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Geopolitical and Environmental Implications of the Ukraine Conflict

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Summary

This paper explores the implications of the Ukraine war for geopolitical organisation and the development of environmentally sustainable technologies. It argues that the Ukraine conflict is likely to be an epochal war, a protracted struggle over political and economic structures, marking some kind of divide between eras. The outcomes of such wars are often radically uncertain, with consequences completely unexpected by those who initiate them. The direct military struggle in the Ukraine may be lengthy or a solution may be negotiated. But the economic war of embargoes, confiscations and boycotts will probably continue indefinitely, and will have the effect of reconfiguring the world system. Neither Russia nor China are likely to succumb to the sanctions, because they have well-educated populations, comprehensive natural resource bases, and large agricultural and industrial sectors. This suggests that there will be a new geopolitical structure based on strong partition between two great power blocs, with competition for influence among other economies and polities. But this geopolitical division is occurring within a geophysical crisis of environmental degradation and climate change. Against the geophysical background, the biggest global problem is the breakdown of multilateral collaboration needed to find workable energy technology solutions. Current emissions targets are dead and the collective action framework associated with the UN climate process is probably dead. Longer-term solutions, such as the cooperative development of new energy technologies, are impossible to envisage at the moment. Even so, it is highly likely that the uncertain dynamics of economic war and geophysical crisis will provide radical challenges to the new geopolitical order. The key innovation policy challenge for the future is to find and build, within this reconfigured but turbulent geopolitical structure, a new basis for multilateral technological collaboration.

The conflict in Ukraine is a regional war with global implications. We cannot know how the military situation will turn out, but we can already make a judgement about the economic war. The US/EU sanctions on Russia and China are comprehensive but unlikely to achieve their objectives, which include at their limit the collapse of the Russian Federation. This is because both Russia and China possess major industrial assets and comprehensive resource bases. Instead we are seeing a geopolitical partition of the world, a reconfiguration of the world system. Quite apart from geopolitical dangers ahead, this will affect the already tenuous possibilities for collective global action in the face of climate change and other environmental crises. These geophysical crises are entering a new phase and the key challenge for the new world system is whether any kind of adequate institutional and technological responses can be formulated and implemented.

Learning from history?

It is usually futile to seek lessons from history because circumstances, contexts, and technological capabilities change so much. Even so, for the moment we are in a time of war, and from the history of warfare we can draw two reliable, although abstract, conclusions (Kolko, 1995).

One is that wars are radically unpredictable, and actors simply never know what is in store. Christopher Clark's detailed study of how Europe's political classes and military staffs took Europe into general war in 1914, makes it sharply clear that nobody was even remotely aware of the kind of war they were entering (Clark 2012). World War I may be an extreme case but almost any significant conflict involves big surprises in the way it is fought and in its outcomes. The second conclusion follows: those who initiate war rarely survive it, because wars produce challenges with which political cultures cannot contend. This applies both to individual politicians and political regimes. If this pattern repeats itself in the Ukraine then there may be significant changes in the political context within which the geophysical crisis must be faced.

So trying to forecast the outcome of the war is a fool's errand. Neither the specific events that may occur, nor their probabilities, can realistically be discussed. Certainly politicians and functionaries currently on the front pages will disappear soon enough. And we can also expect big surprises in the evolution of the war. However there are some things we *can* discuss, because they have already happened. These are to do with the economic aspects of US-EU-Russia-China relations, which have been fundamentally changed by the war in Ukraine.

Economic dimensions of the Ukraine conflict

Ukraine is an interstate war, which many have believed is a thing of the past. Much recent writing on warfare focuses on asymmetric or hybrid warfare between states and political fronts, terrorist groups, etc (Smith, 2019). Interstate wars differ first and foremost in scale, because they deploy all of the assets of a state, and in particular industrial capabilities and technologies.

Interstate wars have two main components. First, kinetic war, in which armies engage in manoeuvre and battle, and then struggle for supremacy. Second, economic war, which in turn has three elements. In part, it concerns out-producing an enemy in military equipment. Then there is military action against economic assets - attempts to seize resources or to destroy production capabilities and infrastructures.¹ Finally, there are economic-financial sanctions comprising trade embargoes (especially on allegedly critical products), investment prohibitions or boycotts, disruption of supply chains, financial measures, or confiscation of assets (financial or real, or intangible assets such as patents). Such sanctions are instruments of war rather than alternatives to war - they are intended to wreck the enemy's economy and through that, its state.

The current war has at least two of these elements. The kinetic war is being fought out in the Ukraine, using modern military-industrial and digital technologies. On the other hand, there is now a global war of sanctions, carried out more or less exclusively by the USA (and its dependent states), and the EU. Some of the economic war is already serious in outcome: the boycotts of Russian hydrocarbons, metals, and fertiliser feedstocks are having impacts because of shortages and rising prices. But the impacts are likely to go beyond rising prices, towards a new division of the world.

The new economic war

After the Kyiv coup in 2014, with the subsequent transfer of Crimea to Russia, and the beginnings of civil war in the Donbass, the US imposed a wide array of sanctions on Russia and Russian citizens. These were considerably extended after February 24 2022. Thus far, the sanctions cover seven broad areas:²

¹ In *The Peloponnesian War*, Thucydides paid close attention to the initial Spartan strategy of wrecking Athenian farms, wells, vineyards, orchards, olive groves etc., rather than attacking Athens directly.

² The EU sanctions are overviewed at <https://bit.ly/3oWlGih>, and the US sanctions at <https://bit.ly/3PXL2bw>. There is so far no full analysis of the types and scope of sanctions on Russia, but many individuals have tracked specific areas, and these are collected in the Wikipedia entry '*International sanctions during the 2022 Russian invasion of Ukraine*'. This information is subject to all of the usual criticisms of Wikipedia as a source (unrefereed, subject to author bias, poor editorial control etc.), and should be handled with care; even a cursory

- *large-scale asset appropriations* (including confiscation of Russian central bank reserves).
- *financial sector prohibitions* (exclusion of Russia from interbank transfer systems, and general financial services including management consulting).
- *trade prohibitions*, especially large but incomplete boycotts of Russian oil and gas, but also export controls on 'strategic' products, especially capital and intermediate electronic goods.
- *foreign investment and technology transfer prohibitions*, including trade in some types of machinery, and infrastructure prohibitions (such as Nordstream 2).
- *transport bans*: Western ports are barred to most Russian merchant ships, and US/NATO airspace is closed to Russian aircraft.
- *boycotts of organisations and individuals*, and in some cases confiscation of their assets (especially alleged political supporters of Vladimir Putin).
- *regulatory actions* aimed at excluding Russian technologies from international operations (such as type approvals for aircraft)

At the time of writing the sanctions (late September 2022) are being extended in various ways: the G7 has announced plans to impose a price cap on Russian oil, and the EU is raising obstacles to visas for travel by Russian citizens. Currently, the sanctions do not include trade in pharmaceuticals and medical products, so there is some degree of concern for population well-being. China has also been subjected to enhanced sanctions since September 2018, especially on semiconductor technologies, chips and fabrication equipment, focusing on the Chinese companies Huawei and SMIC (Semiconductor Manufacturing International Corporation). These sanctions also were extended, twice, in 2022.

Objectives of sanctions

Most economic warfare has rested on the idea that there is some product or technology on which the enemy is 'dependent' in a strong sense - if the enemy is deprived of the product/technology then its economy will not be viable. Russia is widely held to be dependent on technology imports from the West, so export controls on semiconductors, microelectronics, navigation equipment, aircraft components etc. are in focus. Such controls are also argued, although without evidence, to have caused the 'defeat' of the Soviet Union (Shagana, 2022). Beyond these technical objectives with sanctions there lie broader strategic aims. There appears to be no definitive statement of these aims, but they include:

reading will suggest problems of framing and data. For the moment, however, it probably gives the best overview of the US/NATO sanctions effort.

First, to damage Russia's ability to finance the war with foreign-currency earnings. The US says that '... the entire G7 (is) committed to phasing out or banning the import of Russian oil. This will hit hard at the main artery of Putin's economy and deny him the revenue he needs to fund his war ... These new controls will further limit Russia's access to items and revenue that could support its military capabilities' (White House 2022). These notions ignore the argument that 'financing' the war is not necessarily a problem for Russia - it does not need foreign exchange to pay for its operations in Ukraine so much as the mobilisation of domestic resources, physical and financial. This is primarily a matter of organisation, not finance, but nevertheless the financial arguments are widely heard.

Second, to impose economic penalties on the political supporters of Vladimir Putin, thus eroding his political base and possibly causing him to be removed. The European Commission adds this to its economic argument, which is otherwise similar to the US: '(Sanctions) ... are imposing a clear economic and political cost on Russia's political elite, while diminishing its economic base' (European Commission 2022). Elliott A. Cohen, writing in *The Atlantic*, suggested that 'the Western objective must be to leave Russia profoundly weakened and militarily crippled, incapable of renewing such an onslaught, isolated and internally divided until the point that an aging autocrat falls from power' (Cohen 2022).

Third, there is an objective not expressed officially, but discussed among supporters of a more active Western policy. This is to collapse Russia itself and thereby diminish any future great-power coalition between Russia and China. The clearest expression of this comes from the Commission on Security and Cooperation in Europe (CSCE), a US agency that was established to follow up the Helsinki Accords in the 1970s. CSCE recently held a discussion in Washington on 'Decolonizing Russia', which it described as 'a moral and strategic imperative', remarking that

(Russia's) aggression ... is catalyzing a long-overdue conversation about Russia's interior empire, given Moscow's dominion over many indigenous non-Russian nations, and the brutal extent to which the Kremlin has taken to suppress their national self-expression and self-determination. Serious and controversial discussions are now underway about reckoning with Russia's fundamental imperialism and the need to "decolonize" Russia for it to become a viable stakeholder in European security and stability (CSCE 2022).

The wish to break up Russia has been expressed from time to time in neo-conservative circles, for example by Dick Cheney (Gates 2015). Although CSCE is a somewhat erratic organisation it remains an independent commission of the US Federal Government ('...nine Commissioners are members of the Senate, nine are members of the House of Representatives, and three are executive branch officials') so this may presage things going to a new level. Mike Pompeo, former US Secretary of State, in a recent speech on

Ukraine, spoke of the geopolitical need to weaken Russia as part of the objective of blocking a Russia-China strategic alliance: 'We must prevent the formation of a Pan-Eurasian colossus incorporating Russia, but led by China' (Hudson Institute 2022).

Probably the most coherent rationale for the current sanctions regime is found in the RAND report, *Extending Russia: Competing from Advantageous Ground*, of 2019 (i.e. well before the Russian invasion of Ukraine). The RAND point of departure is bluntly that 'the United States is currently locked in a great-power competition with Russia', and it examines all available strategies for prosecuting this competition. These include economic, geopolitical, ideological, air and space, and maritime measures. Many of the measures pose dangerous escalatory risks, and in the face of these RAND is cautious, recommending two forms of economic warfare - pressure on Russian energy exports, and sanctions focused on capital and intermediate goods imports. The overall aim to 'extend' Russia, by which it means stressing Russian financial and governmental resources to the point of breakdown. This, combined with arms supplies and military/intelligence support to Ukraine, is essentially the course on which the West is now engaged (Dobbins et al 2019).

Historical Effects of Sanctions

How likely is it that the sanctions will have the effects desired by the Western coalition? The analytical literature mostly focusses on technical effectiveness - whether sanctions actually achieve the results of closing down production, eroding foreign-exchange earnings, creating political instability etc.

The technical effects of economic warfare have been assessed in two major ways. One is through a historical analysis of the kinds of blockade and finance sanctions currently being used on Russia. Nicholas Mulder argues that with few exceptions such sanctions have been largely ineffective both as a form of economic warfare and as a form of deterrence (Mulder 2022). He makes the powerful point that even where sanctions have been effective (for example, in creating mass starvation among target populations) they were not efficacious in political or military terms. This is mainly because targeting populations produces not acquiescence but resistance.

Perhaps the only systematic examination of the effects of serious economic warfare has been the analysis of the Allied strategic bombing campaigns against Germany and Japan in World War II. Here the record is mixed. The general conclusion was that the attempt to destroy allegedly strategic resources (such as production of ball-bearings) was a failure (Harrison 2020). The main reason is that in a diversified economy, such as Germany's, there were substitution possibilities that allowed switching between products and technologies as a response to sanctions or attacks. If the ball bearing supply was restricted, for example, then the reduced supply could be directed to high-priority uses, and other types of bearings used where necessary. Where there were

successes, such as the bombing attacks on German synthetic fuel production, the effectiveness was in large part because this fuel source was marginal, and Germany had already lost control of the important resource-producing regions. The US Strategic Bombing Survey on Japan concluded that the bombing campaign was highly effective but largely irrelevant to the course of the war, because Japanese industry at its peak was only about 10 percent of US industrial output, so the US would have won anyway, even without the bombing offensive (United States Strategic Bombing Survey, 1946, especially Ch. 4., 41-56).

Can Russia and China withstand sanctions?

The substitution and 'working around' possibilities noted above apply to Russia and China, as they do to any other country on the receiving end of economic war. The question is, do Russia's and China's economic structures and resource bases offer credible opportunities for withstanding the pressure? The issues can only be sketched here, but the evidence suggests that neither Russia nor China is particularly vulnerable.

Taking Russia first, it may be the country in the world that is closest to a viable strategy of autarky.³ It has the largest land mass in the world, with obvious climatic and geophysical problems, but large areas of agricultural land (third largest in the world), large supplies of renewable fresh water, major fossil energy sources (with just over a quarter of the world's natural gas reserves), hydro power, metal ores (ferrous and non-ferrous), minerals, timber, and basic agricultural products (wheat, other grains, cotton etc.). In each of these areas Russia is usually among the top ten countries in the world in terms of production and reserves. There is a large manufacturing sector which is at its most technologically advanced in military equipment, but which covers a significant array of manufactured products. There are close links with China, through which Western manufactured imports can be substituted. Russia has a well-educated and well-trained labour force, with the highest proportion of tertiary-educated people in the world. It has reasonably competent government, and extensive trade and cooperation agreements with other large countries, notably China, Iran, India and Brazil. All of this suggests that even in a partitioned world Russia has viable economic strategies, such as creating new markets in energy exports, possibly combined with an import-substituting industrialisation drive to upgrade manufacturing. Whether and how effectively this can be done remains to be seen, but the possibilities are there.

Similar considerations apply to China. If China was to be further sanctioned or blockaded, it has even greater resources and substitution possibilities than Russia. It is

³ It is sometimes argued that Russia is a small economy, roughly the size of Spain. This result follows from converting Russian GDP into dollars at current exchange rates. If, more appropriately, Purchasing Power Parity exchange rates are used, then the Russian economy is comparable with Germany, and close to Japan. See World Bank: https://data.worldbank.org/indicator/NY.GDP.MKTP.PP.CD?most_recent_value_desc=true

the world's largest producer of wheat, cotton, rice, coal, rare earth minerals, titanium, zinc, and so on. These resource capabilities feed through into manufacturing, where China is the world's largest producer of cars, steel, mobile phones, railway equipment, ships, trucks, textiles, electric vehicles, nitrogenous fertilizer, computers, television sets, refrigerators, wind turbines etc. Although China is a large user of coal, it is also the world's leader in renewable energy technologies, including hydroelectric power. It has a major scientific-technological base, with the world's largest production of scientific articles.⁴ China's resource and industrial bases are highly diversified industrially and geographically, and probably impervious to any foreseeable types of sanctions.

In other words, both of these economies have problems, which need not be rehearsed here, since the Western press covers little else. But any honest approach must recognise that they have some big resources also. Western objectives of collapsing Russia or blocking Chinese growth are almost certainly misconceived.

The Geopolitical Impacts of Sanction: Global Partition

The economic war is likely to continue. The history of US sanctions since 1945 suggests that they are usually very long-lasting because of institutional resistance in the military-industrial complex, ideological opposition in the media, and political constraints in Congress. There are two further grounds for thinking that sanctions will remain. First, the US sanctions have been replicated and even intensified by the EU, and it is unclear what it might take for them to be relaxed. If any EU changes require unanimity, then there will almost certainly be a permanent Poland/Baltic States veto. There may be problems in Europe removing even sanctions that are damaging for Europe itself, although changes in EU decision-making processes are in train. Second, sanctions have been encouraged by vehement anti-Russian sentiment among Western peoples, media and organisations, leading to boycotts of individual Russian artists, sportspeople, researchers, etc., censorship of Russian media in the West, and travel restrictions for Russian citizens. The intensity of this popular and media anti-Russianism is likely to be an obstacle to revision of sanctions even if (as seems unlikely) there is serious political will.

If this is so, the consequences are profound. The sanctions are so comprehensive that their continuation implies a major break between Russia and the West, with relatively few transactions between them. The sanctions on China are less comprehensive, but being focussed on allegedly strategic technologies are having the effect of creating economic partition between the US-EU and China-Russia. This geopolitical outcome is where the real significance of the Ukraine conflict is to be found. This shows every sign

⁴ China has a major science base: moreover 'Chinese authors are now more likely than ever to publish the world's "best" content; in 2020, they contributed 29% of the articles published in the world's top 10% journals', <https://www.elsevier.com/connect/behind-the-rising-influence-of-chinese-research>

of becoming an epochal war, in the sense used by Philip Bobbitt - a protracted coalitional conflict between different types of constitutional and legal order, and different forms of socio-economic and political structure (Bobbitt 2003). Epochal wars incorporate not only interstate war but class struggles and social conflicts, and are resolved, if at all, by constitutional and economic settlements that mark a division between different eras of political organisation. Bobbitt saw the collapse of the Soviet Union as marking the end of an epochal conflict between market society and state socialism. He may have been a little premature in this. In any event, the economic war means that the Ukraine-Russia conflict is more than a military power struggle - it will have geopolitical effects.

Geopolitics: Halford Mackinder and the current conflict

In considering the implications of this new partitioned world, a possible starting point is the classic geopolitical thought of Halford Mackinder, since he concerned himself with precisely the regions at the centre of this conflict. Mackinder did not produce any template or model for understanding the present situation, but he did offer insights that are relevant to the emerging geopolitical division.

Mackinder wrote two significant pieces on geopolitics: *The Geographical Pivot of History*, delivered in 1899 as a lecture at the Royal Geographical Society, and a book, *Democratic Ideals and Reality* published twenty years later (Mackinder 1904 and 1919). The latter was intended as a support to Allied negotiators in the peace conference at Versailles. His concern was with the distribution of power in an integrated world, and with the forces shaping global human history from the perspective of physical and human geography: in a word, geopolitics.

Mackinder sought to correct what he saw as a major mistake in British strategic thinking, namely the idea that world power would be determined by maritime strategy and naval strength. He argued that the 'Columbian era', of naval warfare supporting long-distance trade, investment, colonisation and empire-building, was a historical conjuncture whose time had passed - it had been the dominant form of global power from ca. 1500 to ca.1900, but was coming to an end. Instead, the world was returning to military power based on the resources of large, integrated landmasses. These had been the drivers of power in the millennia before 1500. Sea power would continue to be important, but as an adjunct to power resting on land based resources.

Mackinder's thinking rested on three geographic concepts:

1. The 'world island', meaning the vast contiguous continental masses of Europe, Asia and Africa which contain most of the world's natural resources and population.

2. 'Euro-Asia', meaning the continuous land mass stretching from the Atlantic to the Pacific and incorporating all of Europe, Russia, Central Asia and China.
3. The 'heartland', meaning the central land-locked East European region of Euro-Asia comprising (in modern terms) European Russia, Belarus and Ukraine. (Of these European Russia is by far the largest part). The heartland was the 'pivot' that reflected and determined the overall political character of Euro-Asia.

Mackinder's emphasis was continuously on population and resources, and he saw this as the basis of Russian growth in particular: 'The spaces within the Russian Empire and Mongolia are so vast, and their potentialities in population, wheat, cotton, fuel, and metals so incalculably great, that it is inevitable that a vast economic world, more or less apart, will there develop inaccessible to oceanic commerce' (Mackinder 1904, 18). The future of Eurasia was seen by him in terms of new technologies that were enhancing the cohesion of both Eurasia and the world-island, particularly railways (Mackinder 1904, 17).

This meta-innovation was transforming the basis of global power by creating a potentially integrated Eurasia, and in *Democratic Ideals and Reality*, Mackinder provided a succinct formula, cast as advice to the Versailles negotiators, that has been beloved of geopolitical writers ever since:

Who rules East Europe commands the Heartland:
Who rules the Heartland commands the World-Island:
Who rules the World-Island commands the World. (Mackinder 1919, 121)

It is easy to criticise or neglect Mackinder because he clearly failed to foresee the continuing twentieth-century relevance of maritime trade and the powerful naval strategies through which the US has organised its global role. A key feature of the modern world economy has been sustained declines in marine transport costs (Hummels 2007 gives a thorough overview).

It is arguable that the most important technological innovations in the modern world economy have been in shipping: very large oil tankers, bulk carrier ships, and containerisation. These innovations were the technological basis of globalisation, and so the major shipping routes and their 'choke points' continue to be central in economic and military strategy. But the world of maritime trade is not the only story: Hummels showed that air transport has increased rapidly and, perhaps surprisingly, that about a quarter of all world trade occurs between countries sharing a land border. So Mackinder's ideas continue to invite us to keep in mind the connections between physical and human geography, natural resources and great power politics. As John Darwin put it, 'What we can see today, perhaps even more clearly than (Mackinder), is that the shifting balance of wealth and power between Eurasia's main elements, and the different terms on which these elements entered the global economy and the modern

"world system", form the hammer and anvil of modern world history'(Darwin, 2008, 19).

Against this resource-based geopolitical background, how viable will the economic war be in achieving US/NATO aims? This depends on whether Russia and China have resource reserves and economic structures that can withstand the sanctions regime.

Economic Development and Natural Resources

Natural resources are central to economic performance. A strange feature of mainstream economics - the broadly neoclassical tradition that has dominated since the 1950s - is that until recently it has said little or nothing about the role of resources in production. (Policymakers, on the other hand, have often had a very practical and focussed approach to resource access and control, especially concerning energy).

In terms of growth, the economics mainstream (and also, for the most part, its heterodox alternatives) thinks primarily in terms of inputs of capital, labour and knowledge, with knowledge determining technological capabilities and providing efficiency increases over time. In quantitative approaches, knowledge is usually proxied by Research and Development (R&D) expenditures, or by data on patents. Resource inputs play no real role: insofar as they are considered at all they tend to be seen as something that is 'harvested' rather than produced. This is strange for many reasons, not least because any serious definition of an economy must recognise that it is a process that uses energy and knowledge to transform resources into products, and that accumulating natural resources requires scientific and technological knowledges, capital (lots of it), skill and work. It is only recently that a small number of economists have begun to incorporate resources into theories of growth (Wicken 2009).

In practice, six main resource groups have been central to the industrial regimes that define the modern world: fresh water, marine resources, forest products, agricultural land, minerals, and fossil-fuels. Resources were central to the key economic transformation of the world, namely industrialisation, from the early 18th century. British industrialisation, for example, is often written around allegedly decisive knowledge breakthroughs taking the form of mechanical inventions, such as cotton-spinning machinery and the steam engine.⁵ But in reality it rested more significantly on massively expanded access to natural resources: inputs of cotton, sugar, coffee, tea, copper, dyestuffs, iron ore, industrial textiles (such as sisal), clay (for bricks), grain and above all, coal. Many of these inputs came out of the Atlantic slave economies, and this is

⁵ Joel Mokyr is typical in ascribing industrialisation to steam, textile spinning, and mechanisation, all resting on an 'industrial enlightenment', rather than to the thermic and resource-based technologies indicated here. 'Although its full economic effects were slow to be realized, steam power still became an inexorable force in determining the shape of modern society' (Mokyr 2009, 126).

where slavery had its real impact on industrialisation. Early industrialisation was driven by thermic technologies for processing these resources, for which coal was essential: brewing, baking, sugar refining, smelting, brick-making etc (Bruland, 2004). Paul David and Gavin Wright showed that resources were equally central to the industrialisation of the USA. The federal government sponsored a continent-wide geological survey that mapped mineral resources, and then encouraged technological developments that produced significant increasing returns within resource sectors, and in using sectors also. The US rise to global dominance was inextricable from its command over a wide array of strategically vital natural resources: '... there is reason to believe that the condition of abundant resources was a significant factor in shaping, if not propelling, the U.S. path to world leadership in manufacturing' (Wright and Czelusta, 2007). The central great power of the world, the United States, is the world's most successful resource-based economy, and natural resources continue to buttress its power.

We have no reason to think that the importance of resources has declined. Although many claim an alleged transition to service-based economies, and knowledge-based sectors (sometimes called 'the weightless economy'), services and other intangible activities are often intensely resource-using. And if we look to resource production itself, we find that in most fields the world is producing record volumes: iron ore, wheat, fuels, hydroelectricity etc., are all at historically high levels of output globally. But there are also record volumes of industrial production. So industrial power and the geopolitical future of the world will continue to rest on access to and use of resources. Moreover we should not assume that resource-based economies are likely to perform badly. A key feature of modern economic research on natural resources has been to stress the extent to which resource-based economies are also knowledge-intensive and potentially high-performing (Wicken and Ville, 2015).

A changing world order?

To put it in Mackinder's terms, as a result of the Ukraine war, the entire non-Ukraine Heartland (the 'Pivot') has split away from the West, and is now in clear coalition with China. There have been important increases in trade and economic cooperation between Russia and countries to the South and East (Iran, Turkey, India, South-East Asia etc). US/NATO policy has created precisely the Eurasian alliance that Mackinder claimed would command the World Island.

The conclusion must be that the Ukraine-related sanctions on Russia will not be effective in terms of damage, but they will reinforce Russian and Chinese exclusion from the Western economic order over the long term, and therefore lead to a coalition and possibly an alliance between Russia and China. This has already led to major strategic trade and technology agreements. After the 2014 sanctions, Russia built the 'Power of Siberia' gas pipeline plus other energy-transport infrastructure to support new gas

supply deals. This is now on stream, and this has led to large increases in Russian exports of gas, plus coal, oil and agricultural commodities to China, with a large jump in 2021 which continued into Q1 2022. A second major pipeline is being built. The Russian trade surplus with China is leading to foreign direct investment (FDI) flows from Russia into China, especially via Hong Kong.⁶ Chinese manufactured exports to Russia are rising sharply, and Chinese FDI in Russia is also growing, from a low base.

All this occurs against the background of major geopolitical initiatives by China, which have been developing over many years. These include the Belt and Road communications network (built around railways, precisely the core technology identified by Mackinder), the Shanghai Cooperation Organisation (SCO), the Asian Infrastructure Investment Bank, and the transformation of BRICS into a working alliance (and its possible expansion). China has almost 150 bilateral agreements on trade and investment with individual countries.⁷ Some developments also have potentially large consequences for the global financial system. Russia and China are settling their transactions in roubles and yuan, and similar agreements are in train with other countries, including India. The BRICS are discussing a new commodity-based international currency. New bank transfer systems are now operating. Finally, the sanctions on chip sales to China have led to very rapid growth of chip production there (Silk Road Briefing, 2022).

We have seen a wide range of developments in the economic war, but relatively little discussion in the West of what they imply as a whole. An overall assessment must argue that behind the myriad of military events and economic sanctions lies a fundamentally coherent process - a geopolitical reconfiguration of the world order.

We do not necessarily need the concepts of Mackinder to appraise this. For example, the most important intellectual development in modern historiography is the development of 'global economic history', meaning a sustained attempt to see economic history in terms of global interactions and inter-dependencies. Within this new history there has been a strong focus on 'the great divergence', the dramatic growth of Western Europe and the USA after the 18th century, which led to Western global hegemony. A central idea of global history is that in the late 18th century the dominant economies of the world were India and China, in a world of what Kenneth Pomeranz called 'surprising resemblances' (Pomeranz 2000). Chinese and Indian economic capability was ultimately destroyed by the combination of new industrial technologies (especially machinofacture), and military organisations that created both economic dominance and military superiority. But the enormous dispersion of inter-country incomes which began in the 18th century stabilised about 1950, and began to narrow sharply after

⁷ Full texts of all agreements are available at <https://investmentpolicy.unctad.org/international-investment-agreements/countries/42/china>

1980 (Milanovic 2016 especially figure 3.4, 130-131, which gives an overview of the long term income distribution between India, China and the USA). So a different interpretation of current dynamics might be that we are not looking at a new development. For forty years we have been returning to the global balance of the pre-industrial take-off, before the 'great divergence' began.

Nothing is settled, and the US will undertake a wide response - there will certainly be contests for the allegiance of the BRICS and related countries. And there will presumably be conflicts within the blocks - the EU is plainly facing recession and may not remain as subservient to US foreign policy as it has been, or it may even split. There have already been divergences between Russia, China and Iran with respect to nuclear policies. Moreover there is every possibility of civil disorder and political upheaval in a number of countries. All this suggests a geopolitical reconfiguration that will persist, but also that a more fluid and disruptive period of international relations lies ahead.

The full implications of the changing world order are as yet obscure. However there are wider implications, far more important than any geopolitical issue, that are not hard to identify. They are to do with the world geophysical crisis. First and foremost this consists of climate change, but there are also serious problems in the marine environment, and the environmental conditions that foster pandemic disease.

The geophysical crisis

The geopolitical crisis is being enveloped by a geophysical one. The earth's atmosphere and climate, like the oceans and space, are prime examples of the 'global commons' - that is, common resources held by the whole world, accessible to all, usable by all, and beyond the control of any national jurisdiction. Focusing simply on climate, greenhouse gas build-up means that global average temperatures are now 1.1C above the pre-industrial average, and rising.

The main implication of this is that the complex system that makes up the climate of the earth is approaching a number of transition points, often called 'tipping points', at which the system irreversibly enters new states. Recent climate science suggests that a set of tipping points become likely from about 1.5C above the pre-industrial average, and become more serious at higher temperatures. This is not far away. 'There is a 50:50 chance of the annual average global temperature temporarily reaching 1.5 °C above the pre-industrial level for at least one of the next five years', according to the recent climate forecast issued by the World Meteorological Organization (WMO).⁸ The International Energy Agency (IEA) has sketched four main temperature scenarios:⁹

⁸ WMO, <https://public.wmo.int/en/media/press-release/wmo-update-5050-chance-of-global-temperature-temporarily-reaching-1.5%C2%B0c-threshold>

⁹ IEA, <https://www.iea.org/reports/world-energy-model/understanding-weo-scenarios>

- the world continues on 2021 policy settings. This leads to 2.6C above pre-industrial level by 2100, then continuing to rise
- if all climate pledges made through COPS (Conference of the Parties) agreements are implemented in full and on time then the increase will be 2.1C by 2100 and continuing to rise
- if there is a surge to sustainable technology such that advanced economies reach net zero by 2050, and all others by 2071, then we reach 1.7C by 2050, declining gradually thereafter
- if there is full net zero by 2050 for the world, then we reach 1.5C followed by gradual but sustained decline

What are the potential effects of these paths? A major study on tipping points has just been published in the journal *Science* (Mackay et al 2022). This extensive article and its Appendices review all of the relevant literature, overview all major data, and report new research. The authors identify sixteen tipping points at increased temperatures from 1.5C to 6C above the pre-industrial average, ranging from die-off of coral reefs, to a West African monsoon shift, to Atlantic current collapse, to the loss of the East Antarctic ice sheet. At 1.5C, which is the minimum now expected by 2050, four of their first five tipping points become 'likely', including collapse of the Greenland ice sheet. At that temperature other points move to increased likelihood.

These tipping points obviously have major implications for the global commons, but also for the geopolitics of the world - for example, the melting of Barents Sea ice would open up a new, much shorter, trade route from the Pacific to the North Atlantic, which would run more or less entirely along the north coast of Russia. Other changes, such as shifts in ocean currents, would be far more dramatic.

Managing the Global Commons

The pervasive problem with all shared resources, including the atmosphere, is over-use, since nobody has incentives or power to limit degradation of the resource. So common goods can lead to resource exhaustion. This is 'the tragedy of the commons', taught in a rather ahistorical way to generations of economics students. For many years economists had a narrow answer to the alleged problem of over-use: privatisation of common assets, or full state control. But this cannot apply to the global commons, because we have no global state to compel sustainable governance. In the climate case, fossil fuels involve massive external costs (mainly the build-up of greenhouse gases) that - without world government - cannot be controlled.

Modern economics has come a long way in understanding how these common-property problems have been successfully resolved in the past. A major theoretical and empirical finding has been that common property resources do not necessarily lead to over-use,

and collapse, because there are many practical forms of collective action that successfully manage common resources (Ostrom 1990 is a superb overview of the politics and economics of this). There are very many case studies of such success, usually looking at rather small-scale common resources such as pastures, fisheries, water supplies, etc. From this work a major conclusion has emerged, but one that does not fit at all with current geopolitical developments. This is that resolving common property problems requires painstaking cooperation, which in turn means shared institutions, multilateral collaboration, recognition of others' interests, creation of forums in which to discuss and work together, and above all willingness to commit to negotiated access rules and enforcement mechanisms (Smith 2017).

It may be that in the multipolar world that is emerging, global cooperation will not be necessary. Perhaps the blocs can go their own ways, and nevertheless develop climate actions that will ameliorate the global problem. After all, China is pursuing serious policies for electrification via renewables. The Australian journalist Nick O'Malley has pointed out that although China is currently the largest user of coal for electricity generation, it is also responsible for almost half of the world's entire investment in renewable infrastructure, and is dominant in 'wind and solar installation, in wind and solar manufacturing, in electric vehicle production, in batteries, in hydro, in nuclear, in ground heat pumps, in grid transmission and distribution, and in green hydrogen. They literally lead the world in every zero-emissions technology today' (O'Malley 2022).

But the temptation for other countries to free-ride will remain strong, so this may offer scant hope. And things could get worse. For example, there are powerful forces in the US advocating geo-engineering, something the US could pursue independently. Geo-engineering, such as releasing sulphates into the atmosphere to reflect sunlight, would leave the hydrocarbon system intact at the cost of deep risks for the entire globe (risks which are partly to do with unexpected effects, and partly to do with what happens when the engineering initiative stops).

The main global challenge is to build collective action structures that permit sustainability. This means the diffusion of renewable energy technologies or a sustained search for new energy carrier technologies. This can probably only be achieved through large-scale collaborative effort. This is not necessarily a vain hope. There are international collaborative successes to look back on. The Montreal Protocol, under the auspices of the UN Environmental Program, successfully controlled CFC emissions, and the long-term work of the International Whaling Commission, has saved whale populations. However the existing channels for climate collaboration - namely the UN Framework Convention on Climate Change, and the 'Conference of the Parties' (COP)

system, or the G20 process - continue to exist, but are close to collapse.¹⁰ In such an unpromising situation, with a dangerous war in train, with a more or less complete breakdown in cooperative discourse, and with no viable route forward for the building of multilateral collaboration, pessimism is very tempting. But this would be unjustified.

The future

The primary technological challenge facing the world is the development of new sustainable energy carriers. Because of the scale of this task it will require public innovation policies, on a global scale, and therefore new forms of multilateral collaboration. The main geopolitical outcome of the present war, which will remain into the future, has already been established. This is the three-way partition of the world into two adversarial blocs, and a largely non-aligned group of middle- and low-income countries. Within this geopolitical reconfiguration the radical uncertainties that characterise all wars will be played out. The argument here has been that the geopolitical blocs are relatively stable in the face of anything short of nuclear war. Russia and China rest on resource and knowledge bases that make it highly unlikely that they will succumb to economic warfare. The West is facing nothing comparable, but will have to confront some implications of its own sanctions regime, especially the boycott of Russian gas. One possibility is a protracted evolutionary struggle in which differences in economic growth and performance will ultimately determine which, if any, of the blocs will dominate.

This is to ignore, however, the genuinely new feature of this geopolitical conjuncture, namely the dynamic effects of climate change which are now forcing their way onto the geopolitical agenda. A key question is whether the climate crisis will be tangible enough to create a new collective action process, or whether the conflict will result in the mutual ruin of the contending powers. In this situation there will be probably efforts across countries to reconstruct some effective basis for multilateral collaboration. It is completely possible that all current geopolitical calculations will be upended by developments in the geophysical crisis and the economic and technological challenges that it is bringing.

It is important to bear in mind the point emphasised at the outset, namely the uncertainty associated with epochal wars. As with all epochal wars, we do not know what is on the global agenda and events are certainly not under the control of the belligerents. In particular, what Jonathan Schell called 'the unconquerable world' of political movements and civil societies has yet to speak. Wars of this type have in the past generated utterly unexpected outcomes, ranging from abrupt regime shifts, to

¹⁰ The breakdown of dialogue affects other areas also. At the Geneva UN Human Rights Council Summit, in March 2022, all NATO-country representatives walked out when the Russian Foreign Minister spoke.

large-scale political outcomes (such as the end of monarchical rule or the collapse of imperial orders, or revolutionary political change). And from time to time, out of the turbulence of epochal conflicts, major technological changes have emerged that have altered the economic landscape of the world. Such social and technological changes are already in train, embodied in the new geopolitical structure of the world, and the geophysical challenges that it must confront. Other changes will arise in coming years, playing out in this new context, and perhaps transforming it radically.

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