



MICHAEL BARR

Senior Research Analyst—Equity Research

ANDRE CHAN

Senior Research Analyst—Equity Research

DANIEL FLAX

Senior Research Analyst—Equity Research

TERRI TOWERS, PhD

Senior Research Analyst—Equity Research

Hardening Borders: Opportunities in Security, Health and Trade

Thirty-three years ago, one of the world's most infamous borders was breached. The fall of the Berlin Wall ushered in an age of relative geopolitical calm that laid the foundations for the last great period of globalization—a time when borders dissolved, and goods, services, people, capital and ideas moved more freely around the world.

Recent events are hardening those borders once more, in ways that are changing the strategic and economic landscape. Twentieth century-style war between major states has returned, but against a context of 21st-century technology. The COVID-19 pandemic has not only crystalized the cross-border threat of contagious disease, but also the fragility of globalized health and pharmaceutical infrastructure. And political resistance to globalization, combined with a heightened sense of the vulnerability of globalized supply chains and a carve-up of markets along new geopolitical lines, is complicating the free flow of trade.

We believe investors can adapt to this new environment in three ways: seeking out some of the lesser-known companies playing a growing role in the 21st-century defense industry; investing in the therapeutics and other tools vital to securing national public health; and identifying the potential beneficiaries of on-shoring, near-shoring and “friend-shoring.”

Executive Summary

- An age of globalization is giving way to a period of hardening borders, raising security challenges and opening up a multitrillion-dollar global security financing gap.
- We believe investors can adapt to this new environment, and invest in the potential solutions, starting in these three areas:
 - **In Security:** The growing importance of sophisticated technology in military capabilities means not only more dependence on the commercial sector, but on specialists within the commercial sector that are often outside the traditional defense industry.
 - **In Healthcare:** The COVID-19 pandemic underlined the neglected importance of diagnostic technologies, but also the over-reliance on global pharmaceutical supply chains.
 - **In Trade:** Companies creating solutions that help to localize supply chains could stand to benefit from the momentum behind on-shoring, near-shoring and “friend-shoring.”

We believe significant spending will be required to bridge the gap between the world’s broad security needs and its current capabilities. It is an enormous field that is difficult to define, but our reading of various sources covering a range of issues—from cybersecurity through military and public health expenditure to climate change—suggests that the global economic cost of security failures could amount to \$30 trillion between 2025 and 2030 alone. Our estimate suggests it could double to \$60 trillion when we add food and energy risks. In 2021, we estimate that just \$3.5 trillion was invested in the resilience of our security ecosystem.

As governments, institutions and companies seek to adjust to the emerging security reality and close that financing gap, we think the following issues could include some of the most attractive investment opportunities.

Borders and Security: Technology Over Tanks

Russia’s invasion of Ukraine is understandably dominating the discussion of Western defense spending. The U.S. had provided more than \$17bn in security assistance to Ukraine by September 2022. The invasion revolutionized attitudes toward defense and security in Europe, with Germany setting up a €100bn special fund and many NATO countries recommitting to the spending target of 2% of GDP, which alone could generate some \$60bn of spending each year. JPMorgan Private Bank has calculated that, to make up the deficits relative to this 2% target built up since 2000, including inflation, NATO countries would have to spend an extra \$1.5 trillion.¹

But we should not let events in Europe overshadow the long-running rise of China as a genuine global strategic power, and the U.S. pivot from two decades of counterterrorism in response. While the Ukraine crisis is a lurch back to 20th-century warfare (heavy military hardware, some of it literally dating from the 20th century, being used to forcibly attack and defend a physical national border), the latter is an emerging 21st-century standoff, where control of technology is likely to be as much of a force multiplier as industrial might.

China has been rapidly narrowing its gap with NATO in weapons system technology. As Morgan Stanley researchers have argued, maintaining the U.S. technology advantage will require more than simply evolving today’s weapons systems: their base case sees modernization spending expanding at around 6% a year out to 2030, versus a post-Cold War median eight-year annual growth rate of just 2%, with the fastest growth in areas such as space (24% a year) and nuclear modernization (30% a year).²

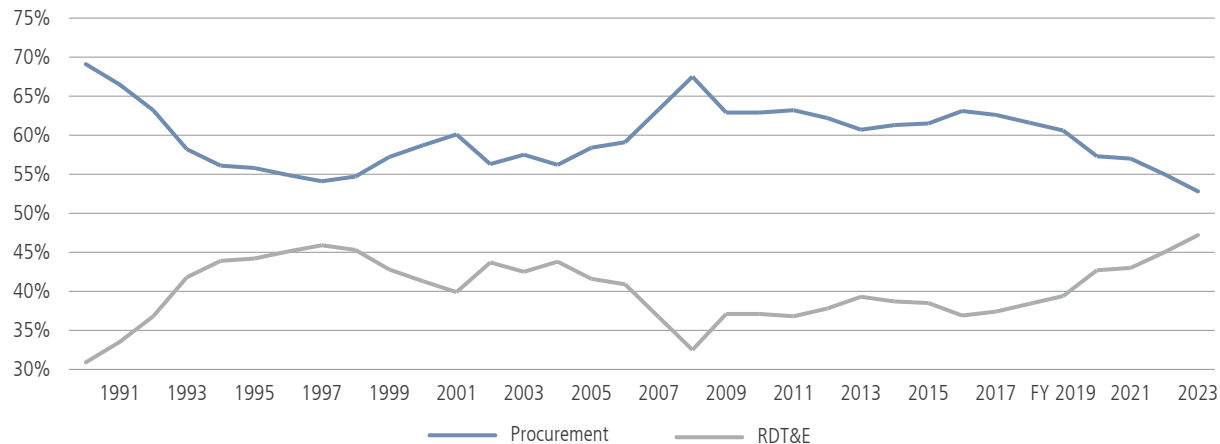
¹ U.S. Department of State, “U.S. Security Cooperation with Ukraine”, at <https://www.state.gov/u-s-security-cooperation-with-ukraine/>; Morgan Stanley, “Blue Paper: Navigating ‘Slowbalization’ & the Multipolar World” (May 2022); JPMorgan Private Bank, “Smart security: Ongoing megatrend and investment hedge to geopolitical tensions” (May 2022), at <https://privatebank.jpmorgan.com/gl/en/insights/investing/smart-security-ongoing-megatrend-and-investment-hedge-to-geopolitical-tensions>.

² Morgan Stanley, “Blue Paper: Navigating ‘Slowbalization’ & the Multipolar World” (May 2022), “Generational Investments in Defense” (July 2022) and “Opportunities Emerge as National Security Priorities Pivot” (August 2022).

We see this structural change in the level and nature of defense spending in other metrics, too. For example, the U.S. Department of Defense (DoD) is set to spend \$130bn of its \$785bn budget for 2023 on research and development (R&D). The U.S. DoD has shifted its focus toward R&D over the last five years, with the rate of change in R&D spending outstripping that of procurement every year since 2017. In 2023, almost as many defense dollars will be spent on R&D as on procurement, a clear sign of the need to innovate.

FIGURE 1. U.S. DEFENSE IS BECOMING A RESEARCH ENTERPRISE

U.S. Department of Defense, Investment Accounts, mix between procurement and research, development, test and evaluation, by fiscal year



Source: U.S. Department of Defense. Data as of July 2022. For illustrative purposes only.

As the DoD grapples with new and emerging threats to the borders of the U.S. and its allies, R&D programs are targeting a whole range of developments to stimulate innovation, from adopting emerging technologies to bolstering deterrence capabilities and modernizing military fleets. Artificial intelligence, hypersonic technologies and quantum computing are just some of the areas of focus. Given the specialist nature of these emerging technologies, we believe these R&D priorities are opening the door to smaller companies with specific expertise that the established large defense companies may not have.

For example, while several major defense aerospace companies are involved in the development of the U.S.'s next-generation fighter jet, some of its key systems—such as the capability to fly with or without a pilot, an artificial intelligence-enabled heads-up display, and the capability to lead networked operations with other aircraft—are being developed by smaller companies. The unmanned operational capability, for example, is being led by Kratos Defense & Security Solutions, a company with a market capitalization of less than \$1.5bn which is nonetheless the world's leading maker of tactical, jet-powered unmanned aerial systems.

Commercial satellite imaging is another technology with which militaries are increasingly supplementing their own capabilities, to stay one step ahead of their adversaries in the war for information and intelligence. Companies such as Maxar (the largest U.S. earth observation service provider) and Planet Labs (operating the largest fleet of optical earth observation satellites) are seeing government demand match or even exceed commercial demand for a growing number of their capabilities. Militaries are adjusting to these new commercial contracting terms as they focus on procuring more commercial data. Moreover, governments increasingly recognize that it's not just their militaries that can benefit from these commercial capabilities. Use cases including environmental monitoring for undetected or ignored greenhouse gas leaks, deforestation or illegal fishing are behind estimates that the demand for "earth observation" services can grow at 15% annually through 2030.³

³ For example, see Acumen Research and Consulting, "At CAGR 15.2% Growing Number of Earth Observation Projects, Remote Sensing Services Market Size to Reach USD 64,375 Million by 2030" (June 2022) at <https://www.globenewswire.com/news-release/2022/06/28/2470861/0/en/At-CAGR-15-2-Growing-Number-of-Earth-Observation-Projects-Remote-Sensing-Services-Market-Size-to-Rreach-USD-64-375-Million-by-2030-Report-by-Acumen-Research-and-Consulting.html>.

Borders and Healthcare: Strategies for Pathogens

Just as the nature of defense spending has changed, nations now think of public health with a security lens. COVID-19 was a sharp reminder that when people and goods move across borders, potentially deadly pathogens move with them. That has raised two challenges to the top of the agenda worldwide: how can we better detect those pathogens to enable us to stop them at our borders; and how can we deal with those pathogens—without crippling lockdowns—when they do cross our borders? The resulting reallocation of priorities and government spending is providing opportunities for companies well placed to address these challenges.

The pandemic shined a light on the power of molecular diagnostic testing, but also the lack of investment it has received in the past. The technology allowed for rapid and accurate identification of the SARS-CoV2 virus, but it required sudden and massive expansion in the manufacture and sourcing of testing components, sample-collection and transport consumables, and electronic results-reporting equipment. That emergency expansion was required because of what we would regard as a structural mismatch: in the U.S., for example, the Center for Disease Control and Prevention says that diagnostic testing directs 70% of treatment decisions, but the American Association for Clinical Chemistry has estimated that it receives less than 3% of healthcare spending. We anticipate at least a partial correction to that mismatch, potentially benefitting companies specializing in diagnostic tests and the testing hardware.

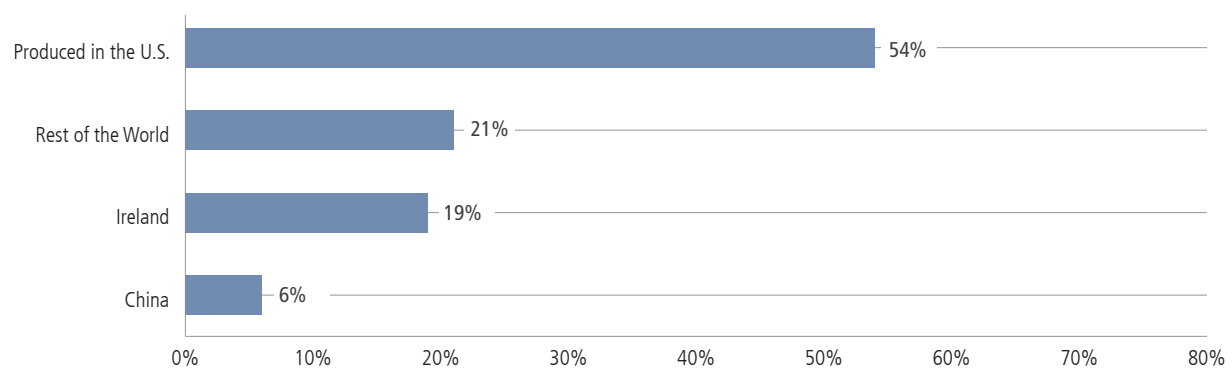
Diagnostic, testing and tracking programs can help alert us to dangers and take action to stop diseases from spreading. But once pathogens have spread and become unmanageable, we also need to respond, and that often requires investment in the next generation of vaccines and treatments. Here, we see the pandemic as a defining learning experience in two important ways.

The first key lesson was that the answers sometimes lie with processes and technologies that already exist, but are underappreciated. Messenger RNA-based technology was far from new in 2020, but it had never taken off because there had never been the pressing need for its particular advantages that could outweigh the cost of large-scale clinical trials. Messenger RNA vaccines are fast and cost-effective to produce—just what was needed in the pandemic. And now that several billion doses have been administered worldwide with minimal side effects, the technology is a hotbed of research after years of near-dormancy, with academic and corporate laboratories exploring vaccines against other viruses, as well as other rare diseases and even cancers.

The second key lesson was just how dependent on China the U.S. and Europe had become for these and many other treatments. For example, approximately 46% of the active pharmaceutical ingredients (APIs) used to manufacture medicines in the U.S. come from outside its borders, including 6% from China. The U.S. depends on China for well over half of its supply of acetaminophen (or paracetamol). The U.S. government is addressing this dependency on several fronts, from Republican Congressman Mike Gallagher's Protecting our Pharmaceutical Supply Chain from China bill to President Joe Biden's National Biotechnology and Biomanufacturing Initiative—all of which have the potential to create new growth opportunities for domestic biotech, pharmaceutical and medical products companies. Leading Life Science Tools companies like Thermo Fisher Scientific are potential beneficiaries of policy support for localizing medicine manufacturing.

FIGURE 2. AN UNHEALTHY DEPENDENCE?

Sources of active pharmaceutical ingredients used to manufacture medicines consumed in the U.S. in 2019, by dollar value



Source: The U.S.-China Business Council (uschina.org), Avalere Health LLC. For illustrative purposes only.

Borders and Trade: Avoiding Friction

Similar concerns have been raised about how centralized the global semiconductor ecosystem is in China and Taiwan. The combined impact of the U.S.-China trade war and the pandemic has seen Apple moving part of its iPhone manufacturing from China to India, numerous companies redesigning products around component shortages, and Intel building foundries in the U.S. to improve its supply chain resiliency.

And this year, events in Ukraine have turned the spotlight on supplies that are even more fundamental than medicines and semiconductors: food and energy. Some 2.5 billion people live in countries where food and fuel are over 30% of total imports, making the flow of these goods—or dealing with an interruption in that flow—critical.

One country that is highly exposed to these risks is Japan, whose food-calorie self-sufficiency ratio is the lowest in the developed world at just 38%, according to its own Ministry of Agriculture. Japanese conglomerate Marubeni, by some measures the world's largest seafood supplier, could have found itself highly exposed to the Ukraine crisis and consequent sanctions on Russia because Russia is one of the world's most important seafood exporters. In fact, it was quickly able to begin cutting ties with its Russian suppliers in part by signing an exclusive sales and distribution agreement with Proximar, a company that is currently building the first Atlantic salmon farm in Japan. This land-based facility is being designed to ensure stable harvest volumes throughout the year, estimated at approximately 10% of annual Japanese demand for Atlantic salmon. This is the nutrition equivalent of Intel's U.S. chip foundries, and we anticipate more of this kind of onshoring within national borders, with companies that create solutions to localize supply chains, like Proximar, reaping the benefits.

Near-shoring, friend-shoring and moving from “just-in-time” to “just-in-case” food supply-chain management are driving what we see as a general redirection of spending. Take Bunge, for example. It is one of the world's largest food commodity trading and processing companies, and the biggest supplier of bottled vegetable oil—like Marubeni, it would have been easy to assume that it was highly exposed to the Ukraine crisis, as Ukraine and Russia are two of the most important exporters of food commodities such as wheat and sunflower oil. In fact, Bunge quickly pivoted to Argentina to source these commodities, and to Canada for canola oil. Indeed, ongoing supply chain issues have justifiably changed how many of Bunge's food customers think about sourcing. Prior to COVID-19, many Bunge customers were consciously going to multiple suppliers in search of the best prices. Today, exacerbated by the Russia-Ukraine war, many of these same customers are more concerned with reliability and origination flexibility of suppliers.

Keeping the Four Horsemen at Bay

The Four Horsemen of the Biblical Apocalypse are Death, War, Famine and Plague. It's a potent metaphor for the major threats to human life, security and civilization.

We don't take an apocalyptic view, but we do see a breakdown in the political, geopolitical and practical consensus behind globalization, the key idea with which humanity has tried to contain these Four Horsemen for the past 30 to 40 years. As we enter a new age of hardening borders, we believe we need to identify new models for keeping them at bay—and allocate our capital accordingly.

How can we ensure continued access to food, energy, pharmaceuticals and other goods in a world of trade friction? How can we ensure that our medical technology and infrastructure is efficient enough to stay ahead of ever-evolving pathogens? And how can we secure these essentials of life in a world of heightened tensions, where the fronts of conflict are increasingly informational and technological?

These are the questions that we believe investors with a multi-decade view should be asking today.

This material is provided for informational purposes only and nothing herein constitutes investment, legal, accounting or tax advice. This material is general in nature and is not directed to any category of investors and should not be regarded as individualized, a recommendation, investment advice or a suggestion to engage in or refrain from any investment-related course of action. Investment decisions and the appropriateness of this material should be made based on an investor's individual objectives and circumstances and in consultation with his or her advisors. Information is obtained from sources deemed reliable, but there is no representation or warranty as to its accuracy, completeness or reliability. All information is current as of the date of this material and is subject to change without notice. The firm, its employees and advisory accounts may hold positions of any companies discussed. Any views or opinions expressed may not reflect those of the firm as a whole. Neuberger Berman products and services may not be available in all jurisdictions or to all client types. References to third-party sites are for informational purposes only and do not imply any endorsement, approval, investigation, verification or monitoring by Neuberger Berman of any content or information contained within or accessible from such sites.

Investing entails risks, including possible loss of principal. Investments in hedge funds and private equity are speculative and involve a higher degree of risk than more traditional investments. Investments in hedge funds and private equity are intended for sophisticated investors only. Indexes are unmanaged and are not available for direct investment. **Past performance is no guarantee of future results.**

This material may include estimates, outlooks, projections and other "forward-looking statements." Due to a variety of factors, actual events or market behavior may differ significantly from any views expressed. Investing entails risks, including possible loss of principal. Investments in hedge funds and private equity are speculative and involve a higher degree of risk than more traditional investments. Investments in hedge funds and private equity are intended for sophisticated investors only. Indexes are unmanaged and are not available for direct investment. **Past performance is no guarantee of future results.**

Discussions of any specific sectors and companies are for informational purposes only. This material is not intended as a formal research report and should not be relied upon as a basis for making an investment decision. The firm, its employees and advisory accounts may hold positions of any companies discussed. Nothing herein constitutes a recommendation to buy, sell or hold a security. Specific securities identified and described do not represent all of the securities purchased, sold or recommended for advisory clients. It should not be assumed that any investments in securities, companies, sectors or markets identified and described were or will be profitable.

The views of the research analyst and the firm and its employees on medical topics should not be relied upon as medical advice and are not intended to serve as a substitute for consulting with a qualified medical professional. There is no representation or warranty as to its accuracy, completeness or reliability. All information is current as of the date of the material and is subject to change without notice. The firm, its employees and advisory accounts may hold positions of the manufacturers of the products discussed.

This material is being issued on a limited basis through various global subsidiaries and affiliates of Neuberger Berman Group LLC. Please visit www.nb.com/disclosure-globalcommunications for the specific entities and jurisdictional limitations and restrictions.

The "Neuberger Berman" name and logo are registered service marks of Neuberger Berman Group LLC.

NEUBERGER	BERMAN
-----------	--------

Neuberger Berman
1290 Avenue of the Americas
New York, NY 10104-0001

www.nb.com