The Power of Nations

Measuring What Matters

Michael Beckley

What makes some countries more powerful than others? This is the most important question for the study and practice of international relations.[1] Scholars need a sound way to measure power, because the balance of power is the motor of world politics, playing a role as central as the role of energy in physics and money in economics,[2] and serving as a key variable in seminal theories of war and peace,[3] alliance politics,[4] international cooperation,[5] state build-

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1. David A. Baldwin, *Power and International Relations: A Conceptual Approach* (Princeton, N.J.: Princeton University Press, 2016), p. 1; Martha Finnemore and Judith Goldstein, eds., *Back to Basics: State Power in a Contemporary World* (New York: Oxford University Press, 2013), pp. 4–5; Robert O. Keohane, "Big Questions in the Study of World Politics," in Christian Reus-Smit and Duncan Snidal, eds., *The Oxford Handbook of International Relations* (Oxford: Oxford University Press, 2008), p. 709; and Harold D. Lasswell and Abraham Kaplan, *Power and Society: A Framework for Political Inquiry* (New York: McGraw-Hill, 1950), p. 75.
2. Bertrand Russell, *Power: A New Social Analysis* (London: George Allen and Unwin, 1938), pp. 10–12; and John J. Mearsheimer, *The Tragedy of Great Power Politics* (New York: W.W. Norton, 2014), p. 12.
3. See, for example, Alexandre Debs and Nuno P. Monteiro, "Known Unknowns: Power Shifts, Uncertainty, and War," *International Organization*, Vol. 68, No. 1 (January 2014), pp. 1–32, doi:10.1017/S0020818313000192; A.F.K. Organski and Jacek Kugler, *The War Ledger* (Chicago: University of Chicago Press, 1980); Robert Powell, "War as a Commitment Problem," *International Organization*, Vol. 60, No. 1 (January 2006), pp. 169–203, doi:10.1017/S0020818306060061; and William C. Wohlforth, "The Stability of a Unipolar World," *International Security*, Vol. 24, No. 1 (Summer 1999), pp. 5–41, doi:10.1162/016228899560031.
4. See Glenn H. Snyder, *Alliance Politics* (Ithaca, N.Y.: Cornell University Press, 2007); Stephen M. Walt, *The Origins of Alliances* (Ithaca, N.Y.: Cornell University Press, 1987); and Kenneth N. Waltz, *Theory of International Politics* (Reading, Mass.: Addison-Wesley, 1979).
5. See, for example, Kenneth W. Abbott and Duncan Snidal, "Why States Act through Formal International Organizations," *Journal of Conflict Resolution*, Vol. 42, No. 1 (February 1998), pp. 3–32, doi:10.1177/0022002798042001001; James D. Fearon, "Bargaining, Enforcement, and International Cooperation," *International Organization*, Vol. 52, No. 2 (Spring 1998), pp. 269–305, doi:10.1162/002081898753162820; and Lloyd Gruber, *Ruling the World: Power Politics and the Rise of Supranational Institutions* (Princeton, N.J.: Princeton University Press, 2000).

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ing,[6] trade,[7] nuclear proliferation,[8] and democratization.[9] Policymakers, too, need an accurate way to gauge the power of nations, because vital decisions regarding grand strategy, alliance commitments, economic policy, military procurement, and the use of force hinge on estimates of relative power.[10]

Power, however, is like love; it is "easier to experience than to define or measure."[11] Just as one cannot say "I love you 3.6 times more than her," scholars cannot calculate the balance of power precisely, because power is largely unobservable and context dependent.[12] Power is typically defined as the ability of a country to shape world politics in line with its interests, but measuring this ability systematically is impossible, because doing so would require parsing each country's interests in, and influence over, a potentially infinite number of international events.[13] Moreover, measuring power by evaluating outcomes is not very useful for policymaking, because analysts have to wait for an event (e.g., a war, diplomatic summit, or trade dispute) to occur before they can assess the balance of power—and even then, they will only know the distribution of power regarding that particular event.[14]

To get around these problems, most scholars measure power in terms of resources, specifically wealth and military assets.[15] The logic of this approach is simple and sound: countries with more wealth and more military assets at their disposal tend to get their way more often than countries with fewer of these resources.

Unfortunately, however, most scholars measure resources with gross indi-

6. See, for example, Michael C. Desch, "War and Strong States, Peace and Weak States?" *International Organization*, Vol. 50, No. 2 (Spring 1996), pp. 237–268, doi:10.1017/S0020818300028551.
7. See, for example, Joanne Gowa and Edward D. Mansfield, "Power Politics and International Trade," *American Political Science Review*, Vol. 87, No. 2 (June 1993), pp. 408–420, doi:10.2307/2939050; and Albert O. Hirschman, *National Power and the Structure of Foreign Trade* (Berkeley: University of California Press, 1945).
8. See, for example, Nuno P. Monteiro and Alexandre Debs, "The Strategic Logic of Nuclear Proliferation," *International Security*, Vol. 39, No. 2 (Fall 2014), pp. 7–51, doi:10.1162/ISEC_a_00177.
9. See, for example, Seva Gunitsky, *Aftershocks: Great Powers and Domestic Reforms in the Twentieth Century* (Princeton, N.J.: Princeton University Press, 2017).
10. Ashley J. Tellis et al., *Measuring Power in the Postindustrial Age* (Santa Monica, Calif.: RAND Corporation, 2000), pp. 1–11.
11. Joseph S. Nye Jr., "The Changing Nature of World Power," *Political Science Quarterly*, Vol. 105, No. 2 (Summer 1990), p. 177, doi:10.2307/2151022.
12. Joseph S. Nye Jr., *The Future of Power* (New York: PublicAffairs, 2011), p. 3.
13. Nye, "The Changing Nature of World Power," p. 178.
14. Mearsheimer, *The Tragedy of Great Power Politics*, p. 60; Nye, *The Future of Power*, p. 8; and William C. Wohlforth, *The Elusive Balance: Power and Perceptions during the Cold War* (Ithaca, N.Y.: Cornell University Press, 1993), pp. 4, 10.
15. On the link between resources and power, see Paul M. Kennedy, *The Rise and Fall of the Great Powers: Economic Change and Military Conflict from 1500 to 2000* (New York: Random House, 1987); Mearsheimer, *The Tragedy of Great Power Politics*, pp. 55–138; Nye, *The Future of Power*, pp. 25–81; and Tellis et al., *Measuring Power in the Postindustrial Age*, pp. 1–33.

cators, such as gross domestic product (GDP); military spending; or the Composite Indicator of National Capability (CINC), which combines data on military spending, troops, population, urban population, iron and steel production, and energy consumption.[16] These indicators systematically exaggerate the wealth and military capabilities of poor, populous countries, because they tally countries' resources without deducting the costs countries pay to police, protect, and serve their people. A country with a big population might produce vast output and field a large army, but it also may bear massive welfare and security burdens that drain its wealth and bog down its military, leaving it with few resources for power projection abroad.

Previous studies have highlighted this problem,[17] yet most scholars continue to measure power with gross indicators. In doing so, they implicitly assume that these indicators are good enough, serving as "rough but reliable" measures of power, and that they are the best indicators available given data constraints.[18] Are these assumptions true?

In this article, I argue that neither assumption holds. Standard gross indicators are not good enough; they are logically unsound and empirically unreliable, severely mischaracterizing the balance of power in numerous cases, including in some of the most consequential geopolitical events in modern history. Moreover, gross indicators are not the only available option; scholars should measure resources with net indicators. In essence, this process involves creating a balance sheet for each country: assets go on one side of the ledger; liabilities go on the other side; and net resources are calculated by subtracting the latter from the former. I explain how scholars can go about this process in qualitative research and develop a proxy for net resources that they can use in quantitative research.

I then show that this net framework does a better job than prevailing gross approaches at tracking the rise and fall of great powers over the past 200 years, predicting war and dispute outcomes, and serving as a control variable in statistical models of various aspects of international relations. Taken together, these results strongly support my contention that power is a function of net resources.

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16. David J. Singer, Stuart Bremer, and John Stuckey, "Capability Distribution, Uncertainty, and Major Power War, 1820–1965," in Bruce M. Russett, ed., *Peace, War, and Numbers* (Beverly Hills, Calif.: Sage, 1972), pp. 19–48.
17. See, for example, Klaus Knorr, *The War Potential of Nations* (Princeton, N.J.: Princeton University Press, 1956), p. 231; Mearsheimer, *The Tragedy of Great Power Politics*, pp. 61–63; and Michael Beckley, "China's Century? Why America's Edge Will Endure," *International Security*, Vol. 36, No. 3 (Winter 2011/12), pp. 58–59, doi:10.1162/ISEC_a_00066.
18. Mearsheimer, *The Tragedy of Great Power Politics*, pp. 55, 60–68; and Tellis et al., *Measuring Power in the Postindustrial Age*, p. 26.

These findings have two main implications. First, an enormous body of scholarship has been based on flawed gross indicators of power, so scholars may need to reevaluate old studies with new measures. For example, more than 1,000 studies have used CINC as a proxy for power.[19] As I show later, however, CINC distorts the balance of power in numerous cases. How might the findings of seminal studies change if scholars replaced CINC with more accurate measures of power? The only way to find out is to retest old studies with new measures. This study is intended to be a first step in this process.

Second, my results challenge the conventional wisdom about current trends in the balance of power. Since the 1990s, and especially since the 2008 financial crisis, many scholars, analysts, and journalists have argued that the United States' "unipolar moment" is being swept away by the rise of new powers—most notably, China.[20] Bookstores feature best-sellers such as *The Post-American World*, *When China Rules the World*, *Death by China*, *Becoming China's Bitch*, and *Destined for War: Can the United States and China Escape Thucydides's Trap*?;[21] and the "rise of China" has become the most read-about news story of the twenty-first century.[22]

These writings, in turn, have shaped public opinion and government policy. Polls show that most people in most countries think that China is overtak-

19. Citations calculated from Google Scholar.
20. See, for example, Charles Krauthammer, "The Unipolar Moment," *Foreign Affairs*, Vol. 70, No. 1 (January/February 1990/91), pp. 23–33, doi:10.2307/20044692; Christopher Layne, "The Unipolar Illusion: Why New Great Powers Will Rise," *International Security*, Vol. 17, No. 4 (Spring 1993), pp. 5–51, doi:10.2307/2539020; Kenneth N. Waltz, "The Emerging Structure of International Politics," *International Security*, Vol. 18, No. 2 (Fall 1993), pp. 44–79, doi:10.2307/2539097; Kishore Mahbubani, *The New Asian Hemisphere: The Irresistible Shift of Global Power to the East* (New York: PublicAffairs, 2009); Parag Khanna, *The Second World: How Emerging Powers Are Redefining Global Competition in the Twenty-first Century* (New York: Random House, 2009); Thomas L. Friedman and Michael Mandelbaum, *That Used to Be Us: How America Fell Behind in the World It Invented and How We Can Come Back* (New York: Farrar, Straus and Giroux, 2011); Arvind Subramanian, *Eclipse: Living in the Shadow of China's Economic Dominance* (Washington, D.C.: Petersen Institute for International Economics, 2011); Edward Luce, *Time to Start Thinking: America in the Age of Descent* (New York: Atlantic Monthly, 2012); Amitav Acharya, *The End of American World Order* (New York: Polity, 2014); Gideon Rachman, *Easternization: Asia's Rise and America's Decline from Obama to Trump and Beyond* (New York: Other Press, 2017); and Christopher Layne, "The U.S.-Chinese Power Shift and the End of Pax Americana," *International Affairs*, Vol. 94, No. 1 (January 2018), pp. 89–111, doi:10.1093/ia/iix249.
21. Fareed Zakaria, *The Post-American World: Release 2.0* (New York: W.W. Norton, 2011); Martin Jacques, *When China Rules the World: The End of the Western World and the Birth of a New Global Order* (New York: Penguin, 2009); Peter W. Navarro and Greg W. Autry, *Death by China: Confronting the Dragon—A Global Call to Action* (Upper Saddle River, N.J.: Prentice Hall, 2011); Peter D. Kiernan, *Becoming China's Bitch: And Nine More Catastrophes We Must Avoid Right Now* (New York: Turner, 2012); and Graham Allison, *Destined for War: Can America and China Escape Thucydides's Trap?* (Boston: Houghton Mifflin Harcourt, 2017).
22. "Osama bin Laden Eclipses Royal Wedding in Global Media," Reuters, May 5, 2011, https://www.reuters.com/article/idINIndia-56809920110505.

ing the United States as the world's leading power.[23] The U.S. National Intelligence Council has issued multiple reports advising the president to prepare the country for the rise of China and the reemergence of multipolarity by 2030.[24] China's president, Xi Jinping, has invoked the Thucydides Trap in public speeches; and the author of *Death by China* has become President Donald Trump's top adviser on trade.

The hype about China's rise, however, has been based largely on gross indicators that ignore costs. When costs are accounted for, it becomes clear that the United States' economic and military lead over China is much larger than typically assumed—and the trends are mostly in America's favor.

This article proceeds in eight sections. The first section explains why scholars typically measure power in terms of resources. The second explains why scholars should measure resources in net rather than gross terms. The third discusses specific indicators of gross and net resources. Sections four through seven test the validity of these indicators with case studies, large-*n* statistics, and replication analyses. The final section discusses implications of these analyses for scholarship and policy.

Measuring Power: Resources versus Outcomes

Power can be measured in two main ways.[25] The most common approach, and the one I focus on in this article, measures power by tallying the wealth and military assets of each country. The logic of this "power as resources" approach is straightforward.[26] Wealth enables a country to buy influence through aid, loans, investment, and bribes and to cultivate soft power (the ability of a country to attract and co-opt others) by, among other things, funding global propaganda campaigns, building huge skyscrapers, and hosting international expositions and sporting events.[27] Military resources (e.g., troops and weapons), on the other hand, enable a country to destroy enemies; attract allies; and extract concessions and kickbacks from weaker countries by issuing threats of violence and offers of protection.

23. Pew Research Center, "Global Indicators Database" (Washington, D.C.: Pew Research Center, 2017), http://www.pewglobal.org/database/.
24. National Intelligence Council (NIC), *Global Trends 2030: Alternative Worlds* (Washington, D.C.: U.S. Government Printing Office, 2012).
25. Mearsheimer, *The Tragedy of Great Power Politics*, pp. 57–60; Nye, *The Future of Power*, pp. 3–25; and Tellis et al., *Measuring Power in the Postindustrial Age*, pp. 12–24.
26. Kennedy, *The Rise and Fall of the Great Powers*; Mearsheimer, *The Tragedy of Great Power Politics*, pp. 55–138; Nye, *The Future of Power*, pp. 12–81; and Tellis et al., *Measuring Power in the Postindustrial Age*, pp. 53–132.
27. On soft power, see Joseph S. Nye Jr., *Soft Power: The Means to Success in World Politics* (New York: PublicAffairs, 2004).

Some scholars, however, reject the power-as-resources approach and instead measure power in terms of outcomes.[28] In their view, power is first and foremost about winning. It is the ability of a country to prevail in a dispute,[29] set the agenda for international negotiations,[30] or alter the preferences of other countries.[31] Measuring power thus requires a "power as outcomes" approach that involves observing international events—such as wars or diplomatic negotiations—and then determining the extent to which the participants shaped the outcomes in line with their respective interests.

Both methods have virtues. The power-as-outcomes approach identifies who got what, when, and how on a specific issue.[32] It also helps explain cases in which the side with fewer resources prevailed. As I show later, these David versus Goliath cases are common; in fact, they account for roughly 20 to 30 percent of all international disputes and wars. Materially weak countries can defeat stronger opponents through smart strategy, or dumb luck, or by running more risks or bearing greater costs.[33] The power-as-outcomes approach accounts for these nonmaterial factors and thus measures power with a greater degree of granularity than the power-as-resources approach.

Yet, the power-as-outcomes approach has several weaknesses that limit its usefulness for the empirical study of international relations. First, scholars often want to assess the overall balance of power—that is, the balance of power across a broad range of issues—but the power-as-outcomes approach is inherently issue specific. The reason is that evaluating outcomes requires knowing the preferences of the actors involved; in other words, determining which country won a dispute (the outcome) requires establishing what each country wanted to happen in the first place (preferences).[34] Preferences, however, are

28. For one of many examples, see David A. Baldwin, *Paradoxes of Power* (Cambridge, Mass.: Basil Blackwell, 1989).
29. In Robert A. Dahl's famous terms, power is A's ability to get B to do something that B otherwise would not. See Dahl, "The Concept of Power," *Behavioral Science*, Vol. 2, No. 3 (July 1957), pp. 201–215, doi:10.1002/bs.3830020303.
30. Peter Bachrach and Morton S. Baratz, "Two Faces of Power," *American Political Science Review*, Vol. 56, No. 4 (December 1962), pp. 947–952, doi:10.2307/1952796; and Robert O. Keohane and Joseph S. Nye Jr., *Power and Interdependence* (New York.: HarperCollins, 1989), pp. 32–33.
31. Michael Barnett and Raymond Duvall, "Power in International Politics," *International Organization*, Vol. 59, No. 1 (January 2005), pp. 39–75, doi:10.1017/S0020818305050010; Stefano Guzzini, "Structural Power: The Limits of Neorealist Power Analysis," *International Organization*, Vol. 47, No. 3 (Summer 1993), pp. 443–478, doi:10.1017/S0020818300028022; and Steven Lukes, *Power: A Radical View* (Basingstoke, U.K.: Palgrave Macmillan, 2005).
32. On the importance of specifying scope and domain when measuring power, see Baldwin, *Power and International Relations*.
33. Andrew J.R. Mack, "Why Big Nations Lose Small Wars: The Politics of Asymmetric Conflict," *World Politics*, Vol. 27, No. 2 (January 1975), pp. 175–200, doi:10.2307/2009880; and Ivan Arreguín-Toft, "How the Weak Win Wars: A Theory of Asymmetric Conflict," *International Security*, Vol. 26, No. 1 (Summer 2001), pp. 93–128, doi:10.1162/016228801753212868.
34. Peter Morris, *Power: A Philosophical Analysis* (Manchester, U.K.: Manchester University Press, 2002), pp. 25–28.

not fixed—different countries, at different times, want different things—so although analysts might be able to know a country's preferred outcome regarding a particular event, it is difficult, if not impossible, to know the preferences of many countries across hundreds of events over long periods of time.[35] Thus, the strength of the power-as-outcomes approach—its specificity—becomes a weakness when the goal is to assess the overall balance of power.

Second, the power-as-outcomes approach is useful only for analyzing past events.[36] After all, analysts must wait for an outcome to occur before they can study it. Scholars, however, often want to measure the balance of power today and make an educated guess about what the balance of power will look like in the future.

Third, the power-as-outcomes approach sometimes leads to nonsensical conclusions.[37] For example, North Vietnam defeated the United States in the Vietnam War (1965–73), but it would be strange to argue that North Vietnam, a fledgling country where most of the population was living on less than a dollar per day, was more powerful than the United States, a globally engaged superpower with a $3 trillion economy, dozens of allies, and thousands of nuclear weapons. A better interpretation of the war's outcome would be that power has limits, and that North Vietnam defeated the United States, not because it was more powerful, but because it was more resolved (i.e., more willing to bear costs in pursuit of its objectives). In short, power alone does not determine outcomes; grit, luck, and wisdom matter, too. The power-as-resources approach untangles power from these and other nonmaterial elements, whereas the power-as-outcomes approach lumps them together.

For these reasons, I ultimately adopt the power-as-resources approach. I do so, however, using a hybrid approach: I measure power in terms of resources, but I use data on outcomes to evaluate the relative validity of different resource indicators. Specifically, I assess which indicators of resources most accurately track the rise and fall of the great powers and predict the winners of past international disputes and wars. This dual approach captures the best of both worlds; it yields a measure of power that is historically valid and

35. In a recent study, Robert J. Carroll and Brenton Kenkel try to get around this problem by using machine learning techniques, CINC data, and militarized interstate dispute (MID) data to develop a proxy for power called the Dispute Outcome Expectations (DOE) score, which is directly interpretable as the probability of victory in a militarized interstate dispute. Unfortunately, however, DOE scores cannot be used to study dispute and war outcomes, because the scores are based on war and dispute outcome data and would thus be endogenous in statistical models. Moreover, DOE scores are based on CINC, which I show to be a severely flawed measure of power resources. See Carroll and Kenkel, "Prediction, Proxies, and Power," Florida State University and Vanderbilt University, 2016, http://doe-scores.com/doe.pdf.
36. Mearsheimer, *The Tragedy of Great Power Politics*, p. 60; Nye, *The Future of Power*, p. 8; and Wohlforth, *The Elusive Balance*, pp. 4, 10.
37. Mearsheimer, *The Tragedy of Great Power Politics*, p. 60.

generalizable, one that faithfully reflects the past but also can be applied to the present and projected into the future.

Measuring Resources: Gross versus Net

Many scholars and analysts measure power in terms of resources. Unfortunately, most of them measure resources in gross rather than net terms. As noted, gross indicators systematically overstate the power of populous countries, because they count the benefits of having a big population, but not the costs.

A big population is obviously an important power asset.[38] Luxembourg, for example, will never be a great power, because its workforce is a blip in world markets and its army is smaller than Cleveland's police department. A big population, however, is no guarantee of great power status, because people both produce and consume resources; 1 billion peasants will produce immense output, but they also will consume most of that output on the spot, leaving few resources left over to buy global influence or build a powerful military.

To rank among the most powerful nations in the world, a state needs to amass a large stock of resources, and to do that a state must be big and efficient. It must produce high output at low costs. It must not only mobilize vast inputs, but also produce significant output per unit of input. In short, a nation's power stems not from its gross resources, but from its net resources—the resources left over after subtracting costs.[39]

What costs? There are three main costs that erode countries' power resources: production costs, welfare costs, and security costs.

Production costs are the price of doing business; they are the resources a nation must input to generate economic and military outputs. In economics, production costs include the raw materials consumed, and the negative externalities (e.g., pollution) created, during the production process. In military affairs, production costs refer to the number of assets needed to generate a given level of force and are mainly a function of skill and technology—a military with skillful military personnel and superior technology will use fewer resources to accomplish a mission than a military with low skill and outdated technology.[40]

38. Kingsley Davis, "The Demographic Foundations of National Power," in Monroe Berger, Theodore Abel, and Charles H. Page, eds., *Freedom and Control in Modern Societies* (New York: Van Nostrand, 1954), pp. 206–242; and Katherine Organski and A.F.K. Organski, *Population and World Power* (New York: Alfred A. Knopf, 1961).
39. Klaus Knorr calls these resources the "disposable surplus." See Knorr, *The War Potential of Nations*, p. 231.
40. Stephen Biddle, *Military Power: Explaining Victory and Defeat in Modern Battle* (Princeton, N.J.: Princeton University Press, 2004).

Welfare costs are subsistence costs; they are the expenses a nation pays to keep its people from dying in the streets and include outlays on basic items such as food, health care, social security, and education.

Security costs are the price a government pays to police and protect its citizens. The logic of deducting assets tied up in domestic law enforcement and homeland security is simple: police and military units that are bogged down chasing criminals, quelling rebellions, or defending borders against foreign invasions cannot project power abroad or create wealth at home. Measuring security costs thus accounts for the fact that two nations with identical sets of gross resources may, nevertheless, wield vastly different levels of power if one country is surrounded by enemies and wracked by internal strife whereas the other is stable and surrounded by allies.

Needless to say, production, welfare, and security costs add up. In fact, for most of human history, they consumed nearly all of every country's resources.[41] Even today, they tie down large amounts of the world's economic and military assets. To assess the balance of power, therefore, analysts must deduct these costs by using net indicators.

Power Indicators

In this section, I show that the most commonly used indicators of economic and military resources ignore production, welfare, and security costs. After highlighting this problem, I discuss how scholars can address it by using net indicators.

GROSS INDICATORS

Most scholars and analysts measure power using gross indicators, including various measures of economic input (e.g., on research and development [R&D] spending, capital investment, and energy consumption); economic output (e.g., GDP, manufacturing, and industrial output); trade and financial flows; and "bean counts" of military spending, platforms, and personnel. According to a review of the literature, scholars and government analysts produced at least sixty-nine power measurement frameworks from 1936 to 2010, and forty-two of these frameworks were composed solely of some combination of the gross indicators listed above.[42]

41. Ian Morris, *Why the West Rules—For Now: The Patterns of History, and What They Reveal about the Future* (New York: Farrar, Straus and Giroux, 2010).
42. The remaining twenty-seven formulas combined gross material indicators with nonmaterial factors (e.g., morale, prestige, and diplomatic skill), per capita material indicators, or both. See Karl Hermann Höhn, "Geopolitics and the Measurement of National Power," Ph.D. dissertation, University of Hamburg, 2011.

The most popular indicator is GDP, which records the value of all goods and services produced within a country over a fixed period of time. GDP has been described as "the leading indicator" and "the Zeus of the statistical pantheon," because governments, organizations, and scholars around the world use it to gauge states' raw capabilities.[43] Although GDP is technically an economic indicator, proponents argue that it captures both economic and military capacity, because states can easily convert economic resources into military might. In short, GDP is considered to be fungible; it can be turned into "any mix of military, economic, and political" resources, just as a person can use cash to buy many forms of influence.[44]

Despite the widespread use of GDP, however, few people know what it actually measures or recognize that it does not deduct costs.

To begin, GDP counts production costs (inputs and externalities) as output. Spending money always increases GDP, even if the funds are wasted on boondoggles; in fact, the most common method of calculating GDP is called the "expenditure method" and involves simply adding up all of the spending done by the government, consumers, and businesses in a country in a given time period.[45] Thus, hiring workers always increases GDP, even if they spend all day getting drunk in the break room. Boosting production always increases GDP, even if the goods rot on the shelf and tons of toxic waste are released in the process. In fact, a country can increase its GDP by dumping toxic waste into the streets and then spending billions of dollars to clean it up.

GDP also does not deduct welfare costs. Money spent feeding people is counted the same as profits earned selling supercomputers on world markets. Consequently, populous countries generate considerable economic activity simply by existing. Even a nation caught in a Malthusian hell, in which all output is immediately devoured, will post a large GDP if it has a big population.

Finally, GDP counts security spending as economic output. GDP does not distinguish between guns and butter. It counts a $100 million gulag the same as a $100 million innovation center. Hence, GDP fails to account fully for the economic costs of domestic instability and international conflict. In fact, GDP usually rises when a country mobilizes for war. To be sure, military investments can sometimes yield economic dividends. For example, the internet and

43. Zachary Karabell, *The Leading Indicators: A Short History of the Numbers That Rule Our World* (New York: Simon and Schuster, 2014), p. 158.
44. Emilio Casetti, "Power Shifts and Economic Development: When Will China Overtake the USA?" *Journal of Peace Research*, Vol. 40, No. 6 (November 2003), p. 663, doi:10.1177/00223433030406003.
45. Diane Coyle, *GDP: A Brief but Affectionate History* (Princeton, N.J.: Princeton University Press, 2014).

the Global Positioning System began as U.S. military research projects. In general, however, resources devoted to policing and protection drain wealth rather than create it.[46]

Besides GDP, the other most commonly used indicator is "war potential," which combines measures of gross economic output and gross military resources.[47] The logic of this approach is that power ultimately depends on the ability to win major wars, and doing that requires a big army backed by a hefty military budget and substantial industrial might.

Governments are fond of this approach. For example, the U.S. National Intelligence Council, a body that advises the president, gauges global power trends with an index that combines military spending, GDP, population, and R&D spending.[48] Academics, too, typically measure the power of nations in terms of war potential. As noted, more than 1,000 peer-reviewed studies have used CINC, which combines data on military spending, troops, population, urban population, iron and steel production, and energy consumption.[49]

Measures of war potential, however, suffer from the same problem as GDP: they are gross measures that do not deduct production, welfare, or security costs. They count military units the same, regardless of their level of skill or technology, the welfare costs of supporting those units,[50] or whether they are projecting power abroad or imposing order at home. They also treat military spending and other inputs, such as energy consumption or R&D spending, as if they were outputs, so a country could substantially increase its CINC score by making enemies and then raising a huge, oil-guzzling army to attack them.

Ultimately, all gross indicators are one-dimensional; they measure only the size of a country's resources, not how efficiently a country uses them.

NET INDICATORS

How can scholars address the shortcomings of the standard indicators of national power discussed above? The ideal solution would be to deduct costs

46. Kennedy, *The Rise and Fall of the Great Powers*.
47. Knorr, *The War Potential of Nations*. For exhaustive reviews of dozens of different indexes of war potential, see Höhn, "Geopolitics and the Measurement of National Power"; and Tellis et al., *Measuring Power in the Postindustrial Age*, pp. 25–33.
48. NIC, *Global Trends 2030*, pp. 16–17.
49. Singer, Bremer, and Stuckey, "Capability Distribution, Uncertainty, and Major Power War, 1820–1965."
50. Personnel costs typically consume roughly one-third of countries' military budgets, and these expenses can balloon to 50 percent or more for large armies, especially after wars. On this point, see Peter E. Robertson and Adrian Sin, "Measuring Hard Power: China's Economic Growth and Military Capacity," *Defence & Peace Economics*, Vol. 28, No. 1 (February 2017), pp. 91–111, doi:10.1080/10242694.2015.1033895.

and thereby measure net stocks of economic and military resources directly. For example, if a country cuts down a forest to build a new office park, then the value of the forest would show up as a loss on the country's balance sheet. If a country spends $50 billion fighting a war—or growing food to feed its people or cleaning up toxic waste or hosting the Olympics—then $50 billion would be deducted from its stock of assets. In short, there would be no free lunch.

The obvious problem with such an approach, however, is that compiling balance sheets for every country is a painstaking process that requires substantial data and time. The World Bank and the United Nations, working with dozens of economists from leading universities and research organizations, have recently taken up the task and published rough estimates of countries' net stocks of resources.[51] These databases, however, go back only to 1990 and are therefore of limited use for studying long-term trends or general patterns in international relations. To do that, scholars need a proxy for net resources that has data covering many countries going back many decades. Does such an indicator exist?

In an oft-cited statistical reference, the historian Paul Bairoch suggested that the "strength of a nation could be found in a formula combining per capita and total GDP."[52] Bairoch did not elaborate on this point, but subsequent research supports his intuition: as noted, scholars already believe that GDP represents the gross size of a state's economic and military output, and there is a large literature showing that GDP per capita serves as a reliable proxy for economic and military efficiency.

Economists, for example, use GDP per capita to measure economic development, because rich countries are, almost by definition, more efficient than poor countries—the main exceptions to this rule are petro-states, such as Saudi Arabia, that can grow rich simply by pumping oil. Military studies also show that the higher a country's GDP per capita, the more efficiently its military fights in battle.[53] The reason is that a vibrant civilian economy helps a country produce advanced weapons, train skillful military personnel, and manage complex military systems.

51. Glenn-Marie Lange and Kevin Carey, eds., *The Changing Wealth of Nations 2018: Building a Sustainable Future* (Washington, D.C.: World Bank, 2018); and United Nations University International Human Dimensions Programme on Global Environmental Change (UNU-IHDP) and United Nations Environment Programme (UNEP), *Inclusive Wealth Report 2014: Measuring Progress toward Sustainability* (New York: Cambridge University Press, 2014).
52. Paul Bairoch, "Europe's Gross National Product: 1800–1975," *Journal of European Economic History*, Vol. 5, No. 2 (Fall 1976), p. 282.
53. Michael Beckley, "Economic Development and Military Effectiveness," *Journal of Strategic Studies*, Vol. 33, No. 1 (February 2010), pp. 43–79, doi:10.1080/01402391003603581.

GDP per capita thus provides a rough but reliable measure of economic and military efficiency. This finding is not surprising, because population size is the main driver of production, welfare, and security costs. The bigger a country's population, the more people the government must protect and provide for. Therefore, dividing GDP by population controls for some of the costs that make the difference between a state's gross and net resources. Combining GDP with GDP per capita thus yields an indicator that accounts for size and efficiency, the two main dimensions of net resources.

To create a rough proxy for net resources, I follow Bairoch's advice by simply multiplying GDP by GDP per capita, creating an index that gives equal weight to a nation's gross output and its output per person. This two-variable index obviously does not measure net resources directly, nor does it resolve all of the shortcomings of GDP and CINC. By penalizing population, however, it provides a better sense of a nation's net resources than GDP, CINC, or other gross indicators alone.

Future studies can experiment with ways to improve this measure by adjusting the weights or, even better, by expanding the databases created by the World Bank and the United Nations or developing new measures of net stocks of resources. For now, however, multiplying GDP by GDP per capita yields a primitive proxy that scholars can use to evaluate the importance of net resources in international politics. The following sections conduct such an evaluation.

Research Design

I use three methods to compare the importance of gross versus net resources in international politics. First, I conduct case studies of extended great power rivalries in which one nation had a preponderance of gross resources while the other had a preponderance of net resources. I focus on "extended" rivalries, meaning geopolitical competitions that lasted for several decades or longer, because they provide more information about each nation's relative power than does a single war or crisis. I focus on great powers, because minor power competitions are often shaped by great power politics and thus may not reveal much information about the relative power of the minor powers themselves. Additionally, I focus on cases in which one side had a preponderance of gross resources while the other side had a preponderance of net resources, because these cases constitute head-to-head tests of the importance of gross versus net resources in geopolitical competition.

Second, I use large datasets to assess how well some of the single-variable indicators highlighted above (GDP, CINC, and GDP $\times$ GDP per capita) predict the winners and losers of international disputes and wars. In essence, I use GDP and CINC as representatives for the standard, gross approach to measuring power; and I use GDP × GDP per capita as the representative for my alternative, net approach. I focus on dispute and war outcomes, because they are especially revealing about nations' relative power: in peacetime, countries may be able to exaggerate their power; but in times of conflict, bluffs get called, vulnerabilities get exposed, and stronger nations usually emerge victorious. Obviously, no measure of power will predict all dispute and war outcomes—resolve, strategy, luck, and selection effects also play a role, as I explain below—but a valid measure of power should perform better than random chance at predicting dispute and war outcomes, and, all else equal, scholars should prefer the measure that predicts the most outcomes.

Third, I analyze how well each measure performs as a control variable when plugged into existing models of international relations. Many studies use statistical models that control for power to isolate correlations among other variables. I replicate two dozen of these studies and substitute measures of gross and net resources to see how each indicator affects the models' in-sample goodness-of-fit. All else equal, scholars should prefer the measure of power that maximizes the goodness-of-fit in the most models, meaning the measure that explains the most variance in the data.

Each of these methods has strengths and weaknesses. My goal is to compensate for the weaknesses of one with the strengths of others. The case study method allows me to analyze cases in detail and incorporate a range of indicators consistent with each measurement framework, rather than relying solely on single-variable proxies. The large-*n* results, by contrast, sacrifice the detail of the case studies, but help ensure that my findings apply broadly across many cases. Finally, the replication analyses test the resilience of each measure to a variety of model specifications and across numerous areas of international relations.

Case Studies

As noted, the ideal case to test the relative importance of gross versus net resources in international politics would be an extended great power rivalry in which one nation had a preponderance of gross resources while the other had a preponderance of net resources. According to widely used datasets, there have been fourteen great power rivalries since 1816 that lasted at least twenty-five years.[54] From this list, I select the rivalries with the largest gaps between the balance of gross and net resources.

54. Correlates of War Project. 2017. "State System Membership List, v2016," http://

To measure the balance of gross resources in a given rivalry, I take the average of one nation's share of the sum of the two sides' GDPs and of the two sides' CINC scores. For example, imagine that country A and country B are rivals. Country A's share of gross resources would be calculated as:

$$\frac{\left(\frac{GDP_A}{GDP_A+GDP_B}\right)+\left(\frac{CINC_A}{CINC_A+CINC_B}\right)}{2}.$$

To measure the balance of net resources, I calculate that same nation's share of the sum of the two sides' GDP × GDP per capita. In my hypothetical example, this would be:

$$\frac{GDP\ per\ capita_A}{GDP\ per\ capita_A + GDP\ per\ capita_B}.$$

To calculate the gap between the balance of gross and net resources in a rivalry in a given year, I simply subtract country A's share of gross resources in that year from its share of net resources in that year and take the absolute value of the difference:

$$\left|\frac{\left(\frac{GDP_A}{GDP_A+GDP_B}\right)+\left(\frac{CINC_A}{CINC_A+CINC_B}\right)}{2}-\frac{GDP\ per\ capita_A}{GDP\ per\ capita_A + GDP\ per\ capita_B}\right|.$$

For each of the fourteen great power rivalries mentioned above, I perform this calculation for every year of the rivalry and then take the average. These averages are displayed in descending order in table 1.

Given space constraints, I focus on the rivalries with the largest gaps, which I arbitrarily define as those with at least a 20 percentage-point difference between the average balance of gross resources and the average balance of net resources. Six cases meet this criterion; however, I ultimately exclude two of them—France versus China (1860–1929) and Britain versus the Soviet Union (1946–91)—because these rivalries were sideshows in larger geopolitical competitions and thus do not constitute independent cases. In the nineteenth century, France challenged China only after Britain had already brought China to its knees in the Opium Wars.[55] And during the Cold War, Britain's rivalry with

correlatesofwar.org; and Scott Bennett, "Coding Notes for Interstate/Enduring Data," Pennsylvania State Department of Political Science, updated version, May 1, 2017.
55. For this reason, I add the Britain versus China (1839–1911) rivalry to the list even though it was not included in the original rivalry datasets.

Table 1. Extended Great Power Rivalries, 1816–1991

Rivalry	Years	Percentage Point Gap between Balance of Gross Resources and Balance of Net Resources
Britain vs. China	1839–1911	33
France vs. China	1860–1929	32
Britain vs. Soviet Union	1946–1991	29
United States vs. Soviet Union	1946–1991	26
Germany vs. Russia	1891–1917	22
Japan vs. China	1874–1945	21
Russia/Soviet Union vs. China	1857–1991	19
Britain vs. Russia	1833–1907	18
Japan vs. Russia	1853–1991	13
Britain vs. Germany	1853–1991	10
Britain vs. Italy	1911–1947	10
France vs. Germany	1830–1945	5
United States vs. Britain	1816–1903	4
Germany vs. Italy	1914–1945	4
Austria-Hungary vs. Italy	1843–1930	insufficient data

the Soviet Union was shaped by the larger U.S.-Soviet rivalry. In sum, I am left with four cases for further study, which are highlighted in gray in table 1.

Before I analyze the cases, it is worth noting that the nine cases with the largest gaps between the balance of gross and net resources, including the four cases I study below, involve Russia or China. This is not surprising, because China and Russia are the only countries in the past 200 years to have led the world in gross resources while lagging behind other great powers in net resources. Their experience in competitions with smaller but more developed countries thus provides the most straightforward test of my contention that power stems from net, rather than gross, resources.

BRITAIN VERSUS CHINA, 1839–1911

By standard indicators, China looked like a superpower in the nineteenth and early twentieth centuries. It had the largest GDP and military in the world until the 1890s, and the second largest GDP and military until the 1930s.[56] During this time, however, China suffered a "century of humiliation" in which it lost

56. Christopher J. Fariss, Jonathan Markowitz, and Therese Anders, "Over 500 Years of Latent GDP and Population Estimates," University of Michigan and University of Southern California, 2017; Stephen Broadberry, Hanhui Guan, and David Daokui Li, "China, Europe, and the Great Divergence: A Study in Historical National Accounting, 980–1850," Discussion Papers in Economic and Social History, No. 155 (Oxford: University of Oxford, April 2017); and Chiu Yu Ko, Mark Koyama, and Tuan-Hwee Sng, "Unified China and Divided Europe," *International Economic Review*, Vol. 58, No. 1 (January 2018), pp. 285–327, doi:10.1111/iere.12270.

significant territory and most of its sovereign rights, fighting at least a dozen wars on its home soil—and losing every single one of them.

The most important of these conflicts were two "opium wars" with Britain.[57] For centuries, European merchants had traveled to China to swap silver for tea and silk. In the nineteenth century, however, British traders discovered that they could obtain better terms of trade by growing opium in India and selling it on the black market in China.[58] Despite China's long-standing ban on opium, British dealers smuggled into China nearly twelve tons of the drug annually, enough to keep 3 million addicts high year-round.[59] This influx of narcotics eroded 20 percent of China's wealth from 1828 to 1836.[60]

To stem the opium epidemic, the Chinese government declared a war on drugs in 1839, and Chinese officials began seizing opium from British merchants and dumping it into the sea. Britain responded by sailing sixteen warships into Chinese waters and sinking China's navy. From 1839 to 1842, in what is now called the First Opium War, British forces occupied most of China's major coastal cities and brought Beijing to the brink of famine by blockading the Grand Canal, the lifeline linking the Chinese capital to China's rice fields in the south.

Overmatched, the Chinese government capitulated in 1842 and signed the Treaty of Nanjing, which gave Britain $21 million in reparations, a perpetual lease on Hong Kong, access to five port cities, unprecedentedly low Chinese tariffs, and immunity from Chinese law for British citizens living in China.

Fifteen years later, Britain upped the ante by demanding full economic access to all of China and the right to sell opium legally throughout the country. When the Chinese government resisted, Britain again used military force, sparking what is now known as the Second Opium War. In January 1858, British forces occupied Guangzhou, the largest port in China; and in April 1858, British forces, joined by French troops and Russian and U.S. diplomats, occupied Tianjin, the commercial hub of northern China only 100 miles from Beijing.

China mustered little resistance, in part because its military was busy sup-

57. W. Travis Hanes III and Frank Sanello, *The Opium Wars: The Addiction of One Empire and the Corruption of Another* (Naperville, Ill.: Sourcebooks, 2004).
58. Frances V. Moulder, *Japan, China, and the Modern World Economy: Toward a Reinterpretation of East Asian Development ca. 1600 to ca. 1918* (Cambridge: Cambridge University Press, 1977), pp. 100–102. See also Peter Ward Fay, *The Opium War, 1840–1842* (Chapel Hill: University of North Carolina Press, 1998). For a detailed study of Britain's opium trade, see Carl Trocki, *Opium, Empire, and the Global Political Economy: A Study of the Asian Opium Trade, 1750–1950* (London: Routledge, 1999).
59. Morris, *Why the West Rules—For Now*, p. 515.
60. Julia Lovell, *The Opium War: Drugs, Dreams, and the Making of Modern China* (London: Picador, 2011), pp. 36–37.

pressing the Taiping Rebellion, the bloodiest uprising in human history.[61] In June 1858, therefore, the Chinese government signed the Treaty of Tianjin, granting Britain and its allies access to ten new treaty ports, freedom of travel throughout China, freedom of navigation on the Yangtze River, reparations of 6 million silver taels, and the right to sell opium in China.

When the Chinese government delayed in honoring these terms, British and French forces marched on Beijing, burned down the emperor's Summer Palace, and forced the Chinese government to sign a new treaty—the Treaty of Beijing—that quadrupled China's reparations bill, added Tianjin to the list of open treaty ports, and incorporated the Kowloon Peninsula and Stonecutter's Island into Britain's colony at Hong Kong. Over the next fifty years, China would be forced to sign a dozen more "unequal treaties" with Britain, France, Germany, Japan, Russia, and the United States.

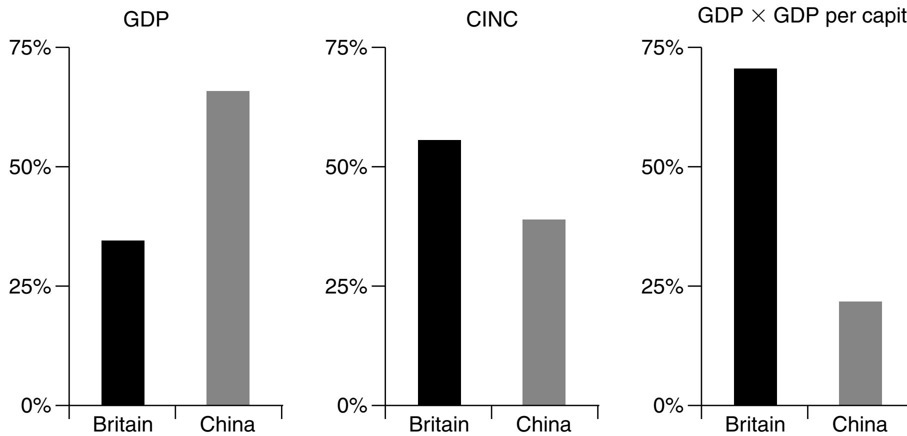
Clearly, Britain was more powerful than China during the Opium Wars. This fact, however, is not captured by standard gross metrics: China's GDP and defense budget were more than twice the size of Britain's, and China's army of 800,000 troops dwarfed the 7,000-troop force that Britain sent to China to fight the wars.[62]

China's weakness is apparent only when costs are taken into account. Figure 1 provides a first-cut assessment and hints at what more detailed research makes clear: China suffered from greater production, welfare, and security costs than Britain and thus had fewer resources to draw on in their many disputes. Whereas Britain comes out far ahead of China when power is measured by my proxy for net resources (GDP × GDP per capita), Britain never overtook China in terms of GDP. Moreover, CINC suggests, nonsensically, that China and Britain were equally matched in the mid-nineteenth century and that China surpassed Britain in power in 1907, five years before the Chinese government collapsed.

What were China's costs? First, China was far less productive than Britain. The average unskilled worker in London generated three to six times the output of the average laborer in Beijing, and each British industrial worker generated sixteen to thirty-three times the output of each Chinese industrial worker.[63] British workers were not only healthier and better educated than

61. Stephen R. Platt, *Autumn in the Heavenly Kingdom: China, the West, and the Epic Story of the Taiping Civil War* (New York: Alfred A. Knopf, 2012).
62. Fariss, Markowitz, and Anders, "Over 500 Years of Latent GDP and Population Estimates"; Peer Vries, "Public Finance in China and Britain in the Long Eighteenth Century," Working Paper No. 167/12 (London: London School of Economics and Political Science, August 2012), p. 19; and Lovell, *The Opium War*, pp. 111–113.
63. Morris, *Why the West Rules—For Now*, p. 502; and Paul Bairoch, "International Industrialization Levels from 1750 to 1980," *Journal of European Economic History*, Vol. 11, No. 2 (Fall 1982), p. 281.

Figure 1. British and Chinese Relative Shares of Power Resources, 1870



SOURCES: Christopher J. Fariss, Jonathan Markowitz, and Therese Anders, "Over 500 Years of Latent GDP and Population Estimates," University of Michigan and University of Southern California, 2017; and David J. Singer, Stuart Bremer, and John Stuckey, "Capability Distribution, Uncertainty, and Major Power War, 1820–1965," in Bruce Russett, ed., *Peace, War, and Numbers* (Beverly Hills, Calif.: Sage, 1972).

NOTE: GDP stands for gross domestic product. CINC stands for Composite Indicator of National Capability.

Chinese workers on average, they also had better technology to do their jobs. British looms, for example, could produce twenty times the output of a Chinese handworker, and British power-driven "mules" (spinning machines) had 200 times the capacity of Chinese spinning wheels.[64]

Second, China's massive population, which was thirteen times larger than Britain's, generated substantial welfare costs. China's "welfare ratio" (its economic output divided by the costs of providing its population with food, clothing, and shelter) was stuck at "bare bones subsistence" levels throughout the nineteenth century, except during the Taiping Rebellion in the 1850s, when the ratio dipped below subsistence and millions of people starved to death.[65] In Britain, by contrast, economic production was four times subsistence in 1820 and more than ten times subsistence by 1900.

Third, domestic instability generated severe security costs for China. The Chinese government faced twenty-five major uprisings each year on average,

64. Kennedy, *The Rise and Fall of the Great Powers*, p. 145.
65. Robert C. Allen et al., "Wages, Prices, and Living Standards in China, 1738–1925: In Comparison with Europe, Japan, and India," *Economic History Review*, Vol. 64, No. S1 (February 2011), pp. 8–38, doi:10.1111/j.1468-0289.2010.00515.x.

so the central government had to keep taxes low to appease local rulers while keeping military spending high to sustain large internal security forces.[66] These competing demands plunged China into fiscal crisis. China's tax revenues in the nineteenth century were 50 percent lower than they were in the seventeenth century and were five times smaller than Britain's in aggregate and one hundred times smaller on a per capita basis.[67] Meanwhile, China's military spending consumed 50 to 70 percent of government revenues in peacetime and 100 percent or more during wars.[68]

Production, welfare, and security costs also drained China's seemingly vast military resources. To begin, China's military was unskilled and under-equipped compared with Britain's. As one study concludes, "In all areas of equipment—weaponry, forts, and most critically ships—Chinese equipment lagged behind that of the British . . . the British had long moved into the era of firepower, while parts of the Chinese army hung on to bows, swords, spears, and rattan shields."[69] The best Chinese firearm was the matchlock, a muzzle-loading musket developed in the fifteenth century that required soldiers to light a match each time it was fired; British regiments, by contrast, were equipped with flintlocks or breech-loading percussion locks.[70] Chinese warships carried 10 cannons each, whereas British ships had 120 or more, and Chinese cannons lacked sights and swivels and thus could not target moving objects, such as enemy ships and soldiers.[71] Repeatedly during the Opium Wars, therefore, Chinese armies of thousands were routed in minutes by a few hundred, or even a few dozen, British troops.

Security costs also degraded China's military power. China's forces were "scattered through the empire, far too busy with domestic peace-keeping duties (killing bandits or rebels; carrying out disaster relief; guarding prisons; policing smugglers) to be spared for the quarrel with the British."[72] At any given time, 50,000 Chinese soldiers were in transit around the country suppressing revolts. Consequently, Chinese garrisons often had only a quarter of their troops on hand to counter British assaults.[73]

66. Tuan-Hwee Sng, "Size and Dynastic Decline: The Principal-Agent Problem in Late Imperial China, 1700–1850," *Explorations in Economic History*, Vol. 54 (October 2014), pp. 107–127, doi:10.1016/j.eeh.2014.05.002.
67. Ibid., p. 120.
68. Vries, "Public Finance in China and Britain in the Long Eighteenth Century," p. 19; and Albert Feuerwerker, *The Chinese Economy, 1870–1949* (Ann Arbor: University of Michigan Press, 1969), pp. 80–83.
69. Lovell, *The Opium War*, p. 111.
70. Haijian Mao, *The Qing Empire and the Opium War: The Collapse of the Heavenly Dynasty* (Cambridge: Cambridge University Press, 2016), pp. 27–30.
71. Ibid., pp. 30–38.
72. Lovell, *The Opium War*, p. 113.
73. Ibid.

JAPAN VERSUS CHINA, 1874–1945

China's misery did not end with the Opium Wars. In the latter half of the nineteenth century, Japan became determined not to suffer the same fate as China, so it revamped its government, economy, and military and began seizing territory and resources in East Asia. When China tried to stand in the way of Japan's imperialist plans, Japan went on a rampage and quickly defeated China militarily in 1894 and forced it to sign the Treaty of Shimonoseki, which ceded the Liaodong Peninsula, Formosa, and the Pescadores to Japan. China also was forced to recognize Korea's independence—which effectively meant that Korea would become a vassal of Japan, no longer of China—and to give Japan commercial rights in China and a massive indemnity.[74]

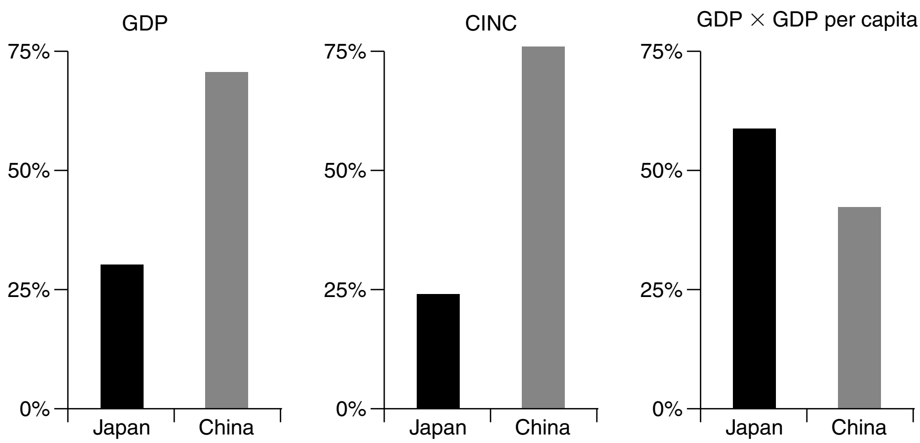
After pocketing these gains, Japan annexed Korea in 1910, and when World War I broke out in 1914, Japan entered the war on the Allies' side and seized the German-controlled city of Qingdao on China's Shandong Peninsula.[75] Japan then presented China with the infamous "Twenty-One Demands," which basically called for China to become a Japanese ward.[76] The United States forced Japan to abandon its most punishing demands, but Japan still extracted substantial territorial and economic concessions from China.

A little more than a decade later, Japan expanded its presence in northeast China, establishing a colony there called Manchukuo in 1932, and bringing the Chinese provinces of Jehol and Hebei under Japanese control in 1933.[77] In 1934, the Japanese government declared that East Asia was Japan's sphere of influence and warned other great powers not to defend China. Then in 1937, Japan launched a full-scale invasion.[78] By the time World War II began in Europe in 1939, Japan controlled most of eastern China plus Taiwan and its outlying islands. Japanese expansion stopped only when it ran afoul of the United States, which decisively defeated Japan in 1945.

Obviously, Japan was more powerful than China during the late nineteenth and early twentieth centuries. Yet, by standard metrics, China appeared to have far greater power resources (figure 2). China's population, GDP, and military were several times larger than Japan's, but Japan was much more efficient

74. Peter Duus, *The Rise of Modern Japan* (Boston: Houghton Mifflin, 1976), pp. 120–135; and Jonathan D. Spence, *The Search for Modern China* (New York: W.W. Norton, 1991), pp. 216–244.
75. W.G. Beasley, *Japanese Imperialism, 1894–1945* (Oxford: Clarendon, 1987), chap. 7.
76. Ibid., chap. 8.
77. These events are described in Peter Duus, *Japan's Quest for Autonomy: National Security and Foreign Policy, 1930–1938* (Princeton, N.J.: Princeton University Press, 1966), chaps. 2–3; Michael A. Barnhart, *Japan Prepares for Total War* (Ithaca, N.Y.: Cornell University Press, 1987), chap. 1.
78. For a comprehensive account of the Japanese invasion and occupation of China, see Rana Mitter, *China's War with Japan, 1937–1945: The Struggle for Survival* (London: Allan Lane, 2013).

Figure 2. Chinese and Japanese Relative Shares of Power Resources, 1930



SOURCES: Christopher J. Fariss, Jonathan Markowitz, and Therese Anders, "Over 500 Years of Latent GDP and Population Estimates," University of Michigan and University of Southern California, 2017; and David J. Singer, Stuart Bremer, and John Stuckey, "Capability Distribution, Uncertainty, and Major Power War, 1820–1965," in Bruce Russett, ed., *Peace, War, and Numbers* (Beverly Hills, Calif.: Sage, 1972).

NOTE: GDP stands for gross domestic product. CINC stands for Composite Indicator of National Capability.

than China, with lower production, welfare, and security costs, and was thus able to garner a preponderance of net resources.

First, Japanese industry was more productive than China's. In 1913, Japan's labor productivity was three times greater than China's overall. By 1930, Japan was producing 150 times as much iron and steel as China and controlled 80 percent of the global silk market, China's top export industry.[79]

Second, welfare costs worked in Japan's favor. Whereas Chinese economic output hovered around subsistence levels in the early twentieth century, Japan's economy grew five times faster than its population, "making it possible to feed the increasing number of Japanese born every year with enough left over to finance both the government's modernization efforts and investment in the modern sectors of the economy."[80] Whereas agriculture tied down

79. Bairoch, "International Industrialization Levels from 1750 to 1980," p. 281; Allen et al., "Wages, Prices, and Living Standards in China, 1738–1925," p. 20; Singer, Bremer, and Stuckey, "Capability Distribution, Uncertainty, and Major Power War, 1820–1965"; and Debin Ma, "Why Japan, Not China, Was the First to Develop in East Asia: Lessons from Sericulture, 1850–1937," *Economic Development and Cultural Change*, Vol. 52, No. 2 (January 2004), pp. 369, 373, doi:10.1086/380947.
80. Duus, *The Rise of Modern Japan*, p. 137.

80 percent of China's workforce and accounted for 65 percent of China's GDP in the 1930s, it occupied only 47 percent of Japan's workforce and made up 15 percent of its economy.[81]

Third, security costs took a smaller toll on Japan's economy than they did on China's. Military spending consumed half of China's government revenues in the first three decades of the twentieth century, and if indemnities are included, then China's security spending totaled 85 to 100 percent of government revenues.[82] In Japan, by contrast, the government allocated only 7 to 11 percent of its funds to the military, and this spending was largely offset by the wealth Japan looted from China.[83]

In military affairs, the story was similar.[84] As one study concludes, "Chinese forces lost every major confrontation on the battle field . . . and were inferior in organization, equipment, training, and leadership to the Japanese Army."[85] China had one rifle for every 3 soldiers and one artillery piece for every 6,000 soldiers, and 80 percent of Chinese hand grenades failed to explode.[86] Japanese soldiers, by contrast, had not only modern firearms, but also tanks, armored vehicles, combat aircraft, and chemical weapons, which they used indiscriminately on Chinese troops and civilians. Only 27 percent of Chinese officers received any formal training,[87] and Chinese units lacked field doctors, so even minor wounds often resulted in death.[88] The Chinese military also lacked modern communication and transport equipment—according to one government report, there were only 6,000 trucks in the entire country, half of which were inoperable—so messages were sent via runners, and soldiers moved around the country on foot.[89] As a result, Chinese forces had a limited combat radius, a situation that made counterattacks and timely reinforcement nearly impossible.

Chinese military power also was undermined by welfare costs. As one study concludes:

81. Feuerwerker, *The Chinese Economy, 1870–1949*, p. 121; and David Flath, *The Japanese Economy* (Oxford: Oxford University Press, 2014), p. 52.
82. Feuerwerker, *The Chinese Economy, 1870–1949*, p. 168; Moulder, *Japan, China, and the Modern World Economy*, p. 191; and Spence, *The Search for Modern China*, p. 235.
83. E. Sydney Crawcour, "Industrialization and Technological Change, 1885–1920," in Kozo Yamamura, ed., *The Economic Emergence of Modern Japan* (Cambridge: Cambridge University Press, 1997), p. 52.
84. Hsi-sheng Chi, "The Military Dimension, 1942–1945," in James C. Hsiung and Steven I. Levine, eds., *China's Bitter Victory: War with Japan, 1937–45* (New York: Routledge, 1992).
85. Marvin Williamsen, "The Military Dimension, 1937–1941," in Hsiung and Levine, *China's Bitter Victory*, p. 135.
86. Ibid., pp. 170–171.
87. Chi, "The Military Dimension, 1942–1945," p. 173.
88. Williamsen, "The Military Dimension, 1937–1941," p. 148.
89. Chi, "The Military Dimension, 1942–1945," pp. 168–169.

The typical Chinese military unit spent the bulk of its time and energy simply trying to preserve its existence. It expected to have to take care of its own needs, including food, clothing, conscripts, weapons, and transportation. Fighting consumed too much energy, so fighting was done only when absolutely necessary. When sufficiently desperate, soldiers would not hesitate to pillage the very same people they were supposed to protect. This in turn provoked numerous incidents of friction between the army and the civilian population. Probably the worst case occurred in Honan during the early phase of Operation Ichigo. When the Chinese troops retreated in defeat, more soldiers were killed by the indignant local population than by the Japanese.[90]

Finally, Chinese forces suffered substantial security costs. China was internally divided prior to the Japanese invasion; indeed, historians call the period from 1916 to 1928 the "Warlord Era," because China was chopped up among rival military cliques. The Nationalist Party, led by Chiang Kai-shek, took control of China in 1928, but its rule remained contested by warlords, communists, and various ethnic separatist groups. During the war with Japan, therefore, the Chinese government stationed troops throughout the country to prevent domestic rivals from seizing power or seceding.[91] With its forces dispersed, the Chinese military often found itself outnumbered in battles with the Japanese despite its four-to-one advantage in troops overall.[92]

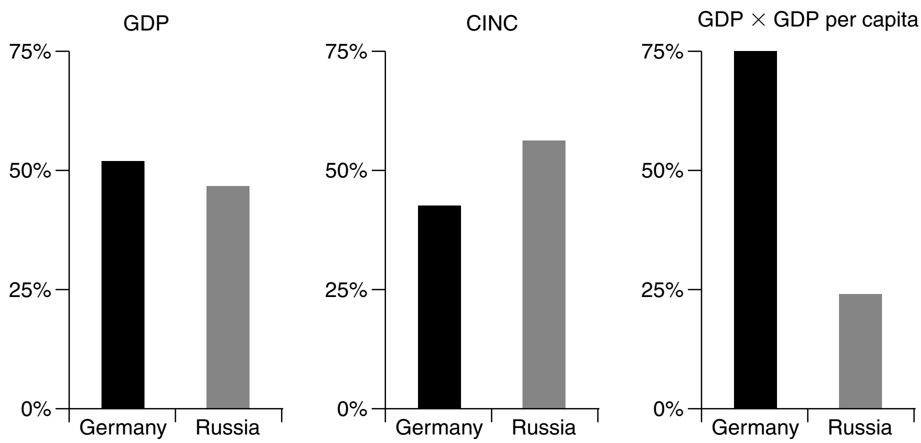
GERMANY VERSUS RUSSIA, 1891–1917

For most of the nineteenth century, Russia had the largest GDP and military in Europe. During this time, however, Russia suffered "a steady slackening of power and prestige" and a series of crushing military defeats that culminated in the collapse of the Russian Empire in 1917.[93]

Imperial Russia had two consistent goals throughout the nineteenth century: to expand its empire in the Middle East and Asia while maintaining a balance of power in Europe. This strategy was wrecked in 1871 by the formation of Germany.[94] Although Russia initially allied with Germany and Austria-Hungary to contain France, the rapid growth of German power compelled Russia to switch sides and ally with France in 1894. Germany, finding itself squeezed between two hostile powers, responded by building up its mili-

90. Ibid., p. 171.
91. Ibid., pp. 174–176.
92. Singer, Bremer, and Stuckey, "Capability Distribution, Uncertainty, and Major Power War, 1820–1965."
93. Barbara Jelavich, *A Century of Russian Foreign Policy, 1814–1914* (Philadelphia: Lippincott, 1964), p. vii.
94. William C. Fuller Jr., *Strategy and Power in Russia, 1600–1914* (New York: Free Press, 1998), p. 292.

Figure 3. German and Russian Relative Shares of Power Resources, 1905



SOURCES: Christopher J. Fariss, Jonathan Markowitz, and Therese Anders, "Over 500 Years of Latent GDP and Population Estimates," University of Michigan and University of Southern California, 2017; and David J. Singer, Stuart Bremer, and John Stuckey, "Capability Distribution, Uncertainty, and Major Power War, 1820–1965," in Bruce Russett, ed., *Peace, War, and Numbers* (Beverly Hills, Calif.: Sage, 1972).

NOTE: GDP stands for gross domestic product. CINC stands for Composite Indicator of National Capability.

tary and making plans to eliminate the Russian and French threat through a preventive war.[95]

The result—World War I—was catastrophic for Russia: Germany annihilated Russia's military; exacted a large indemnity; and forced Russia to give up territory comprising parts of modern-day Estonia, Latvia, Lithuania, Poland, Belarus, and Ukraine. Only Germany's defeat by a coalition led by Britain, France, and the United States saved Russia from bearing the full brunt of these losses. Nevertheless, Russia was devastated by the war, and by 1920 it was engulfed in a bloody civil war.

What explains Russia's poor performance against Germany? Russia had higher production, welfare, and security costs than Germany and thus had far fewer net resources available for geopolitical competition (figure 3).

To begin, in the early twentieth century, Russia was literally "the least developed European power," lagging behind its neighbors in terms of per capita in-

95. Jack Snyder and Keir A. Lieber, "Correspondence: Defensive Realism and the 'New' History of World War I," *International Security*, Vol. 33, No. 1 (Summer 2008), pp. 174–194, doi:10.1162/isec.2008.33.1.174.

come, output per worker, and other measures of economic development such as literacy and health.[96] In 1910, Russia was only 40 percent as productive as Germany overall and 20 percent as productive in heavy industries.[97]

In addition, most of Russia's economic output was consumed by welfare costs. Russia's GDP grew steadily during the nineteenth century, but nearly all of this growth stemmed from population growth.[98] The demands of feeding this growing population forced 90 percent of Russia's labor force into agriculture.[99] With more and more mouths to feed, Russia failed to accumulate wealth at the rate of other great powers: whereas the real per capita wealth of Germany grew 3 percent annually from 1890 to 1917, Russia's increased by only 1 percent.[100]

Security costs also took a large toll on Russia's economy. With a territory that stretched across one-sixth of the Earth's landmass, Russia had to maintain large military forces just to police its own borders and prevent remote regions from breaking away.[101] From 1870 to 1913, peacetime defense spending consumed 5 percent of Russia's GDP and 80 percent of the Russian government's revenues annually. In Germany, by contrast, peacetime defense spending accounted for 3 percent of GDP.[102]

Russia's army was twice the size of Germany's and had a bigger budget, but Germany's advantages in technology and skill enabled it to outfight Russia on a soldier for soldier basis. Whereas German troops were well trained and armed, a majority of Russian troops were untrained conscripts and sent into battle without rifles, where they were expected to scavenge weapons from the dead.[103] Russia also lacked railroads in its western regions, which made it difficult for Russia to move its armies around the Russo-German border.[104] Germany, on the other hand, had a well-developed railroad system, so it could move its forces quickly to that same border.

Furthermore, throughout the nineteenth and early twentieth centuries, secu-

96. Alec Nove, *An Economic History of the USSR*, rev. ed. (New York: Penguin, 1989), p. 5.
97. Bairoch, "Europe's Gross National Product."
98. Raymond W. Goldsmith, "The Economic Growth of Tsarist Russia, 1860–1913," *Economic Development and Cultural Change*, Vol. 9, No. 3 (April 1961), p. 441, doi:10.1086/449917.
99. Robert C. Allen, *Farm to Factory: A Reinterpretation of the Soviet Industrial Revolution* (Princeton, N.J.: Princeton University Press, 2005), p. 25.
100. Goldsmith, "The Economic Growth of Tsarist Russia, 1860–1913," pp. 472–475.
101. William C. Wohlforth, "The Russian-Soviet Empire: A Test of Neorealism," *Review of International Studies*, Vol. 27, No. 5 (December 2001), pp. 213–235, doi:10.1017/S0260210501008099.
102. John M. Hobson, "The Military Extraction Gap and the Wary Titan: The Fiscal-Sociology of British Defense Policy, 1870–1913," *Journal of European Economic History*, Vol. 22, No. 3 (January 1993), pp. 478–479; and Kennedy, *The Rise and Fall of the Great Powers*, p. 174.
103. Jonathan R. Adelman, *Revolution, Armies, and War: A Political History* (Boulder, Colo.: Lynne Rienner, 1985), pp. 88–92.
104. Mearsheimer, *The Tragedy of Great Power Politics*, p. 72.

rity costs sapped Russian military power. As the historian Paul Kennedy notes, "The great part of the Russian army was always pinned down by internal garrison duties, by police actions in Poland and the Ukraine, and by other activities, such as border patrol."[105] Consequently, "in every war waged by Russia throughout the reign [of the Russian Empire], its generals were chronically embarrassed by a shortage of troops."[106] This shortage became acute in the years prior to World War I: mass uprisings increased tenfold from 1909 to 1913 as the tsarist government's hold on power deteriorated and the Russian Revolution gathered pace.[107]

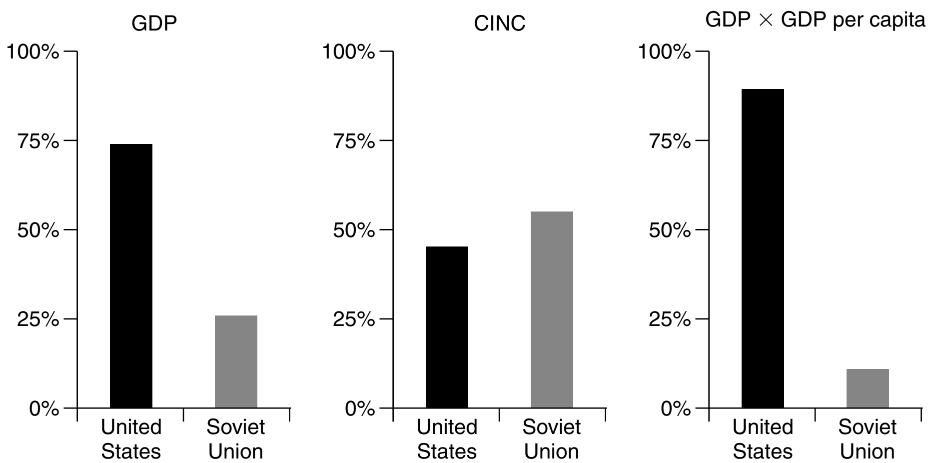
UNITED STATES VERSUS SOVIET UNION, 1946–91

The Soviet Union suffered enormous losses in World War II, but it gained power in relative terms because it gobbled up territory in Eurasia as the allies dismantled the German and Japanese empires. By 1945, the Soviet Union was the most powerful nation in Europe; by the 1950s, it was widely regarded as one of the world's two superpowers alongside the United States; and by the 1970s, the Soviet Union led the world by most measures of gross resources, including CINC, army size, nuclear weapons, military spending, gross industrial output, R&D spending, and employment of scientists and engineers.[108] In 1977, Ray Cline, the chief analyst of the Soviet Union in the U.S. Central Intelligence Agency, combined many of these factors into a single power index and concluded that the Soviet Union was twice as powerful as the United States, and rising.[109]

Yet, between the 1970s and 1991, the Soviet Union withdrew in defeat from Afghanistan, accepted severe arms-control agreements, opened up sectors of its economy to Western corporations, and lost all of its client states in Eastern Europe and 2 million square miles of territory—a chunk of land nearly twice the size of India.[110] Rather than orchestrate a soft landing for its rival, the

105. Kennedy, *The Rise and Fall of the Great Powers*, p. 172.
106. Fuller, *Strategy and Power in Russia, 1600–1914*, p. 253.
107. Kennedy, *The Rise and Fall of the Great Powers*, pp. 236–237.
108. Singer, Bremer, and Stuckey, "Capability Distribution, Uncertainty, and Major Power War, 1820–1965"; Robert S. Norris and Hans M. Kristensen, "Global Nuclear Weapons Inventories, 1945–2010," *Bulletin of the Atomic Scientists*, Vol. 66, No. 4 (July 2010), pp. 77–83, doi:10.2968/066004008; National Science Foundation (NSF), *Science and Engineering Indicators, 1989* (Washington, D.C.: NSF, 1989), p. 313; NSF, *Science and Engineering Indicators, 1987* (Washington, D.C.: NSF, 1987), p. 228.
109. Ray S. Cline, *World Power Assessment 1977: A Calculus of Strategic Drift* (Boulder, Colo.: Westview, 1977).
110. Stephen G. Brooks and William C. Wohlforth, "Power, Globalization, and the End of the Cold War: Reevaluating a Landmark Case for Ideas," *International Security*, Vol. 25, No. 3 (Winter 2000/01), pp. 5–53, doi:10.1162/016228800560516.

Figure 4. U.S. and Soviet Relative Shares of Power Resources, 1975



SOURCES: Christopher J. Fariss, Jonathan Markowitz, and Therese Anders, "Over 500 Years of Latent GDP and Population Estimates," University of Michigan and University of Southern California, 2017; and David J. Singer, Stuart Bremer, and John Stuckey, "Capability Distribution, Uncertainty, and Major Power War, 1820–1965," in Bruce Russett, ed., *Peace, War, and Numbers* (Beverly Hills, Calif.: Sage, 1972).

NOTE: GDP stands for gross domestic product. CINC stands for Composite Indicator of National Capability.

United States engaged in "extreme predation" by backing independence movements within the Soviet Union and absorbing a reunited Germany into the North Atlantic Treaty Organization.[111] In 1989, the Soviet Union effectively called off the Cold War, and in 1991 it broke apart into fifteen states, leaving the United States standing as the world's only superpower.[112]

How could this happen? With the benefit of hindsight, it is clear that the Soviet Union, for all of its vast size, was an inefficient state suffering from onerous production, welfare, and security costs (figure 4).

First, the Soviet Union had the "worst performing economy in the world" in the 1970s and 1980s: its productivity was negative; its output-capital ratios (the amount of wealth generated per unit of investment) declined steadily; and it became the first industrialized nation in history to record peacetime declines

111. Joshua R. Itzkowitz Shifrinson, *Rising Titans, Falling Giants: How Great Powers Exploit Power Shifts*, Texas A&M University, chap. 3.
112. Hal Brands, *Making the Unipolar Moment: U.S. Foreign Policy and the Rise of the Post–Cold War Order* (Ithaca, N.Y.: Cornell University Press, 2016).

in life expectancy and infant mortality.[113] Soviet industries used twice as many raw material and energy inputs as U.S. industries, but produced half the output.[114]

The U.S. productivity advantage was particularly pronounced in high-technology industries.[115] The Soviet Union employed nearly twice as many scientists and engineers as the United States and spent nearly twice as much on R&D as a share of GDP;[116] but the Soviet Union's massive science projects (so-called Projects of the Century) failed to produce breakthroughs and succeeded only in swallowing up ever-greater shares of Soviet resources.[117] While R&D spending and scientific employment steadily increased from the 1960s to 1990, the number of Soviet inventions, prototypes, patents, profitable products, and international scientific prizes declined sharply relative to those of the United States.[118] For example, in 1985, U.S. technology companies sold 7 million computers while the Soviet Union produced only 9,000.[119]

Welfare costs also eroded Soviet wealth. Soviet social assistance programs depleted half of Moscow's revenues annually.[120] In the United States, by contrast, all food, housing, and social assistance programs combined accounted for less than 10 percent of the budget.[121]

Security costs also took their toll on Soviet wealth. Defense spending consumed roughly 40 percent of the Soviet budget and 15 to 20 percent of GDP, at least four times the U.S. level.[122] The Soviet Union also spent an additional 2 to

113. William Easterly and Stanley Fischer, "The Soviet Economic Decline," *World Bank Economic Review*, Vol. 9, No. 3 (September 1995), pp. 341–371, at p. 341, doi:10.3386/w4735; International Monetary Fund, *A Study of the Soviet Economy* (Washington, D.C.: International Monetary Fund, 1991); Brooks and Wohlforth, "Power, Globalization, and the End of the Cold War," pp. 14–20; and Allen, *Farm to Factory*, pp. 190–200.
114. Yegor Gaidar, *Collapse of an Empire: Lessons for Modern Russia* (Washington, D.C.: Brookings Institution Press, 2007), p. 75.
115. John R. Oneal, "Measuring the Material Base of the Contemporary East-West Balance of Power," *International Interactions*, Vol. 15, No. 2 (January 1989), pp. 177–196, doi:10.1080/03050627908434727.
116. NSF, *Science and Engineering Indicators, 1989*, p. 278; and NSF, *Science and Engineering Indicators, 1987*, p. 228.
117. Gur Ofer, "Soviet Economic Growth: 1928–1985," *Journal of Economic Literature*, Vol. 25, No. 4 (December 1987), pp. 1767–1833.
118. Vladimir Kontorovich, "The Long-Run Decline in Soviet R&D Productivity," in Henry S. Rowen and Charles Wolf Jr., eds., *The Impoverished Superpower: Perestroika and the Soviet Military Burden* (San Francisco, Calif.: ICS Press, 1990).
119. U.S. Bureau of the Census, *USA/USSR: Facts and Figures* (Washington, D.C.: U.S. Government Printing Office, 1991), pp. 4–9.
120. International Monetary Fund, *A Study of the Soviet Economy*, p. 53, table II.2.3.
121. Susan B. Carter et al., eds., *Historical Statistics of the United States: Earliest Times to the Present*, millennial ed. (Cambridge: Cambridge University Press, 2006).
122. Noel E. Firth and James H. Noren, *Soviet Defense Spending: A History of CIA Estimates, 1950–1990* (College Station: Texas A&M University Press, 1998), pp. 129–130.

4 percent of GDP annually propping up its allies with aid and arms.[123] The United States, by contrast, spent 0.3 percent of its GDP annually on all forms of foreign assistance combined.[124]

The Soviet military, too, suffered from high production, welfare, and security costs. The Soviet Union spent 2 to 3 percent of its GDP on military R&D, but lagged a generation or more behind the United States in fifteen of the twenty most critical military technologies and was merely on par with the United States in the remaining five categories.[125] The Soviet military was hobbled by a rigid command structure, and its officers lacked initiative; its troops lacked basic skills, such as map-reading; language barriers created serious communication problems among different divisions; and 25 percent of Soviet forces were made up of fresh conscripts with little to no training.[126] Soviet forces trained so little in part because Soviet weapons systems were so fragile; for example, Soviet fighters required overhauls at triple the rate of many Western aircraft, and Soviet tank engines wore out after 500 hours or less of use.[127] Plagued by equipment failures, the government kept most weapons systems "packed away like a family's best china," using them only for special exercises once or twice a year.[128] The resulting skill deficiencies, plus the technology issues discussed above, probably made a successful Soviet invasion of Central Europe impossible.[129]

Finally, and perhaps most important, the Soviet military confronted an extremely hostile security environment.[130] By the 1980s, the United States had six times as many allies as the Soviet Union, and this American alliance network had three times the population and gross resources of the Soviet Union and its

123. Charles Wolf et al., *The Costs of the Soviet Empire* (Santa Monica, Calif.: RAND Corporation, 1983).
124. Ibid.; and Carter et al., *Historical Statistics of the United States*.
125. Oneal, "Measuring the Material Base of the Contemporary East-West Balance of Power," p. 182.
126. John J. Mearsheimer, "Numbers, Strategy, and the European Balance," *International Security*, Vol. 12, No. 4 (Spring 1988), p. 183, doi:10.2307/2539001; William W. Kaufmann, "Who Is Conning the Alliance?" *Brookings Review*, Vol. 5, No. 4 (Fall 1987), p. 13; and William E. Odom, *The Collapse of the Soviet Military* (New Haven, Conn.: Yale University Press, 1998).
127. Richard K. Betts, *Military Readiness: Concepts, Choices, Consequences* (Washington, D.C.: Brookings Institution Press, 1995), pp. 156–159.
128. Ibid., p. 156.
129. John J. Mearsheimer, "Why the Soviets Can't Win Quickly in Central Europe," *International Security*, Vol. 7, No. 1 (Summer 1982), pp. 3–39, doi:10.2307/2538686; Mearsheimer, "Numbers, Strategy, and the European Balance"; Barry R. Posen, "Measuring the European Conventional Balance: Coping with Complexity in Threat Assessment," *International Security*, Vol. 9, No. 3 (Winter 1984/85), pp. 47–88, doi:10.2307/2538587; and Barry R. Posen and Stephen Van Evera, "Defense Policy and the Reagan Administration: Departure from Containment," *International Security*, Vol. 8, No. 1 (Summer 1983), pp. 3–45, doi:10.2307/2538484.
130. Stephen M. Walt, "The Case for Finite Containment: Analyzing U.S. Grand Strategy," *International Security*, Vol. 14, No. 1 (Summer 1989), pp. 5–49, doi:10.2307/2538764.

allies.[131] Facing a robust U.S. containment barrier abroad and disaffected citizens at home, the Soviet Union had to expend significant resources just to defend its borders and prevent restive regions and satellite countries from breaking away. The United States, by contrast, had a secure home base in the Western Hemisphere and dozens of rich allies around the world. It therefore had more leeway to choose where and when to project military power and was able to offload part of the burden of defending the free world to others.

War and Dispute Outcomes, 1816–2010

The cases discussed above focus on a handful of great powers. To provide a broader perspective, I consider international disputes and wars among all nations that occurred from 1816 to 2010. These analyses provide further evidence that power stems from net rather than gross resources.

It would, of course, be unreasonable to expect any single power indicator to predict the outcome of every dispute and war, because such outcomes are determined in part by nonmaterial factors such as strategy, resolve, and luck.[132] On the other hand, it is reasonable to expect a headline indicator of power to perform better than a coin toss at predicting winners and losers. In this section, therefore, I compare the predictive power of GDP and CINC against my crude proxy for net resources, GDP $\times$ GDP per capita.

To evaluate war outcomes, I use a revised version of the Correlates of War's Interstate Wars dataset, which divides coalition wars (e.g., World War II) into sets of bilateral conflicts.[133] The dataset shows who defeated whom in each conflict, but it obscures the role of coalition partners in deciding the outcomes of those conflicts; for example, according to the dataset, China defeated Japan in World War II; Russia defeated Germany in World War I; and Morocco defeated Iraq in the Gulf War. To ensure such cases do not bias my results, I use a restricted sample that includes only bilateral wars.

131. Stephen M. Walt, "Alliance Formation and the Balance of World Power," *International Security*, Vol. 9, No. 4 (Spring 1985), pp. 34–35, doi:10.2307/2538540.
132. Analyses of war and dispute outcomes may also suffer from selection effects, because weak countries are unlikely to pick fights with stronger countries unless they have some advantage (e.g., more resolve, favorable terrain, or the element of surprise) that offsets the stronger side's material superiority. Such effects are probably present in my samples of wars and disputes, but I do not believe that selection effects or omitted variables bias my results, because I am comparing among indicators of power, not between indicators of power and other factors. To guard against omitted variable bias, however, I replicate several existing studies of war and dispute outcomes that control for many factors. The results, which are presented in the next section, show that the balance of net resources is a better predictor of war and dispute outcomes than the balance of gross resources.
133. Dan Reiter, Allan C. Stam, and Michael C. Horowitz, "A Revised Look at Interstate Wars, 1816–2007," *Journal of Conflict Resolution*, Vol. 60, No. 5 (August 2016), pp. 956–976, doi: 10.1177/0022002714553107.

Table 2. Power Indicators as Predictors of War and Dispute Outcomes, 1816–2010 (percentage of outcomes predicted correctly)

	Wars	MIDs
GDP	68%	64%
CINC	70%	64%
GDP × GDP per capita	78%	70%
Number of observations	54	276

NOTE: MIDs are militarized interstates disputes. GDP stands for gross domestic product. CINC stands for Composite Indicator of National Capability.

To evaluate dispute outcomes, I use the Correlates of War's Militarized Interstate Dispute dataset, which codes the outcomes of thousands of disputes, ranging in intensity from low-level diplomatic squabbles to full-blown wars.[134] Most of these disputes ended without a clear winner and thus do not provide a basis on which to compare the predictive validity of different power indicators. In several hundred cases, however, there was a clear winner, and I use the data on these decisive disputes to evaluate the predictive success of the indicators mentioned above. As with the war analyses, I use a restricted sample that includes only bilateral disputes.

Table 2 presents the success rate of each indicator (i.e., the percentage of wars and disputes in which the side with the larger GDP, CINC score, or GDP × GDP per capita won) as well as the number of cases for which data were available. The results show that the proxy for net resources (GDP × GDP per capita) performs 8 to 10 percentage points better than the measures of gross resources in predicting war outcomes and 6 percentage points better at predicting dispute outcomes. All of the power indicators accurately predict a higher percentage of war outcomes than dispute outcomes, probably because many disputes were minor events (e.g., diplomatic squabbles or fishing disputes) that did not fully engage the full power resources of the belligerents.

In the online appendix, I list the wars and disputes in which different indicators produced divergent predictions.[135] Among the disputes predicted by GDP × GDP per capita but not by GDP or CINC, roughly half involve Russian/Soviet or Chinese losses to more developed but less populous nations, and another 15 percent involve Israeli victories over more populous but less developed Arab states. These cases are prevalent for two main reasons.

134. Faten Ghosen, Glenn Palmer, and Stuart A. Bremmer, "The MID3 Data Set, 1993–2001: Procedures, Coding Rules, and Description," *Conflict Management and Peace Science*, Vol. 21, No. 2 (April 2004), pp. 133–154, doi:10.1080/07388940490463861.
135. See the online supplementary materials, doi:10.7910/DVN/58KDCM.

First, Russia, China, and Israel have been involved in a large percentage of all militarized conflicts: Russia and China have been the first and fourth most militarily active nations in the world over the past two centuries, accounting for 19 percent and 11 percent of all militarized interstate disputes since 1816; and Israel has been one of the most militarily active states since its founding, having been involved in 8 percent of all militarized interstate disputes since 1948. Second, these nations consistently fought rivals that had a different balance of gross versus net resources: as noted, Russia and China led the world in gross resources, but lagged behind their great power rivals in terms of net resources; and Israel has a smaller population and set of gross resources than its Arab enemies, but is more developed and therefore has often had greater net resources.

Replication Analyses

My proxy for net resources more accurately accounts for the outcomes of great power rivalries and international wars and disputes, but scholars often want to control for relative power in statistical models of various aspects of international relations. As a final test, therefore, I replicate a random sample of recent international relations studies and substitute measures of gross and net resources into their statistical models to see how each measure affects the models' in-sample goodness-of-fit.

My sample consists of all studies published in seven leading political science journals from January 2012 to April 2017 that included a control variable for relative power and for which replication data were publicly available.[136] These criteria left me with twenty-four studies, which are listed in the online appendix.[137] These studies analyze a variety of aspects of international relations, including nuclear proliferation, terrorism, trade, immigration, international law, alliance formation, and the onset and outcomes of wars and disputes. I provide more information about each study in a separate bibliography, which is included in the online appendix.

I replicated the main model of each study using CINC, GDP, and GDP $\times$ GDP per capita, respectively, as the variable for relative power and calculated the in-sample goodness-of-fit using the Akaike Information Criterion (AIC),

136. The seven journals were *American Journal of Political Science*, *American Political Science Review*, *International Organization*, *International Studies Quarterly*, *Journal of Conflict Resolution*, *Journal of Politics*, and *Security Studies*. I identified studies that control for power by searching for citations of commonly used databases for CINC, GDP, and military spending data.
137. See the online supplementary materials.

$$\text{AIC} = 2(\text{number of coefficients}) - 2(\text{log-likelihood}).$$

The AIC is commonly used in model selection, with lower values representing better fit.[138] When no main model was apparent, I used the most fully specified model.

Table 3 in the online appendix summarizes the results of the replication analyses. In seventeen of twenty-four studies, the models using GDP × GDP per capita achieved a better goodness-of-fit than the models using CINC. Among these seventeen cases, the average ΔAIC (i.e., the difference in AIC between the models using CINC and those using GDP × GDP per capita) is 6, which implies that the models using CINC are .05 times as likely as the models using GDP × GDP per capita to minimize information loss on average. A common rule of thumb is that a ΔAIC greater than 2 provides statistically significant evidence of one model being better than another.[139] By this criterion, eleven of the seventeen cases are significant. In three other studies, the models using GDP × GDP per capita and CINC achieved the same goodness-of-fit, leaving only four studies in which CINC performed better than GDP × GDP per capita.

In eleven of the twenty-four studies, the models using GDP × GDP per capita achieved a better goodness-of-fit than the models using GDP, and the ΔAIC in eight of these eleven cases was 2 or greater. In seven other studies, GDP × GDP per capita and GDP produced the same goodness-of-fit, and in six studies GDP performed better than GDP × GDP per capita.

In sum, replacing standard gross measures of power with my proxy for net resources improves the model fit in a plurality of recent international relations studies. Given the small number of replicated studies, these results certainly do not prove that power is a function of net rather than gross resources. They are consistent, however, with such a claim, as well as with the narrower claim that GDP × GDP per capita is a better single-variable indicator of relative power than CINC or GDP.

Conclusion

I have argued that scholars should measure power in terms of net resources rather than gross resources; developed a rough but ready indicator for doing

138. Hirotugu Akaike, "A New Look at the Statistical Model Identification," *IEEE Transactions on Automatic Control*, Vol. 19, No. 6 (December 1974), pp. 716–723.
139. Kenneth P. Burnham and David R. Anderson, *Model Selection and Multimodel Inference: A Practical Information-Theoretic Approach*, 2nd ed. (New York: Springer, 2002), p. 70.

so; and demonstrated that this indicator does a better job than standard gross indicators at tracking the rise and fall of great powers, predicting the outcomes of international disputes and wars, and serving as a control variable in quantitative studies of international relations. There are two main implications of these results.

First, an enormous literature in international relations has been built on a flawed conception of power, so existing studies may need to be reevaluated with new measures. As noted, more than 1,000 peer-reviewed studies have used CINC to measure power. Yet, this indicator severely mischaracterizes the balance of power in some of the most important geopolitical events of the past 200 years. CINC also suggests, nonsensically, that Israel is, and has always been, one of the weakest countries in the Middle East; Singapore is one of the weakest in Southeast Asia; Brazil dominates South America with roughly five times the power resources of any other state; Russia dominated Europe throughout the 1990s, with more power resources than Germany, France, and the United Kingdom combined; and China has dominated the world since 1996 and currently has twice the power resources of the United States.

Given the size and scope of these errors, one has to wonder whether the results of some seminal studies would change if scholars replaced CINC with more accurate measures of power. I can only conjecture which sets of studies might be ripe for reevaluation, but several immediately come to mind.

One is the literature on war and militarized dispute outcomes. Many studies argue that military power is shaped by nonmaterial factors, such as strategy, culture, and domestic politics.[140] These claims have been bolstered by prominent statistical studies that find little relationship between the balance of material power, as measured by CINC and GDP, and the outcomes of wars and militarized disputes.[141] These nonfindings, however, may be artifacts of flawed indicators. When power is measured in net terms, I find that the side with greater resources has won 70 percent of disputes and nearly 80 percent of wars over the past two centuries. Thus, material resources, when properly measured, may be a more significant source of military power than a large literature in international relations suggests.

Another literature that might need to be reevaluated is power transition theory. For decades, scholars have debated whether power parity increases or decreases the likelihood of war between states.[142] Nearly all of these studies,

140. For a review of this literature, see Nye, *The Future of Power.*
141. Zeev Maoz, "Resolve, Capabilities, and the Outcomes of Interstate Disputes, 1816–1976," *Journal of Conflict Resolution*, Vol. 27, No. 2 (June 1983), pp. 195–229, doi:10.1177/0022002783027002001; and Biddle, *Military Power.*
142. For the most recent study on this issue, see Allison, *Destined for War.*

however, measure power in gross terms, with the most popular indicators being GDP and CINC.[143] As I have shown, these indicators misrepresent the balance of power in many cases, so it is possible that the power transition literature is littered with false positives and false negatives; in other words, many of the cases identified as power transitions may not have involved an actual transition in power, and, conversely, many genuine power transitions may not have not been identified as such.[144] Given that power transition theory relies on a precise measure of power, it is vital that scholars reevaluate it with sound indicators.

The second implication of my results is that they challenge the conventional wisdom about current trends in the balance of power. Since the 1990s, and especially since the 2008 financial crisis, hundreds of books and thousands of articles and reports have asserted that the United States' economic and military edge over other nations is eroding and that the world will soon become multipolar.

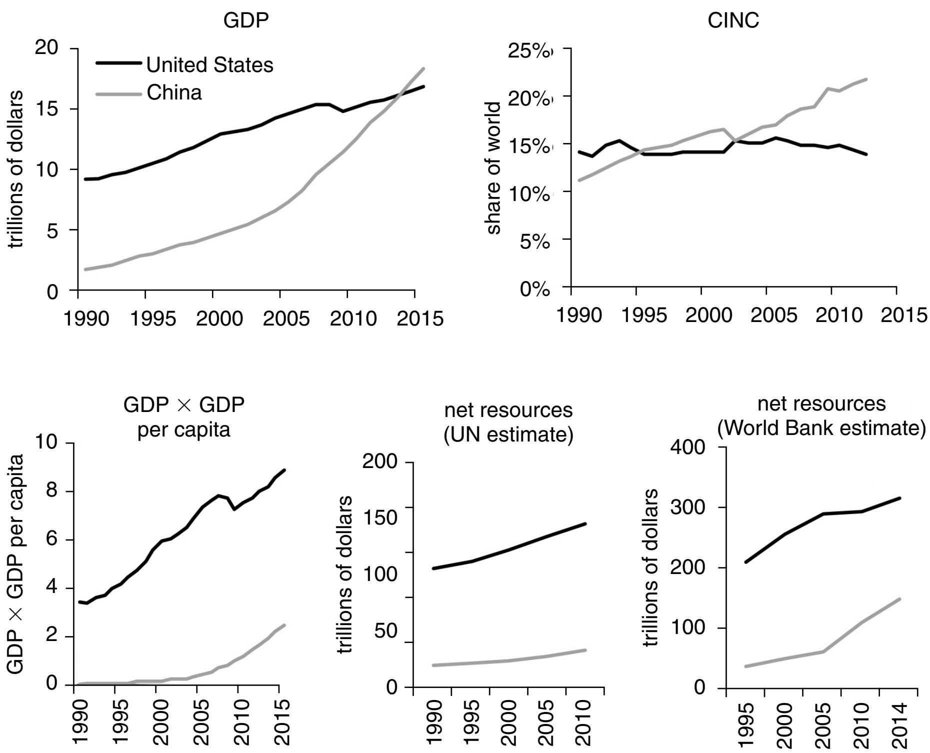
The main evidence typically cited for these trends is China's rising GDP and military spending and various statistics that are essentially subcomponents of GDP—most notably, China's massive manufacturing output; volume of exports; trade surplus with the United States; infrastructure spending; consumer spending; and large government bureaucracy and scientific establishment.[145]

The problem, however, is that these are the same gross indicators that made China look like a superpower during its century of humiliation: in the mid-1800s, China had the world's largest economy and military; led the world in manufacturing output; ran a trade surplus with Britain; presided over a tributary system that extended Chinese trade and investment, infrastructure projects, and soft power across continental East Asia; and was celebrated in the West for its consumer market potential and tradition of bureaucratic competence and scientific ingenuity.

Obviously China is not as weak today as it was in the nineteenth century, but neither is it as powerful as its gross resources suggest. China may have the world's biggest economy and military, but it also leads the world in debt; resource consumption; pollution; useless infrastructure and wasted industrial capacity; scientific fraud; internal security spending; border disputes; and pop-

143. Indra de Soysa, John R. Oneal, and Yong-Hee Park, "Testing Power-Transition Theory Using Alternative Measures of National Capabilities," *Journal of Conflict Resolution*, Vol. 41, No. 4 (August 1997), pp. 509–528, doi:10.1177/0022002797041004002.
144. For evidence of this problem, see Carsten Rauch, "Challenging the Power Consensus: GDP, CINC, and Power Transition Theory," *Security Studies*, Vol. 26, No. 4 (July 2017), pp. 642–664, doi:10.1080/09636412.2017.1336389.
145. See, for example, Rachman, *Easternization*; Zakaria, *The Post-American World*; NIC, *Global Trends 2030*; Allison, *Destined for War*; and Subramanian, *Eclipse*.

Figure 5. The U.S.-China Power Balance, 1990–2015



SOURCES: Christopher J. Fariss, Jonathan Markowitz, and Therese Anders, "Over 500 Years of Latent GDP and Population Estimates," University of Michigan and University of Southern California, 2017; David J. Singer, Stuart Bremer, and John Stuckey, "Capability Distribution, Uncertainty, and Major Power War, 1820–1965," in Bruce Russett, ed., *Peace, War, and Numbers* (Beverly Hills, Calif.: Sage, 1972); Glenn-Marie Lange and Kevin Carey, eds., *The Changing Wealth of Nations, 2018* (Washington, D.C.: World Bank, 2018); and United Nations University International Human Dimensions Programme on Global Environmental Change (UNU-IHDP) and United Nations Environment Programme (UNEP), *Inclusive Wealth Report, 2014: Measuring Progress toward Sustainability* (New York: Cambridge University Press, 2014).

ulations of invalids, geriatrics, and pensioners. China also uses seven times the input to generate a given level of economic output as the United States and is surrounded by nineteen countries, most of which are hostile toward China, politically unstable, or both.

Accounting for even a fraction of these production, welfare, and security costs substantially reduces the significance of China's rise. As shown in figure 5, if power is measured in terms of GDP or CINC, China already appears to be the most powerful country in the world; by contrast, if power is measured with my proxy for net resources or the UN or World Bank's measures of net resources (or other measures of net stocks of economic and military resources not shown here), then China lags far behind the United States and looks set to do so for the foreseeable future.[146]

Clearly, a great deal hangs in the balance with regard to how scholars measure power. The most important point to be made, therefore, is that the measurement of power needs to receive the same kind of sustained and rigorous study that has been given to the effects of power. Power is the central variable in the field of international politics, yet scholars still lack a sound means of measuring it. With so many policy decisions and academic theories relying on accurate assessments of relative power, it is imperative that scholars get those assessments right.

146. These points are detailed in Michael Beckley, *Unrivaled: Why America Will Remain the World's Sole Superpower* (Ithaca, N.Y.: Cornell University Press, 2018), pp. 33–97.