

## APPENDIX: China Defense Spending Estimate Method

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This appendix provides details of assumptions and calculations used in our essay “Estimating China’s Defense Spending: How To Get It Wrong (and Right),” *Texas National Security Review*, Summer 2024 [<https://tnsr.org/2024/06/estimating-chinas-defense-spending-how-to-get-it-wrong-and-right/>]. Please see the full essay for footnotes and data sources.

Our essay in *Texas National Security Review* used the latest detailed World Bank purchasing power parity (PPP) data available at the time of publication. This data was published by the World Bank in October 2020 and was based on field surveys conducted in 2017.

In early June 2024 soon after our *Texas National Security Review* essay was published, the World Bank published new PPP data. This new data is based on field surveys conducted in 2021. We use this new data in our essay “China’s Defense Spending: The \$700 Billion Distraction,” *War on The Rocks*, August 2024. [<https://warontherocks.com/>]. Please see that essay and its separate online appendix for results that use the new 2021 price series data.

When the World Bank published the new 2021 price survey in June 2024, it also published revisions to the 2017 series PPP data that we used in our original calculations. For consistency with the published version of our essay in *Texas National Security Review*, in this appendix we keep to the original 2017 price series to show how we got our results. However, at the end of this appendix we include a table that shows the revisions to the 2017 World Bank PPP exchange rate data.

Our method can be used to generate a reasonable range of estimates for Chinese defense spending, reflecting adjustments in assumptions and some uncertainty in the data. For simplicity and clarity we present a single estimate here, but the principles in our method are more important than any single estimate.

First, any comparison to U.S. defense spending should contain similar spending categories for China and for the United States.

Second, the exchange rate employed for converting currencies should be appropriate to the military budget. If purchasing power parity adjustments are made for specific budget elements such as military wages, then they should, where possible, be based on actual cost data (not estimates). Where this is more difficult, appropriate sector-level purchasing power parity data should be applied to inputs such as personnel, operations and training, and equipment costs.

This method eliminates the potential for errors based on failure to include similar spending categories, or the unbalanced application of PPPs.

### China Defense Spending 2024

Nuclear weapons, space, and intelligence programs not included

	<u>Billion</u> <u>2024</u> <u>RMB</u>	<u>Conversion</u>	<u>PPP</u> <u>Currency</u> <u>Units to</u> <u>1 USD</u>	<u>RMB/</u> <u>1USD</u> <u>MER</u>	<u>2024</u> <u>Billion</u> <u>USD PPP</u>	<u>2024</u> <u>Billion</u> <u>USD MER</u>
<b>Published, Official</b>						
PLA all services personnel	494.3	"Personnel PPP"	3.38	7.20	146.5	68.7
PLA all services operations and training	554.4	"Ops & Training PPP"	5.14	7.20	107.8	77.0
PLA all services equipment	621.2	"Equipment PPP"	9.33	7.20	66.6	86.3
<b>Total Official Defense Budget</b>	<b>1,670</b>			7.20	<b>321</b>	<b>232</b>
<b>Other Published Defense Expenditure</b>						
Paramilitary People's Armed Police (PAP)	183.7	"People, Ops, Equip. PPP"	5.95	7.20	30.9	25.5
Defense related construction	5.2	"Construction PPP"	2.31	7.20	2.2	0.7
<b>Subtotal Other Published Defense Expenditure</b>	<b>189</b>				<b>33</b>	<b>26</b>
<b>Unpublished Resources for Defense</b>						
Payments to retired and demobilized veterans	267.2	"Personnel PPP"	3.38	7.20	79.2	37.1
Additional defense related R&D	250.5	MER	7.20	7.20	34.8	34.8
Coast Guard	19.3	"People, Ops, Equip. PPP"	5.95	7.20	3.2	2.7
<b>Subtotal Unpublished resources for defense</b>	<b>537</b>				<b>117</b>	<b>75</b>
<b>Total Official Defense Spending</b>	<b>1,670</b>				<b>321</b>	<b>232</b>
<b>Total Full Defense Spending</b>	<b>2,396</b>				<b>471</b>	<b>333</b>

Some columns may not add to 100% due to rounding.

#### *Budget items methods and assumptions*

1. Compare apples to apples. Include or exclude similar spending items for both China and the United States or other comparison country. In our essay, we chose to include China's off-budget spending on military related R&D, additional payments to retired and demobilized veterans, and paramilitary forces such as the People's Armed Police and the Chinese Coast Guard. We chose not to include nuclear weapons (fissile material) programs, space programs, and national intelligence programs. We then compared these Chinese spending categories to similar U.S. spending categories. The U.S. has substantial defense-related spending that is not included in the Department of Defense budget. Comparisons using an alternative mix of spending categories can produce reasonable results – the key is to include similar spending categories for both sides.
2. Chinese official budget breakdown by category: this is not published for 2024. We use the following breakdown based on China's last submission to the UN in 2020: Personnel 29.6%; Operations and Training 33.2%; Equipment 37.2%.
3. People's Armed Police (PAP) budget 2024: this is not yet published for 2024. We estimate this based on historical data and we benchmark to other sources who also use Chinese language primary source material such as SIPRI (Nan Tian and Fei Su, *A New Estimate of China's Military Expenditure*, SIPRI January 2021, <https://www.sipri.org/publications/2021/other-publications/new-estimate-chinas-military-expenditure>).

4. Defense construction budget. This spiked during the peak of Chinese military construction in the South China Sea. We estimate this from recent Ministry of Finance reports. See 2022 年中央基本建设支出预算表 [http://yss.mof.gov.cn/2022zyczys/202203/t20220324\\_3797741.htm](http://yss.mof.gov.cn/2022zyczys/202203/t20220324_3797741.htm). We assume a growth rate identical to the PLA budget, 7.2% for the 2024 number. We benchmark to SIPRI.
5. Additional payments to retired and demobilized veterans. This is separate from and additional to the pensions and benefits included in the official defense budget. Up to 2012 this was reported separately by the Ministry of Civil Affairs. Now it is reported by the Ministry of Finance. For 2024 we estimated this based on historical published data and we benchmarked to recent SIPRI estimates.
6. Additional defense related R&D. China has never reported this in any single source. We have estimated this based on published R&D data in China's Science and Technology Yearbooks as well as benchmarking to SIPRI. The SIPRI method examines gaps between total announced R&D spending (a larger number) and the total of R&D spending reported on specific programs (a smaller number), with the remainder assumed to be classified military R&D programs. Our approach builds up from defense related industries and national programs such as the 863 Program and the 973 Program. SIPRI's estimate for additional R&D spending with military applications has been fairly consistent at about 14% of the official defense budget in recent years. Our current estimate works out to 15% of the official defense budget. China's defense related R&D spending is opaque and difficult to estimate. Some sources use the entire government-funded R&D budget – certainly too high. Once settled on an approach to China's spending in this area, however, for comparison purposes it is critical to provide an equivalent estimate for corresponding United States spending in similar categories.
7. While we included an estimate of additional defense R&D for China, in this essay we did not attempt to include "civil-military fusion" spending (the fusing of commercial and defense-related spending on technologies such as semiconductors, global positioning systems, robotics, and artificial intelligence). Both China and the United States have off-budget spending that could be characterized as "military-civil fusion." If civil-military fusion spending is included for one side in a comparison, it should be included for the other side as well.
8. China Coast Guard budget. There is no official breakdown of China's Coast Guard budget, though purportedly this is now part of the PAP budget. The Center for Strategic and International Studies (CSIS) estimates that China's Coast Guard budget was equivalent to US \$1.7 billion in 2017. See <https://chinapower.csis.org/maritime-forces-destabilizing-asia/>; see also Morris, Lyle J. (2017) "Blunt Defenders of Sovereignty - The Rise of Coast Guards in East and Southeast Asia," *Naval War College Review*: Vol. 70: No. 2, Article 5. Available at: <https://digital-commons.usnwc.edu/nwc-review/vol70/iss2/5>. We use the 2017 number as a baseline and increase it at an annual growth rate identical to the growth rate of the official defense budget. We benchmarked this number to publicly available data for other regional coast guard forces, such as Japan.

#### *PPP related methods and assumptions*

9. We use PPP exchange rate data produced by the International Comparison Program and published by the World Bank (<https://www.worldbank.org/en/programs/icp/data>). The World Bank sector-level PPPs are not updated frequently. For this essay in the *Texas National Security Review* we used the latest data available at the time. This data is based on field surveys of prices in 2017, and was published in 2020. An update was published in early June 2024 and is based on field surveys conducted in 2021. Although it is not updated frequently, the World Bank PPP price series has important advantages. First, these PPPs are based on actual price data collected in the field, not on estimates calculated from proxy variables. Second, they provide a consistent data set. So, for example, they show that since the first field survey in 2005 through the latest one in 2021, China's PPP for machinery and equipment has revealed lower purchasing power than that implied by the market exchange rate. This data is counter to the common perception in American national defense circles that PPP exchange rates will always imply greater purchasing power than the MER.
10. Personnel costs include both wages and consumables such as clothing and food, which determines non-salary compensation. We use available data on military salaries (50%) and the World Bank-published PPP for individual consumption (50%) to develop a PPP exchange rate for this category. There are reasonable arguments about how to estimate defense personnel costs. Our view is that personnel costs are not only wages and will include other items to support personnel. Furthermore, Chinese military wages themselves vary greatly between junior enlisted (typically conscripts with short terms of service and therefore the lowest effectiveness) and non-commissioned officers and officers (personnel with longer terms of service, better training, and higher effectiveness). Thus it is best to use actual military wage data where possible, rather than estimates. The use of PPP exchange rates assumes the comparison of "similar goods." Assuming that a Chinese officer or noncommissioned officer fulfills the same functions at the same level of effectiveness as a U.S. counterpart is questionable. Therefore China's cost advantages for personnel must be adjusted for relative productivity (effectiveness). The gap in a specialized subsector such as defense is likely to be greater than the overall labor productivity gap at the national economy level. Most importantly of all, low wage

personnel are among the least lethal military capabilities – much less relevant for comparison to the the United States than spending on equipment and technology, which represent the most lethal military capabilities.

11. Operations and training reflect a combination of military expenses including fuel (at market exchange rates), military consumables like ammunition (at a general economy-wide PPP), and items such as maintenance and repairs, temporary shelter, and consumables (at a consumption PPP). We use these three exchange rates in equal parts. This more sensibly corresponds to a PPP for military activities than a general economy-wide PPP estimate alone.
12. It is important to keep balance in the analysis. If sector-specific PPP exchange rates for labor are used for labor-related spending, then the market exchange rate or sector-specific PPPs should be used for items such as equipment. The most lethal and advanced military equipment and weapons systems depend on components, technologies, and manufacturing equipment that are globally competitive and internationally traded. So, there is a plausible argument for using the market exchange rate for the equipment budget. Alternatively, one could try to break the equipment budget into less capital-intensive and more capital-intensive components each using a different appropriate PPP exchange rate, or one could use a combination of the equipment PPP and the MER. However, the World Bank equipment PPP has advantages: it is based on actual price data collected in the field data surveys from 2005-2021. This PPP category has consistently shown lower purchasing power for machinery and equipment than China’s MER since field surveys were started in 2005, and the equipment PPP may better reflect the cost China actually faces in closing the gap with advanced Western weapons systems. Although the market exchange rate could be a reasonable alternative, in this estimate we use the World Bank’s published equipment PPP exchange rate to convert the relative purchasing power of the equipment portion of China’s military budget.
13. For paramilitary forces, including both the People’s Armed Police (PAP) and the Chinese Coast Guard, we assume a roughly even (1/3 each) allocation between personnel, operations and training, and equipment. We apply the overall simple average of the PPP exchange rates we used for the defense budget (this equals 5.95 RMB to 1 USD). One could reasonably assume alternative allocations for personnel, operations & training, and equipment for the PAP and Coast Guard. Also, one could attempt to use a weighted average PPP exchange rates based on those allocations. We chose to keep it simple in this example.
14. For additional defense R&D, which relies on advanced equipment as well as skilled (and often foreign-trained) scientists and engineers, we apply the market exchange rate. The best scientists, engineers, and researchers in China command salaries and benefits far above typical Chinese wage levels, approaching international compensation levels.
15. For additional payments to retired and demobilized veterans, we employ the same PPP exchange rate as that associated with the personnel portion of the military budget.
16. We use the World Bank-published PPP exchange rate for construction when converting defense construction.

#### **Additional notes and data:**

- Arms imports: Now considered to be in the official defense budget
- Commercial earnings of the PLA: No longer exist at scale.
- Subsidies to arms industry: Considered to be negligible now post economic reforms and the general profitability of state enterprises
- Local support to the People’s Armed Police (PAP): Now considered to be in the PAP budget.
- The above notes/assumptions are consistent with Gilboy and Heginbotham (2012), and benchmark with the methods now adopted by other sources who also examine Chinese-language sources and data (e.g., SIPRI).

#### **World Bank PPP exchange rates used in our TNSR essay**

#### **2017 survey, published in 2020**

Yuan per U.S. dollar

1000000: GROSS DOMESTIC PRODUCT	4.18
1501100: MACHINERY AND EQUIPMENT	9.33
1501200: CONSTRUCTION	2.31
9020000: ACTUAL INDIVIDUAL CONSUMPTION	4.05

Source: <https://www.worldbank.org/en/programs/icp/data>

**Other PPP calculations and exchange rate assumptions used in in our TNSR essay**

Category Label	Value (Yuan/USD)	Calculation	Comment
Market Exchange Rate (MER)	7.20	n/a	As of end May 2024
Military Wage PPP	2.70	n/a	We base this on actual Chinese military wage data we collected in 2023.
Personnel PPP	3.38	$=(2.70+4.05)/2$	50% military wage PPP and 50% actual individual consumption PPP
Ops & Training PPP	5.14	$=(4.18+7.20+4.05)/3$	One third each of the GDP PPP, the MER, and the actual individual consumption PPP
People, Ops, Equip. PPP	5.95	$=(3.38+5.14+9.33)/3$	One third each of Personnel PPP, Ops & Training PPP, and Equipment PPP

**World Bank revisions to the 2017 PPP price series, published in June 2024**

World Bank PPP exchange rates	<u>2017 survey, published in 2020</u>	<u>2017 survey, revised June 2024</u>
Yuan per U.S. dollar		
1000000: GROSS DOMESTIC PRODUCT	4.18	4.04
1501100: MACHINERY AND EQUIPMENT	9.33	9.29
1501200: CONSTRUCTION	2.31	2.18
9020000: ACTUAL INDIVIDUAL CONSUMPTION	4.05	3.85

Source: <https://www.worldbank.org/en/programs/icp/data>

If used in our calculations, the revised 2017 PPP data would produce a 2% increase in estimated Chinese 2024 defense spending compared to our estimate for China's 2024 defense spending as published in the *Texas National Security Review*.