0.0141	0.0132	0.0120	0.0117	0.0126	0.0133	0.0128
Australia	0.0134	0.0137	0.0126	0.0125	0.0113	0.0110	0.0116
Brazil	0.0113	0.0114	0.0098	0.0088	0.0080	0.0084	0.0113
India	0.0109	0.0097	0.0093	0.0088	0.0099	0.0103	0.0113
Qatar	0.0098	0.0111	0.0111	0.0113	0.0118	0.0109	0.0103
Nigeria	0.0156	0.0141	0.0148	0.0128	0.0130	0.0127	0.0094
Kazakhstan	0.0102	0.0106	0.0104	0.0104	0.0109	0.0100	0.0087
Mexico	0.0111	0.0104	0.0094	0.0095	0.0089	0.0077	0.0067
Indonesia	0.0048	0.0052	0.0052	0.0047	0.0053	0.0054	0.0065
Korea	0.0067	0.0073	0.0079	0.0074	0.0070	0.0073	0.0063
Switzerland	0.0064	0.0065	0.0065	0.0066	0.0060	0.0063	0.0057
Malaysia	0.0072	0.0057	0.0060	0.0054	0.0052	0.0056	0.0049
Colombia	0.0051	0.0060	0.0063	0.0061	0.0062	0.0059	0.0047
Thailand	0.0050	0.0049	0.0047	0.0043	0.0042	0.0043	0.0047
Turkey	0.0030	0.0023	0.0036	0.0031	0.0037	0.0041	0.0039
Singapore	0.0048	0.0049	0.0050	0.0037	0.0035	0.0033	0.0034
South Africa	0.0044	0.0038	0.0038	0.0039	0.0034	0.0028	0.0034
Argentina	0.0041	0.0035	0.0027	0.0025	0.0024	0.0024	0.0027
Viet Nam	0.0013	0.0017	0.0016	0.0017	0.0018	0.0018	0.0024
Taiwan	0.0027	0.0026	0.0024	0.0025	0.0024	0.0021	0.0022
Chile	0.0027	0.0028	0.0028	0.0022	0.0021	0.0018	0.0020
New Zealand	0.0020	0.0021	0.0021	0.0020	0.0020	0.0016	0.0018
Peru	0.0011	0.0013	0.0012	0.0012	0.0011	0.0008	0.0011
Philippines	0.0009	0.0008	0.0011	0.0009	0.0009	0.0011	0.0009
Israel	0.0009	0.0007	0.0007	0.0006	0.0006	0.0008	0.0007
Pakistan	0.0006	0.0005	0.0005	0.0006	0.0008	0.0005	0.0006
Morocco	0.0006	0.0006	0.0005	0.0005	0.0005	0.0004	0.0005
Egypt	0.0010	0.0007	0.0006	0.0008	0.0006	0.0009	0.0004
Kenya	0.0002	0.0003	0.0004	0.0004	0.0004	0.0003	0.0003
Ukraine	0.0014	0.0015	0.0010	0.0009	0.0008	0.0009	0.0002

Source: Author calculations

RESEARCH PAPER
1
February 2025

ISBN 978-951-769-870-2
ISSN 1795-8059
Language editing: Lynn Nikkanen
Graphic design: Otso Teperi

This research was conducted within the framework of the research project *Power Politics by Economic Means: The Geoeconomics Research Initiative (GERI)*, led by Mikael Wigell and funded by the Research Council of Finland.

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