



Members of China's People's Liberation Army attend flag-raising ceremony at Tiananmen Square, in Beijing, China, June 16, 2021 (Reuters/Tingshu Wang)

Persistent Knowledge Gaps in the Chinese Defense Budget

By Frederico Bartels

The People's Republic of China (PRC)'s People's Liberation Army (PLA) presents the most significant military challenge to the United States and its allies. It is therefore imperative for us to understand PLA funding to enhance our understanding of the role of the military instrument

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in PRC foreign policy. This article discusses the current knowledge of how much funding is available for the PLA and the gaps in that knowledge, some solutions that attempted to close these gaps, and some areas prime for further development. The cost of a military for a society is not only a theoretical question; it also reveals part of the relative importance of the military in that society. In the case of the PRC, many unknowns remain regarding the cost of the PLA. Such murkiness is expected:

The ruling Chinese Communist Party (CCP) constructed a notoriously ambiguous government in which members manipulate statistics and facts to fit its desired narrative.¹ When it comes to disclosing to the international community its military expenditures, CCP leadership announces a single figure on its defense budget annually. This figure falls short of what other countries release publicly and does not tell the whole story or reveal the whole amount that is dedicated to national defense.

This lack of transparency would be simply a nuisance if the CCP did not represent a fundamental challenge to the current rules-based international order and, increasingly, a rival to the United States.² In its 2017 National Security Strategy and 2018 National Defense Strategy, the Federal Government recognized and prioritized the threat China poses.³ Furthermore, the Joseph Biden administration acknowledges the growing aggression of the PRC.⁴ The 2018 National Defense Strategy describes a multipronged approach to exercising power and influence in the Indo-Pacific region, stating that “China is leveraging military modernization, influence operations, and predatory economics to coerce neighboring countries to reorder the Indo-Pacific region to [its] advantage.”⁵ Much has been written and documented about the military modernization on which the CCP has embarked.⁶ Because there is no documented internal domestic clamor for more data on the Chinese defense budget, however, international actors will have to produce the information. But persistent gaps in Western understanding of Chinese military expenditures and its defense budget—the inputs that enable PLA modernization processes—remain.

When compared with the effort dedicated to understanding Soviet military expenditures, current U.S. attempts to understand Chinese military expenditures are clearly still in their infancy. Noel Firth and James Noren, two former Central Intelligence Agency analysts, have detailed the robust internal debates that took place in the Federal Government on how to account and estimate the Soviet defense budget during the Cold War.⁷ Multiple organizations studied and made informed judgments on how the Soviet defense budget was composed and how it compared with the U.S. defense budget. There were even so-called unconventional approaches that used industrial production data and other inputs to present a more precise estimate of the Soviet defense burden.⁸ Barry Watts, former director of Program Analysis and Evaluation at the Pentagon, describes making different attempts to

estimate Soviet defense spending as one of the core tasks necessary to develop net assessments outlining the comparative advantages of different countries.⁹ Although such methodologies had shortcomings, a discussion of them should shed light on military expenditures in totalitarian societies. Furthermore, these methodologies did bring a better understanding to how the Soviet military was organized and resourced. They also demonstrated that, as disclosures have shown, not even contemporary Soviet leaders knew the actual level of their military expenditures.¹⁰

These public discussions about the Soviet defense budget represent a level of detail that currently is not available on the Chinese defense budget. They demonstrate that the Federal Government used to have the analytical capability for these debates and to produce the data required for them. But today it is fair to assume that the Intelligence Community has had some of the discussion necessary to reach independent assessment of the Chinese defense burden. That said, only a few pages are made public through the annual China Military Power report produced by the Department of Defense.¹¹

Existing Data on the PRC Defense Budget

As of this writing, two sources in the English-language literature can be considered primary data on military expenditures of the PRC: the United Nations (UN) military spending database¹² and the 2019 China white paper on national security, *China’s National Defense in the New Era*.¹³ These two sources present the same information, self-reported by the Chinese government, which like most Chinese data should be understood in the context of the CCP’s regime—that is, it contains only kernels of truth. In fact, the white paper lists the source for the budgetary data as “data on China’s defense expenditure submitted to the UN by the Chinese government.”¹⁴

This defense expenditure information submitted to the UN can be found in the UN Report on Military Expenditures, under the Office for Disarmament Affairs—an entity that started in 1980 as a mechanism to build confidence between

nations and promote transparency in military expenditures. The overall concept is that by bringing more attention and transparency to how states allocate their military resources, countries could have a better understanding of one another’s activities and thus potentially restrain military actions based on misperceptions. As with most UN efforts, the military expenditures database relies on the cooperation of the member states to provide data. There is a lack of consistency, however, that is reflected in gaps spanning years in each country’s report and by changes where the data are located within the UN Web site. Furthermore, this self-reporting approach means that the data are only as reliable as the country generating them wants them to be.

UN member states choose one of four forms with increasing levels of detail to report their annual military expenditures. The first is for countries that do not report any military expenditure. The other three involve different levels of detail for countries that do report military expenditures. The simplest form is a “single figure” report in which the country reports only a single figure reflecting their ministry of defense equivalent. Then there is the simplified form, which divides total military expenditure in two ways.¹⁵ First, it divides the funding by the type of expenditure: personnel, operations and maintenance, procurement and construction, and research and development (R&D). Then, it categorizes those resources by which force controls them: land, naval, air, or other forces. The final form, which is the one recommended by the UN, builds on the simplified form.¹⁶ For the type of expenditures, the form includes 28 categories that are nested under the 4 categories of personnel, operations and maintenance, procurement and construction, and R&D. The force side is split into 10 categories, including the different forces and elements such as support and command, UN peacekeeping, and emergency aid to civilians.

The voluntary reports submitted by the PRC are a half-filled version of the simplified form.¹⁷ This level of disclosure falls short of what would be reasonable to expect from a responsible actor in the

international arena—especially one that is leading the world in military expenditures. The data do not report any resources allocated to R&D. In the category of forces, the report is divided into active, reserve, and militia components, instead of land, naval, and air forces as prescribed by the UN. These major departures from the form make it impossible to observe how PRC resources have changed.

The CCP's defense white paper uses these reports from 2010 to 2017 to construct a table showing the evolution of Chinese defense expenditures.¹⁸ Even with the table's limited data, it is possible to observe that the CCP's defense expenditures nearly doubled in 8 years. Moreover, the table confirms a substantial increase in the percentage of military resources dedicated to purchasing equipment, growing from 33 percent of the budget to 41 percent. This boost indicates that significant resources are behind the PLA's rhetorical emphasis on modernization.¹⁹ For a document that claims to reflect "reasonable and appropriate defense expenditure," however, it fails to provide information on how those expenditures are reasonable and appropriate.²⁰ The level of transparency demonstrated in the white paper is no different from that of the previously released UN-based data.

Also, just like the data available through the UN, the white paper addresses nothing on the past 4 years, from 2018 to 2021. Public reports give reason to believe substantive increases in the PRC's defense budget have occurred.²¹ The United States and its allies should exert public pressure for the PRC to resume reporting under the UN mechanism. Even if these sources cannot be taken at face value, they represent a valuable data point that can and should be used for analysis.

Limitations of the Current Data

The CCP has a worldwide reputation for manipulating and withholding data; in terms of defense budgets, it follows its regular playbook: being as opaque as possible. Transparency International UK, an anticorruption nongovernmental organization, developed a ranking to evaluate the transparency of countries'

defense expenditures, ranging from 0 to 12.²² In that ranking, the PRC scored 1.5 out of 12, a "low" level of transparency. It is in this context of opacity that the primary source data must be evaluated and understood—that is, the figures should be taken with a grain of salt. Such skepticism does not eliminate the utility of or make invalid these data—rather, the data simply demand caution and caveats.

The lack of service-level information makes it difficult to determine how the PLA armed forces have changed through time, especially over a period when the PLA has been undergoing substantial reforms. The PLA has rebalanced its different forces, deemphasizing the role of the land forces, which have been dominant since the army's inception.²³ The UN form requires a breakdown between the different forces, but the PRC did not provide it. Another element of opacity is the short time frame of 8 years between 2010 and 2017 that is accounted for in the form. The small window provided makes it challenging to get a sense of the evolution of the PLA. Also, it is a somewhat outdated snapshot, already 4 years old as of this writing.

Further increasing the opacity of the data are the known omissions inside the budget. Funding devoted to R&D is the glaring omission. The UN reports require separate line items for military R&D resources; however, the PRC claims that "equipment expenses cover research and development, procurement, maintenance, transportation and storage of weaponry and equipment."²⁴ Such a claim is neither credible nor verifiable. At a minimum, it would be a step toward greater transparency for the Chinese government to report the funds allocated within each of the categories that compose "equipment."

Additionally, because of how the CCP defines the relationship between military research and the broader Chinese society, disclosing military, R&D funds would still give an incomplete picture. Under the civil-military fusion model that the CCP employs, the PLA can easily access for military purposes any technology and research developed in civilian

institutions.²⁵ As stated by Tai Ming Cheung, a professor at the University of California, San Diego, "Funding for defense-related research and development . . . comes primarily from other areas of the central government budget, most notably those allocated to the State Administration for Science, Technology, and Industry for National Defense (SASTIND), which is not included in the official defense budget."²⁶ SASTIND represents a line of expenditure that is outside of defense, and there is no indication that the budget is aggregated to the reported totals.²⁷

The presence of state-owned enterprises (SOEs) in the PRC further highlights the challenges in getting a complete picture of military R&D. The Chinese defense industrial base has changed in the past few decades, but SOEs still play a major role in defense.²⁸ The current defense budget provides no visibility into the work of SOEs in the defense industrial base and how much support they get—or do not get—through the official defense budget. Transparency International UK summarizes the state of Chinese defense budget data well, stating that "the little official defence budget information which is released by the Chinese government excludes any data on military R&D and infrastructure projects, strategic forces, and foreign acquisitions."²⁹

Challenges in Dealing with the Existing Data

Even in the context of the limited data available on the PRC's defense budget, other limitations make it hard to compare Chinese military expenditures with those of the rest of the world. The main obstacle is in establishing a common currency for making the comparisons. Simplistic comparisons rely on using a market exchange rate to reach a common currency, usually U.S. dollars. Market exchange rates are the price of one currency that would be necessary at that given moment to buy another currency. However, unless someone is buying just currency, those rates have little utility. These market exchange rate comparisons lead to misleading

statements, such as “the United States spends more on defense than [the next 10 countries] combined.”³⁰ It is a statement devoid of context, thus undermining its credibility. These comparisons ignore the fact that military expenditures are mostly conducted inside the country with local currency and that the labor market for the military, a huge cost driver for most militaries, is national.³¹

Several studies develop a comparison with better fidelity by utilizing purchasing power parity (PPP) data.³² Economists developed PPP indexes to permit comparisons between different economies

that have similar products available.³³ The main goal is to be able to compare the cost of living in different nations using a common basket of goods. PPP indexes aim to be universal and thus do not consider the specificities of a basket of goods the military would buy. Ideally, a specific PPP index would be available based on a military basket of goods. The World Bank and the UN should assess the viability of developing such an index.

Professor Peter Robertson from the University of Western Australia developed an initial concept of a real military purchasing power database. As he explains,

“Since output prices are not observable, I develop an exchange rate based on relative military input costs using defense budget share data. For each country the defense sector PPP exchange rate is constructed as a Törnqvist index of unit military costs relative to the USA.”³⁴ Further study is necessary to both replicate Robertson’s results and update the numbers, as the study uses 2017 data.

Working Around the Data Limitations

The main way to get a better understanding of the PLA’s defense budget



Boatswain's Mate Seaman Daniel Bello (left) and Seaman Emilio Hernandez scan for surface contacts from bridge wing of guided-missile destroyer USS Dewey, East China Sea, November 10, 2021 (U.S. Navy/Justin Stack)

is for other organizations to produce alternative estimates, but it is also important for the United States to explore different methodologies and different sources of data, both inside and outside the Chinese government. Additionally, the United States should elicit the cooperation of its network of allies to crowdsource better data on how the PLA is resourced and how it applies its resources. During the Cold War, the United States needed to better comprehend how the Soviet Union budgeted for its military and how it evolved through time. The focus on one clear potential adversary enabled the Federal Government to encourage arguments among different analysts and organizations on how to best calculate and count Soviet military expenditures.³⁵ These debates ranged from how to understand the cost of each system and the salaries of Soviet military personnel to the rate of production of military assets and all the possible details that could be extracted from a closed society.

Compared with the current effort to get reliable Chinese data, the attempt

to access Soviet information on how it budgeted for its military and how much it allocated to each part was considerably harder. During the Cold War, “two basic approaches for independently estimating Soviet military spending (and thereby testing the working hypothesis) rapidly emerged. One relied on exploiting pertinent available Soviet economic statistics. The second eschewed the use of Soviet statistics and instead employed a direct-costing technique of putting price tags on known and estimated Soviet military forces, programs, and activities.”³⁶ Largely thought of as a top-down description of the defense budget, the first method utilizes the overall economy and the burden of government to determine the amount of funds dedicated to military spending. It focuses on the inputs that go into the defense sector. The second method relies on the purchase price of existing military assets plus their annual upkeep costs to estimate a country’s military expenditures. It largely concentrates on the outputs the countries receive from their expenditures.³⁷ Both types of analysis have been partially conducted

on the PLA’s expenditures, and myriad efforts have been taken to describe the PLA’s new platforms and their capabilities.³⁸ However, most of these analyses do not add a cost element to the equation, making it challenging to build out an aggregated defense budget by totaling major platform costs. It is not a matter of choosing one method or the other; rather, analysts should assess how these approaches could complement each other to give the public and the Intelligence Community a more complete picture.

In the context of Great Power competition, the United States must, using all possible sources of information, secure a better understanding of how the CCP funds its military, how much money is dedicated to military R&D, and how well Chinese military personnel are compensated. The Defense Intelligence Agency (DIA) issues an annual report called *China Military Power*. Its latest edition, published in late 2019, contains a two-page discussion of the Chinese defense budget, which includes a graph that merely reproduces the official Chinese defense budget, converted through



Sailor aboard guided-missile destroyer USS *Milius* observes bilateral exercise with Japan Maritime Self-Defense Force ships, South China Sea, November 16, 2021 (U.S. Navy/RuKiyah Mack)



President Joe Biden meets with Chinese President Xi Jinping during virtual summit in Roosevelt Room of White House, November 15, 2021 (Abaca Press/Alamy/Sarah Silbiger)

market exchange rates and adjusted for inflation.³⁹ The text acknowledges the challenges of an independent valuation, stating that “estimating actual military expenses is difficult because of China’s poor accounting transparency and incomplete transition to a market economy.”⁴⁰ Exactly because it is difficult, the DIA should develop its own independent estimate and make it public, which would allow other actors to expand on it.

The U.S.-China Economic and Security Review Commission (USCC), an independent congressional commission charged with reviewing the National security effects of U.S.-China interactions, also publishes an annual report on the activities of the PRC. The 2019 edition discussed the Chinese defense budget and highlighted lack of transparency, stating that “China’s official budget is not transparent. Authoritative observers note that one cannot accept China’s official figures at face value due to Beijing’s provision of only top-line

numbers and omission of major defense-related expenditures, such as research and development and foreign arms purchases.”⁴¹ The commission takes its analysis one step beyond that of the DIA and includes a graphic representation of the Chinese defense budget alongside two independent estimates performed by independent research organizations.⁴² A participant partially addressed this issue at one public hearing held by the USCC.⁴³ But that is where the discussion ends in publicly available sources from the Federal Government.

The USCC uses the estimates of two international research organizations: the Stockholm International Peace Research Institute (SIPRI) and the International Institute for Strategic Studies (IISS). Beginning in 1997, SIPRI developed its own methodology to estimate the Chinese defense budget. SIPRI’s approach incorporates elements missing from the official budgetary data publicized by the PRC government.⁴⁴ A January 2021 report

from SIPRI updated its methodology and built on the elements that are part of the independent estimate.⁴⁵ Its estimate for the Chinese defense budget takes into account military expenditures that occur outside the official defense budget.⁴⁶ The methodology considers military R&D, costs for the militia and the People’s Armed Police, subsidies for SOEs, and earnings from the PLA’s economic activities and arms exports. As stated by SIPRI, “the estimates for the years 1997–2017 are based on publicly-available figures for official military expenditure and some other items, and estimates for other items based on Professor Wang’s methodology or other methods based on new information.”⁴⁷ The SIPRI data therefore try to fill in the gaps that the publicly available data present. It is a methodology analogous to the building-blocks approach used in past assessments of the Soviet defense budget in which the different elements of the force are examined to get a greater picture of military expenditures.



Lieutenant Louis Petro stands watch as tactical action officer in combat information center aboard amphibious dock landing ship USS *Germantown*, East China Sea, July 17, 2020 (U.S. Navy/Taylor DiMartino)

IISS takes a similar tactic, finding the budgetary categories not represented in the official budget and adding its estimates to them. In a recent report, IISS highlighted new categories that ought to be included in the calculation of the PLA budget to bring it closer to reality.⁴⁸ IISS includes the local budgets for the People's Armed Police and the expenses for the China coast guard. Both inclusions are supported by their recent additions to the Central Military Commission's command structure, effectively making them part of the military chain of command. These additions align with the 2015 reforms of the PLA and its changes in the military structure.⁴⁹ According to IISS calculations, these two additions amount to an extra \$10 billion to the PLA's budget—a substantial addition to a budget that IISS already estimates to be around \$200 billion. The IISS report also points out five other

areas that should be explored to obtain a more precise estimation of the Chinese defense budget, ranging from the costs to build artificial islands in the South China Sea to the operations and maintenance costs of the China coast guard and the expense of building aircraft carriers.

A recent report from the Heritage Foundation advanced a different way to compare and contextualize the Chinese defense budget.⁵⁰ The report reduces the level of details presented on the defense budget of the United States to the ones available on the PLA budget, to obtain an equivalent picture. Because the United States provides substantially more budgetary data, it is possible to reaggregate the data in the categories utilized by the PRC and exclude the elements not presented in the PLA's data. From there, it is possible to utilize both market exchange rates and PPP, when appropriate, to reach a common measurement.

Employing these techniques, the report estimates that the defense budget of the PRC had 87 percent of the purchasing power of the defense budget of the United States in 2017. The year selected was the last year in which available data from the PLA's budget were broken down in any detail.

All these reports are an important step toward getting more clarity on the real level of military expenditures in China; however, these estimates should be refined as new data become available and as the international community gathers new sources of information on China.

Conclusion

To a large extent, defense budget transparency is an area in which the United States leads the world; the United States and other nations should publicly engage and push the PRC to meet a similar standard. The UN Military

Spending database is a great place to start creating this pressure, especially because it is a mechanism that the PRC utilized until 2017. This push would have to be part of a broader effort to get the Chinese to become more transparent—a significant change in behavior for them. As highlighted by Princeton University’s Aaron Friedberg,

In recent years U.S. officials have pressed their Chinese counterparts to be more “transparent” about defense spending, but there is little expectation that these pleas will yield meaningful results. Even if Beijing were suddenly to unleash a flood of information, American analysts would regard it with profound skepticism, scrutinizing it carefully for signs of deception and disinformation. And they would be right to do so; the centralized, tightly controlled Chinese government is far better able to carry off such schemes than its open, divided, and leaky American counterpart.⁵¹

The opacity of the CCP, combined with the inherent distrust that its authoritarian system generates, means that, for the time being, the United States, allied governments, and independent researchers and organizations must strive to develop their own estimates of the Chinese defense budget, if there is to be any improvement in the collective understanding of it. The difficulty and possible pitfalls are all the more reason to get more individuals invested in calculating the right answer rather than a reason to abandon the work and rely solely on those data the CCP chooses to disclose.

A more accurate picture of Chinese military expenditures is a necessary, but not sufficient, component in assessing the PRC’s defense capacities and capabilities. In many cases, it is more important to know that an adversary *has* a certain system rather than what that system *costs*. But when it comes to devising peacetime strategies that aim at putting the adversary in a position where the cost curve is unfavorable, knowing these costs is critical. In terms of China’s military budget, a better understanding will come only from independent analysis—both inside and outside the Federal Government. JFQ

Notes

¹ A good example of this behavior is demonstrated in Vanessa Molter and Renee Diresta, “Pandemics & Propaganda: How Chinese State Media Creates and Propagates CCP Coronavirus Narratives,” *Misinformation Review* 1 (June 8, 2020), available at <<https://misinformationreview.hks.harvard.edu/article/pandemics-propaganda-how-chinese-state-media-creates-and-propagates-ccp-coronavirus-narratives/>>.

² Huiyun Feng and Kai He, “China’s Institutional Challenges to the International Order,” *Strategic Studies Quarterly* 11, no. 4 (Winter 2017), available at <https://www.airuniversity.af.edu/Portals/10/SSQ/documents/Volume-11_Issue-4/Feng.pdf>.

³ *National Security Strategy of the United States of America* (Washington, DC: The White House, December 2017), available at <<https://trumpwhitehouse.archives.gov/wp-content/uploads/2017/12/NSS-Final-12-18-2017-0905.pdf>>; *Summary of the 2018 National Defense Strategy of the United States of America: Sharpening the American Military’s Competitive Edge* (Washington, DC: Department of Defense, January 2018), available at <<https://dod.defense.gov/Portals/1/Documents/pubs/2018-National-Defense-Strategy-Summary.pdf>>.

⁴ *Interim National Security Strategic Guidance* (Washington, DC: The White House, March 2021), available at <<https://www.whitehouse.gov/wp-content/uploads/2021/03/NSC-1v2.pdf>>.

⁵ *Summary of the 2018 National Defense Strategy*, 2.

⁶ An especially good example is Phillip C. Saunders et al., eds., *Chairman Xi Remakes the PLA: Assessing Chinese Military Reforms* (Washington, DC: NDU Press, 2019), available at <<https://ndupress.ndu.edu/Portals/68/Documents/Books/Chairman-Xi/Chairman-Xi.pdf>>.

⁷ 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).

⁸ William Thomas Lee, *The Estimation of Soviet Defense Expenditures, 1955–75: An Unconventional Approach* (New York: Praeger, 1977).

⁹ Barry D. Watts, “Net Assessment in the Era of Superpower Competition,” in *Net Assessment and Military Strategy: Retrospective and Prospective Essays*, ed. Thomas G. Mahnken (Amherst, NY: Cambria Press, 2020), 27–72.

¹⁰ Firth and Noren, *Soviet Defense Spending*, 188.

¹¹ *Military and Security Developments Involving the People’s Republic of China 2020: Annual Report to Congress* (Washington, DC: Office of the Secretary of Defense, 2020), available at <<https://media.defense.gov/2020/sep/01/2002488689/-1/-1/1/2020-dod-china-military-power-report-final.pdf>>.

gov/2020/sep/01/2002488689/-1/-1/1/2020-dod-china-military-power-report-final.pdf>.

¹² United Nations (UN), Office for Disarmament Affairs, Military Expenditures database, available at <<https://milex.un-arm.org>>.

¹³ *In Their Own Words: China’s National Defense in the New Era* (Beijing: State Council Information Office of the People’s Republic of China, July 2019).

¹⁴ *Ibid.*, 39.

¹⁵ UN, “United Nations Report on Military Expenditures—Reporting Forms: Simplified Form,” available at <https://unoda-web.s3-accelerate.amazonaws.com/wp-content/uploads/assets/convarms/Milex/Forms/en/MilEx_simplified_reporting_form_web.doc>.

¹⁶ UN, “United Nations Report on Military Expenditures—Reporting Forms: Standardized Form,” download available at <https://unoda-web.s3-accelerate.amazonaws.com/wp-content/uploads/assets/convarms/Milex/Forms/en/Standardized_reporting_form_web.doc>.

¹⁷ The latest version available is from 2017. See People’s Republic of China (PRC), “Instrument for Standardized International Reporting of Military Expenditures,” 2017, download available at <<https://unoda-web.s3.amazonaws.com/wp-content/uploads/2019/03/MilEx-2017-China.pdf>>.

¹⁸ *China’s National Defense in the New Era*, 39.

¹⁹ Caitlin Campbell, “China’s Military: The People’s Liberation Army (PLA),” Congressional Research Service, January 5, 2021, available at <https://www.everycrsreport.com/files/2021-01-05_IF11719_96211994c0d7e0f24d3851b53ab4f4e0b0b686e5.pdf>.

²⁰ *China’s National Defense in the New Era*.

²¹ Matthew P. Funaiole et al., “Understanding China’s 2021 Defense Budget,” Center for Strategic and International Studies, March 5, 2021, available at <<https://www.csis.org/analysis/understanding-chinas-2021-defense-budget>>.

²² Mariya Gorbanova and Leah Wawro, *The Transparency of National Defence Budgets* (London: Transparency International UK, October 2011), available at <<http://curbingcorruption.com/wp-content/uploads/2018/07/Gorbanova-and-Wawro-2011-The-transparency-of-national-defence-budgets.pdf>>.

²³ Saunders et al., *Chairman Xi Remakes the PLA*.

²⁴ PRC, “Instrument for Standardized International Reporting.”

²⁵ Lorand Laskai, “Civil-Military Fusion and the PLA’s Pursuit of Dominance in Emerging Technologies,” *China Brief* 18, no. 6 (April 9, 2018), available at <<https://jamestown.org/program/civil-military-fusion-and-the-plas-pursuit-of-dominance-in-emerging-technologies/>>.

²⁶ Tai Ming Cheung, “Keeping Up with the *Jundui*: Reforming the Chinese Defense Acquisition, Technology, and Industrial System,” in Saunders et al., *Chairman Xi Remakes the PLA*, 586.

²⁷ Military R&D was one of the most challenging numbers to estimate when assessing Soviet military expenditures. See Central Intelligence Agency, “Analyzing Soviet Defense Programs, 1951–1990,” 1998, available at <https://nsarchive2.gwu.edu/NSAEBB/NSAEBB431/docs/intell_ebb_009.PDF>.

²⁸ Zoey Ye Zhang, “China’s SOE Reforms: What the Latest Round of Reforms Mean for the Market,” *China Briefing*, May 29, 2019, available at <<https://www.china-briefing.com/news/chinas-soe-reform-process/>>.

²⁹ Gorbanova and Wawro, *The Transparency of National Defense Budgets*, 23.

³⁰ Peter G. Peterson Foundation, “U.S. Defense Spending Compared to Other Countries,” May 13, 2020, available at <https://www.pgpf.org/chart-archive/0053_defense-comparison>. Last updated July 9, 2021.

³¹ Rachel Zissimos and Thomas W. Spoehr, *Putting Defense Spending in Context: Simple Comparisons Are Inadequate*, Background Paper No. 3229 (Washington, DC: Heritage Foundation, July 12, 2017), available at <<https://www.heritage.org/defense/report/putting-defense-spending-context-simple-comparisons-are-inadequate>>.

³² See, for example, Richard Connolly, *Russian Military Expenditure in Comparative Perspective: A Purchasing Power Parity Estimate*, CNA Occasional Paper (Arlington, VA: CNA, October 2019), available at <https://www.cna.org/CNA_files/PDF/IOP-2019-U-021955-Final.pdf>; and Frederico Bartels, *China’s Defense Budget in Context: How Under-Reporting and Differing Standards and Economies Distort the Picture*, Special Report No. 225 (Washington, DC: Heritage Foundation, March 25, 2020), available at <<https://www.heritage.org/asia/report/chinas-defense-budget-context-how-under-reporting-and-differing-standards-and-economies>>.

³³ *Purchasing Power Parities and the Real Size of World Economies: A Comprehensive Report of the 2011 International Comparison Program* (Washington, DC: World Bank Group, 2015), available at <<http://pubdocs.worldbank.org/en/142181487105157824/ICP-2011-report.pdf>>.

³⁴ Peter E. Robertson, *International Comparisons of Real Military Purchasing Power: A Global Database*, Economics Discussion Papers No. 19.13 (Perth: University of Western Australia, October 23, 2019), 20.

³⁵ Firth and Noren, *Soviet Defense Spending*.

³⁶ *Ibid.*, 11.

³⁷ This method can be extremely challenging and requires a substantial amount of detailed data on the systems that are being costed and on how that society operated.

See Gertrude Schroeder, “Soviet Reality Sans Potemkin,” in *Inside CIA’s Private World: Declassified Articles from the Agency’s Internal Journal, 1955–1992*, ed. H. Bradford Westerfield (New Haven, CT: Yale University Press, 1995), available at <<https://www.gwern.net/docs/economics/1968-schroeder.pdf>>.

³⁸ A good example of documentation of People’s Liberation Army capabilities is P.W. Singer and Ma Xiu, “China’s Missile Force Is Growing at an Unprecedented Rate,” *Popular Science*, February 25, 2020, available at <<https://www.popsi.com/story/blog-eastern-arsenal/china-missile-force-growing/>>.

³⁹ *China Military Power: Modernizing a Force to Fight and Win* (Washington, DC: Defense Intelligence Agency, 2019), 21, available at <https://www.dia.mil/portals/110/images/news/military_powers_publications/china_military_power_final_5mb_20190103.pdf>.

⁴⁰ *Ibid.*, 20.

⁴¹ U.S.-China Economic and Security Review Commission, *2019 Report to Congress of the U.S.-China Economic and Security Review Commission* (Washington, DC: U.S. Government Publishing Office, November 2019), 295, available at <<https://www.uscc.gov/sites/default/files/2019-11/2019%20Annual%20Report%20to%20Congress.pdf>>.

⁴² *Ibid.*

⁴³ Phillip C. Saunders, *A “World-Class” Military: Assessing China’s Global Military Ambitions*, Testimony Before the U.S.-China Economic and Security Review Commission, 116th Cong., 1st sess., June 20, 2019, available at <https://www.uscc.gov/sites/default/files/Saunders_USCC%20Testimony_FINAL.pdf>.

⁴⁴ Stockholm International Peace Research Institute (SIPRI), “SIPRI Estimates for China,” SIPRI Military Expenditure Database, available at <<https://www.sipri.org/databases/milex/sources-and-methods#sipri-estimates-for-china>>.

⁴⁵ Nan Tian and Fei Su, *A New Estimate of China’s Military Expenditure* (Solna, Sweden: SIPRI, January 2021), available at <https://www.sipri.org/sites/default/files/2021-01/2101_sipri_report_a_new_estimate_of_chinas_military_expenditure.pdf>.

⁴⁶ Shaoguang Wang, “Estimating China’s Defence Expenditure: Some Evidence from Chinese Sources,” *The China Quarterly* 147 (September 1996), 889–911.

⁴⁷ SIPRI, “Footnotes and Special Notes,” SIPRI Military Expenditure Database, n49, available at <<https://www.sipri.org/sites/default/files/Footnotes.pdf>>.

⁴⁸ Meia Nouwens and Lucie Béraud-Sudreau, *Assessing Chinese Defence Spending: Proposals for New Methodologies* (London: International Institute for Strategic Studies, March 2020), available at <<https://www.iiss.org/-/media/files/research-papers/assessing-chinese-defence-spending---iiss-research-paper.pdf>>.

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⁵⁰ Bartels, *China’s Defense Budget in Context*.

⁵¹ Aaron L. Friedberg, *A Contest for Supremacy: China, America, and the Struggle for Mastery in Asia* (New York: W.W. Norton & Company, 2011), 42.