Using Financial Analysis to Compare Defense Budgets

Theodore MacDonald
United States Military Academy, West Point

Many in the United States are unaware of, let alone see issues in the programming, use and return of the defense budget. This paper takes many commonly accepted financial analysis frameworks and applies them to defense budgets to address those topics with both qualitative and quantitative approaches. Assurances about the US spending far more than anyone else or more than any basket of countries combined on defense are not what they appear, and more spending is not the answer. This paper also proposes a defense-specific framework for measuring return on equity and value. Last, investment theories provide a discussion on what the future may bring. These analyses are all done for the United States and the People's Republic of China using open-source data. Those in the United States and the West can use these findings from a financial lens to view the status quo differently, especially as the findings are not very favorable for the United States and its allies.

Keywords: defense economics, public budgeting, return on equity, value chain, investment theory

INTRODUCTION

If the United States Department of Defense were a firm, one might ask if it maximized value for its shareholders – the American people and our allies and partners. While clearly different in nature, firms and the DOD share an obligation to pursue abstract goals: for the former, it is to "maximize value for its shareholders," and for the latter, it is to "provide the military forces needed to deter war and protect the security of the United States." This is not to say that the DOD is failing to deter or provide security for the nation and our allies, the question shareholders rightfully ask is if it *maximizes value* given the finite resources it has. Viewing the DOD in a financial lens can offer an alternative view of how it could maximize value with its available resources and why this view is critical given the United States' current fiscal position and state of competition.

It is not only important in a fiduciary sense to maximize return on taxpayer dollars - especially in the interest of national security - but also given contemporary fiscal challenges. Many federal agencies ask for a larger budget, all armed services compete for finite defense spending, and the country has run at a deficit since 2001 (US Department of Treasury (USDOT), 2023). Total US national debt is at unprecedented levels with little indicators that it will slow (let alone decline), causing some to worry about the long-term assuredness of the USD as the world's reserve currency (US Council of Economic Advisors, 2024; Dollar Dominance, 2023). The Debt to GDP ratio is at a level unseen since the Cold War (US Office of Management and Budget, 2024). The Congressional Budget Office (CBO) forecasts annual interest expenses to increase from $739bn in 2024 to $1.4tr by 2033 (CBO, 2023). With these circumstances, advocating for increased defense budgets in a vacuum incurs much risk. However, by looking for *value*,

the DOD and Congress can find ways to maximize dollars spent while minimizing the risk of perverse fiscal outcomes.

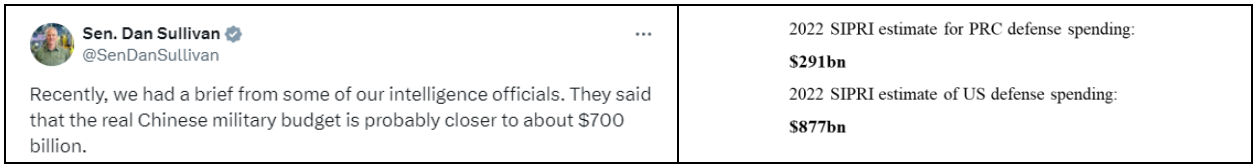
While unorthodox, this paper views US defense spending through four financial lenses that offer an alternative way to evaluate its efficacy compared to the "pacing threat" of the People's Republic of China: "effective" budgets, value chain analysis, "defense ROE," and investment theory. The results of these frameworks offer that the US does not hold as much of a relative advantage as some may think, seeking to head off strategic narcissism and a rude awakening in the future.

ANALYSIS

Effective Budgets

The first analysis is an "effective budget" which aims to arrive at a more "apples-to-apples" comparison of stated budgets. Imagine firms in separate countries have material differences in purchasing power, inflation, and corporate tax rates. Just comparing their reported earnings fails to capture what those earnings mean for the firm. The Stockholm International Peace Research Institute (SIPRI) compiles the gold standard of military expenditure data and makes certain adjustments to reported defense spending in its set. While very comprehensive, it does not adjust for inflation, purchasing power, and how countries organize defense activities (SIPRI, 2024). Although SIPRI reported data shows that the US spends three times more than the PRC for defense, additional adjustments suggest the effective budget is likely only 15-35% greater.[1]

FIGURE 1
MOTIVATION



The effective budget methodology began with the reported SIPRI defense spending as the "top line." Publicly traded American and Chinese defense prime financial filings provided average net, EBIT and EBITDA margins (SIPRI Top 100 arms companies, 2021; Disfold, 2024; Standard & Poor's Global Market Intelligence, 2023).[2] These margins constitute what private defense firms retain as earnings, and, therefore do not directly contribute to the production of goods and services for their respective military. While some margin is required for solvency, uncertainty, and to manage the cost of debt, differences across states can also contribute to differences in production per dollar. Interestingly, margins expectedly decrease when moving down the income statement for American firms, yet not for all Chinese ones. The way margins increase before and after interest and/or tax could suggest state support in exchange for smaller margins for some Chinese defense primes.

FIGURE 2A
UNITED STATES DEFENSE PRIME MARGINS BY COMPANY

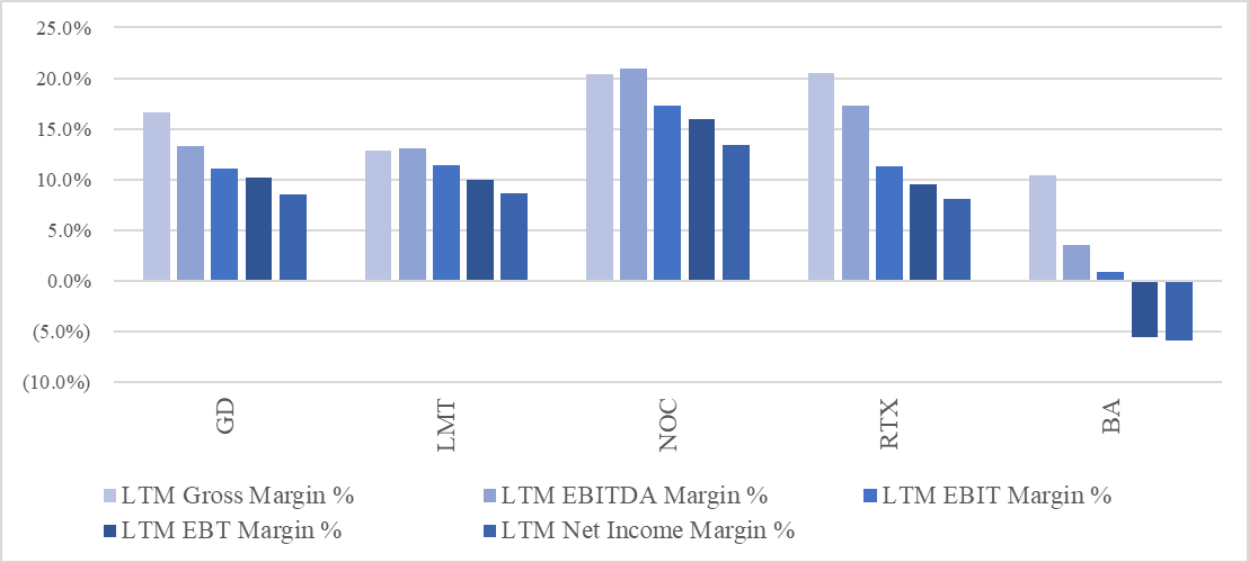
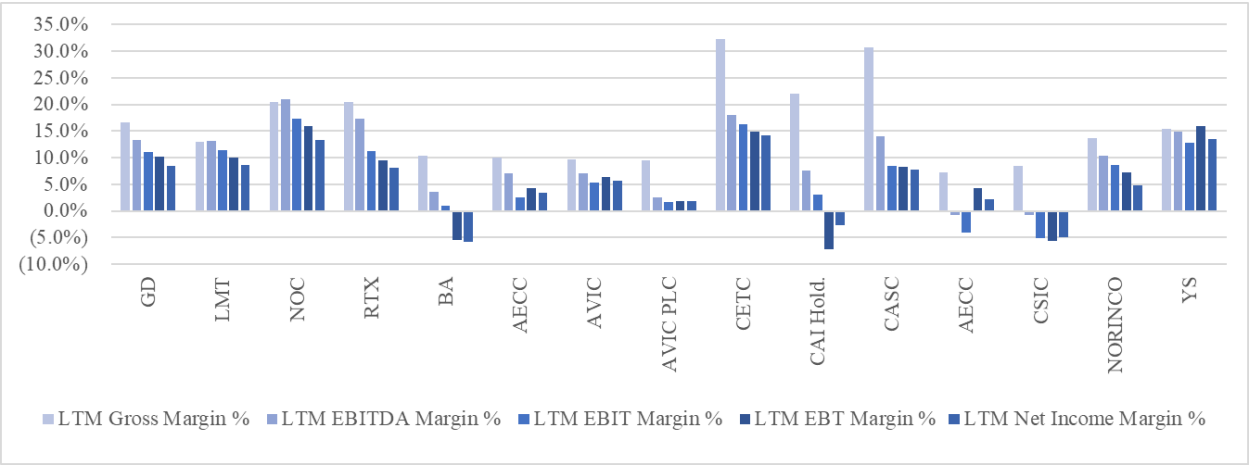


FIGURE 2B
PRC DEFENSE PRIME MARGINS BY COMPANY



Removing items considered capital expenditures (procurement and acquisition costs) leads to a "free cash flow" figure (USDOT Government Spending Explorer, 2022; SIPRI, 2021).[3] It is important to note that it is an approximation given the opaqueness of PLA spending. However, given "Civil-Military Fusion" (CMF – elaborated on in Value Chain Analysis), it is impossible to discern what is defense-related spending or not, even if not by the PLA explicitly. This is the budget remaining for current operations (detailed examination of CapEx is in the investment portion). Adjusting for inflation arrives gives a real FCF (International Monetary Fund, 2023). The largest adjustment came from a defense-specific purchasing power parity (PPP) Dr. Peter E. Robertson calculated. His work provides a defense sector PPP based on defense specific input prices, which differs from that of other databases (Robertson, 2022).

Finally, an efficiency adjustment came from potential differences in budget programming efficiency (not outcomes).[4] Industrial organization literature suggests that functional and divisional industrial organization have efficiency strengths and weaknesses, with strongly led, hybrid organizations perhaps

offering the best of both (Ragozina et al, 2020; Virollina, 2023). A major assumption is that if defense spending takes up a greater share of total national security spending, it will likely be less redundant. It is much easier to deconflict duplication of effort with three entities than two dozen, especially when the same few people in the CCP control multiple entities.

The US national security apparatus is more divisional as it encompasses 18 members in the intelligence community, the armed services, homeland security, and parts of the Department of Energy and NASA. The national security budget included appropriate parts of the non-DOD department budgets (USDOT Spending Explorer, 2022; Office of the Director of National Intelligence (ODNI), 2022). However, the PRC tends closer to a hybrid approach, with all national security activities controlled by just the Central Military Commission (CMC), Ministry of National Security (MNS), and Ministry of State Security (MSS). The PRC total national security budget included appropriate parts of the MNS and MSS budgets (Center for Security and Emerging Technology (CSET), 2022; Center for Strategic and International Studies (CSIS), 2023).

$$Efficiency\ Adjustment = \frac{Total\ Defense\ Budget}{Total\ National\ Security\ Budget} \quad (1)$$

After this final adjustment, data suggest that instead of a 200% greater defense budget than SIPRI data suggests, the United States defense budget is effectively only 17-35% greater than the PRC (ranging for most to least conservative estimates). Going by reported values alone may lead some to conclude that the United States has a sustainable spending advantage, but these findings do not support that. There are limits to this analysis, however. Adjusting for effective budgets says nothing about *how* it is used, or the effectiveness of what it is spent on. Also, "revenue is vanity" as it tells an incomplete story, especially regarding spending outcomes. That is where the concepts of value and return come in.

TABLE 1
EFFECTIVE BUDGET FINDINGS ($bn)

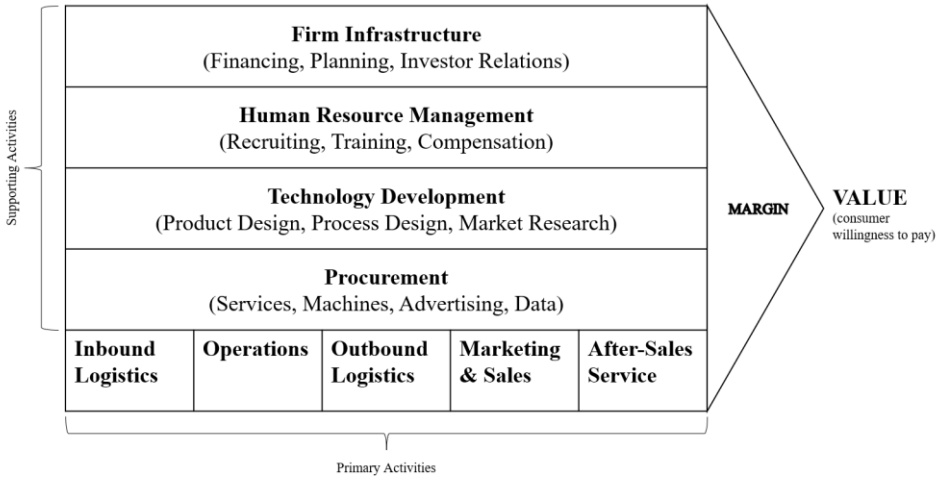
	US	PRC	Difference	
Total Defense Budget ($m)	$876,943.20	$291,958.43	**$ 584,984.77**	**3.00x**
Less Primes Net Margin	6.54%	4.57%		
Net Budget	819,591.11	278,613.01	**540,978.11**	**2.94x**
Less Primes EBIT Margin	10.40%	4.96 %		
EBIT Budget	785,741.11	277,477.29	**508,263.82**	**2.83x**
Less Primes EBITDA Margin	13.6600	7.99%		
EBITDA Budget	757,152.76	268,630.95	**488,521.81**	**2.82x**
Growth CapEx	166,102.49	58,391.69		
Growth FCF	591,050.27	210,239.26	**380,811**	**2.81x**
Growth FCF Margin	67.40%	72.01%		
Growth & Maintenance CapEx	310,944.27	87,587.53		
Growth & Mx FCF	446,208.49	181,043.42	**265,165.07**	**2.46x**
Free Cash Flow Margin	50.88%	62.01%		
Inflation	4.90%	0.90%		
Real FCF (adj.)	424,344.27	179,414.03	**244,930.24**	**2.37x**
Real FCF Margin	48.39%	61_45%		
Defense PPP adjustment	1	1.73		

	US	PRC	Difference	
FCF, real, PPP adj.	424,344.27	309,617.76	**114,726.51**	**1.37x**
PPP adj_ Real Margin (0/0)	48.39%	106_05%		
Budget Efficiency (high estimates)	77.39%	90.83%		
FCF, real, PPP and Efficiency Adjusted	328,418.40	281,235.73	**47182.67**	**1.17x**
PPP & Efficiency adj_ Real Margin (0/0)	37.45%	96.33%		

The Value Chain

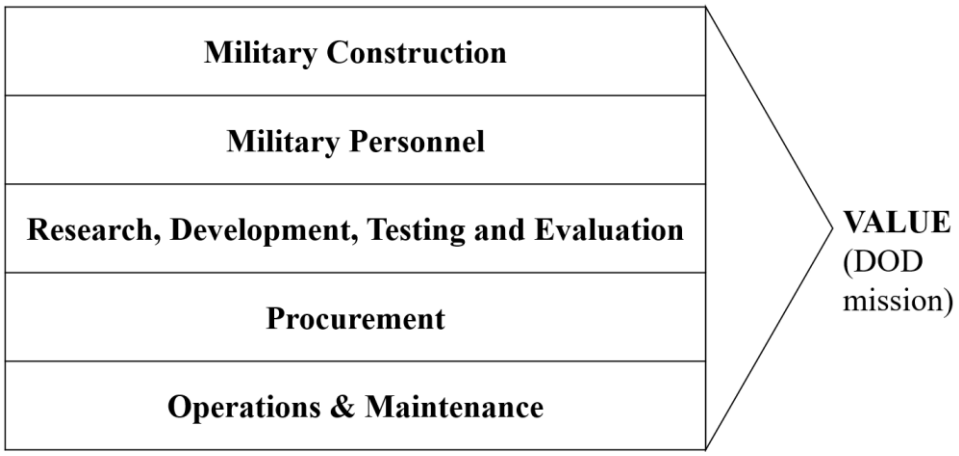
Developed by Dr. Michael Porter at Harvard Business School, the value chain "disaggregates a company into its strategically relevant activities to focus on the sources of competitive advantage" that flips the paradigm of an "activity not just as a cost, but as a step that has to add some increment of value to the finished product or service" (Stobierski, 2020). In a commercial application, if the primary and supporting activities add value, then a customer's willingness to pay should be greater than the total cost, and a firm will be profitable. Applying this framework to defense searches for where value is created or lost would offer a qualitative relative comparison between national systems.

FIGURE 4
VALUE CHAIN METHODOLOGY



The DOD already has a taxonomy of budget categories: Research, Development, Testing and Evaluation (RDT&E), Procurement, Operation and Maintenance, Military Personnel, and Military Construction. As activities require resources, these budget categories then can serve as analogues for Dr. Porter's activities in a defense budget value chain. The value here is not consumers' willingness to pay, but the value of how effectively the DOD accomplishes its mission with the resources at its disposal.

FIGURE 5
DEFENSE VALUE CHAIN METHODOLOGY



These activities take place in what Tai Ming Cheung and Thomas Mahnken refer to as an "anti-statis techno-security system" that was sufficient during the Cold War given public primacy, but now faces a "gap between the public and private sectors and the federal government's status as a late adopter of new technology from the commercial sector" (Cheung, 2023). While each category could receive special attention, it is important to focus on two specifically: RTD&E and Procurement. All services in the DOD are facing periods of expensive materiel transformation, and as described the perverse outcomes of adding to debt make seeking value a critical effort.

Unfortunately, DOD bureaucratic challenges in these two activities cause much value loss. Add to this that the PRC notably reportedly has a "global lead in 37 out of 44 critical technologies," and CCP-directed CMF contributes to the sense of urgency (Gaida, 2023; Kania, 2021, United States Department of State (USDOS), 2021). There are dozens of problems that each deserve special attention, and when viewed in a market sense, they all reduce to two distortions: high transaction costs on the supply side, and the perverse outcomes of monopsony power on the demand side. J. Ronald Fox of Harvard sums it up below (Fox, 2011):

> *"Despite the many studies and the similarity of their findings, major defense programs still require more than fifteen years to deliver less capability than planned, often at two to three times the initial cost. Most attempts to implement improvements in the management of the defense acquisition process during the past fifty years have fallen short of their objectives. It is increasingly evident that barriers to improving the acquisition process derive, not from a lack of ideas, but from the difficulties encountered by senior government managers (in Congress as well as in the Department of Defense) in identifying and changing counterproductive incentives for government* [demand] *and industry* [supply]*."*

For far too many suppliers, the problem is simple: the costs of pursuing a new program of record outweigh the expected benefits. The defense acquisition process is too long and complex, and offers poor returns for the risks taken. Defense primes have sufficient capital to overcome barriers to entry. They can remain solvent over a long process, achieve scale after project approval (although surging capacity for programs of record for unexpected proxy conflicts has proved challenging), and have a proven record of fulfilled contracts over decades. However, cost-plus contracting limits financial upside, and the risks of fixed-cost contract overruns disincentivize participation even by primes (Cameron, 2024). Other (startup/ venture backed, smaller, dual-purpose, and niche) firms with novel, critical technologies far too often

cannot bridge the "valley of death" that is the protracted process of passing production milestones, becoming a program of record, and then scaling as fast as possible (McNamara, 2024).

Beyond competition and completion, technological, and obsolescence risks, the defense sector faces unique, bureaucratically imposed financial risk. Despite the United States retaining the deepest capital markets in the history of the world, the uncertainty and limited upside of future cash flows and their steep discounting due to the protracted process make the opportunity cost of investing in defense very high. There are also additional compliance costs regarding clearances, intellectual property ownership and validating investors and supply chains (Nicastro, 2023). Combined, these factors disincentivize suppliers from participating as costs are tangible and while future benefit may be attractive, it is far from certain.

On the demand side, the DOD (along with other parties involved with national security spending) operates in an obsolete monopsony with nearly all of the leverage. This creates market inefficiency by distorting outcomes and creating deadweight loss (fewer transactions than ought to otherwise happen; and in this case, perhaps less innovation). The market suppliers face is not only solely determined by their customers (select national security members), but their main customer legally prevents them from selling select material to anyone else. While there are valid national security reasons for this, it gives the DOD little to no incentive to adapt when suppliers must play by their rules to participate in the market (Feenstra, 1980; Barr, 2008). There are also demand signaling issues such as how far into the future Congress can feasibly and constitutionally authorize funding (especially for the Army), and rigid restrictions on shifting appropriations post facto. Recurring continuing resolutions adds noise with downstream effects.

Unfortunately, the DOD acquisition system is a Frankenstein of mismatched sub-systems: a planning, programming, budgeting, and execution (PPB&E) process that is calendar driven; a joint capabilities integration development system (JCIDS) that is capability/needs driven; and a defense acquisition system (DAS) that is event driven. This is like if an individual (DOD / Executive) asked their financial manager (Congress) to plan to purchase a car (materiel) with an internal combustion engine five years from now. After a 10-year testing and purchasing process, the car is more expensive than what they expected. It was also now obsolete due to electric vehicles. Despite the opportunity to save money and get the new item, the person must purchase it anyway because they do not have the authority to deviate from the programmed budget. If that is confusing, that is the point.

Last, there also exist incentive misalignments, such as with acquisition teams prioritizing compliance with an acquisition system that is so complex there is a university for it, and not the urgency to move at the "speed of relevance" (DOD, 2018). Congress has scar tissue from failed major acquisition programs (as well as parochial interests). Still, their view remains fixed on "wasted money" and concerns of war profiteering instead of the value lost to the American taxpayer in such a broken system.

Compare the above to the PRC. First introduced by Deng Xiaoping, President Xi Jinping now chairs the Central Commission for Military-Civil Fusion Development which seeks to "break down barriers between civilian and military sectors… to achieve military dominance" (USDOS, 2021; Kania, 2021). This allows the state to coordinate activities across academia, private, and public enterprises in manners that many in the West simply cannot or will not do (e.g., those opposed to industrial policy and "picking winners"). Former Assistant Secretary of the Air Force for Acquisition (Contracting) MG Cam Holt unofficially estimated that the PLA's acquisition process is "five-to-six times faster" than the DOD (Holt, 2022). However, the PRC, too, faces completion, technological and obsolescence risk. Also, even a top-down approach still requires the state to "back the right horse" and the risk of misallocating capital (although they might also confirm infeasibility quicker). The PRC also allocates many resources to anti-corruption endeavors, and a top-down approach also does not guarantee flawless execution across the entire chain.

Cheung and Mahnken again write that "the clash between these systems…calls into question how each system will adapt…to meet the demands of strategic inter-state competition." Market distortions in an "iron triangle" (industry, DOD, congress) will never be how private firms operate, and for good reason. However, the best way to outpace CMF in the PRC is to harness the merits of defense and dual-use market solutions in the United States to their fullest capacity. Proxy conflicts worldwide exposed concerns and placed even more strain on the US defense industrial base that over time became very lean and concentrated. That is all

without discussing the cost of excess capacity for stocks and the unprecedented threat to the defense industrial base in the homeland. While there are encouraging programs in nascent stages such as the Defense Innovation Unit (DIU) and the Office of Strategic Capital (OSC), their authorities and funding are not yet sufficient to make a significant difference without bold reforms (Silicon Valley Defense Group, 2023). Actors respond to incentives, and if the paradigm shifts from preventing waste and limiting war profiteering to creating value and overcoming parochial interests, private and public alignment can surely follow and benefit Americans.

Defense ROE

While the value chain provides qualitative analysis, return on equity (ROE) analysis provides a complementary quantitative one. ROE is a function of profitability, efficiency, and financial leverage (how concentrated a firm's equity is amongst shareholders). This is useful in finance as instead of relying just on revenue and/or earnings, it allows the user to determine the value equity holders receive based on their invested capital. While the DOD does not seek profit or to optimize its capital structure, the concepts of profit, efficiency and leverage can still apply. For profit, how much of the programmed defense budget results in the actual goods or services, rather than what becomes margin for firms or is stolen by adversaries? How well is the DOD budget aligned for maximum efficiency and minimum redundancy within all national security spending? Last, how many "shareholders" (citizens, and allies) is a nation obligated to defend? When dividing a pie, the fewer the people the greater the share. The DOD divides the entire globe between combatant commands, while the PLA divides its own country into regions with a much narrower relative scope into the Indo-Pacific theater.

With this, a proposed "defense ROE" began with "top-line" defense budgets (USDOT, 2022; SIPRI, 2023).[5] Intellectual property theft figures came from the Commission on the Theft of American Intellectual Property, and the same industry margins from effective budgets (National Bureau of Asian Research, 2017, S&P Global, 2023). The remaining figure divided by the original figure served as the profitability metric. Efficiency came from the same efficiency adjustment as effective budgets. Last, the percent of global military expenditure from SIPRI over the percent of global population of each country plus those they have a mutual defense treaty served as leverage (SIPRI, 2023; USDOS, 2017; World Bank Database, 2023; Office of Central Intelligence, 2023).

$$ROE = f[Profitability, Efficiency, Leverage)] \tag{2}$$

$$Financial\ ROE = Net\ Margin * Asset\ Turnover * Equity\ Multiplier \tag{3}$$

$$Defense\ ROE = Defense\ Margin * Efficiency\ Adjustment * MilLeverage \tag{4}$$

$$Defense\ Margin = \frac{Net\ Budget}{Total\ Defense\ Budget} \tag{5}$$

$$Net\ Budget = Total\ Defense\ Budget - IP\ Theft - Industry\ Margin \tag{6}$$

$$MilLeverage = \frac{\%\ Global\ MilEx}{Global\ Obligation} \tag{7}$$

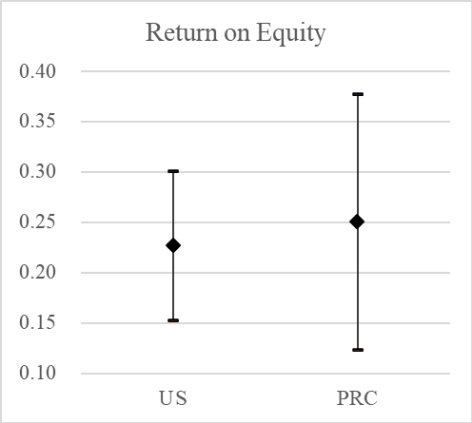
$$Global\ Obligation = \%\ of\ Global\ Population\ in\ country + allies \tag{8}$$

TABLE 2
DEFENSE ROE FINDINGS ($bn)

		US		PRC
Defense Budget	$	989.76%	$	291.96
IP Theft %		1.66%		0.00%
Prime EBITDA Margin		13.66%		7.99%
Defense Margin (low)		**84.68%**		**92.01%**
Defense Industry Avg. Net Margin		6.54%		4.57%
Defense Margin (high)		**91.80%**		**95.43%**
National Security Budget (high est.)	$	1,460.08	$	552.48
Budget Centralization (low est.)		**67.79%**		**52.84%**
National Security Budget (low est.)	$	1,278.85	$	321.42
Budget Centralization (high est.)		**77.39%**		**90.83%**
% of Global Defense Spending (low- PPP)		26.00%		13.22%
% of Global Defense Spending (high - SIPRI)		39.71%		17.00%
High World Obligation		98.03%		52.34%
MilLeverage - Highly Levered		**26.52%**		**25.26%**
Low World Obligation		93.91%		39.12%
MilLeverage - Low Leverage		**42.28%**		**43.46%**
Defense ROE* (low)		**15.23%**		**12.28%**
Defense ROE* (high)		**30.04%**		**37.67%**

With these inputs, the United States defense ROE ranged from 0.15 to 0.30 with a mean of 0.23; while the PRC ranged from 0.12 to 0.38 with a mean of 0.25. The drivers of these overlapping ranges were the opaqueness of PRC spending, less margin in PRC defense primes, a more centralized (efficient) national security budgeting process in the PRC CMC; and the United States outsized amount of mutual defense treaties and China's large internal population that add to the "world obligation" figures (USDOS, 2017; Bennett, 2023). While this paper does not venture into a political science discussion on burden sharing and domestic stability in autocracies, that is a great topic for further research. What is most concerning is that in a large-scale combat scenario, how would China's population respond - would they rally and require fewer resources for internal stability, and thereby free up resources for external conflict? If so, the ROE measures may skew even more in favor of the PRC.

FIGURE 6
ROE FINDINGS (MEAN, HIGH, LOW)



ROE is also an input to forecast a sustainable growth rate for a firm based on how much it invests for the future. With this, the final piece of the analysis includes growth and investment theory.

Investing and Capability Growth

Sustainable Growth Rate

At the end of a period, firms decide how much of their earnings to return to investors in the form of dividends (payout ratio), and how much to keep as retained earnings (retention ratio). The product of a firm's retention ratio and its ROE is the sustainable growth rate (g) for a firm. This reduces a firm's need for outside financing which can add to debt burdens or dilute current equity holders. This analysis applies to defense spending as the proportion of RDT&E and procurement spending is analogous to a retention ratio (investing in current and future capability).

Within this retention ratio, it is also important to distinguish exactly what types of investment the funds go to. Major outlays for assets with useful lives greater than a year are known as Capital Expenditures (CapEx). Growth CapEx is for items considered new and not fully integrated (RDT&E); and maintenance CapEx is to upgrade and maintain items in operation (procurement). Each type also included a realized figure, which included technology transfer from the US to the PRC in the form of stolen IP (using the same percentage as effective budgets). Again, the findings were not encouraging for the United States. Using growth and maintenance CapEx as the low and high estimates of investment and the ROE ranges previously discussed, US growth forecasts ranged from 0.03 to 0.09, and the PRC ranged from 0.04 to 0.11.

$$Financial\ Sustainable\ Growth = ROE * Retention\ Ratio \tag{9}$$

$$Defense\ Sustainable\ Growth = Defense\ ROE * CapEx\ Ratio \tag{10}$$

$$CapEx\ Ratio = \frac{Specific\ type\ of\ CapEx}{Total\ Defense\ Budget} \tag{11}$$

While the findings largely overlap, the spread between just growth and growth + maintenance CapEx is worth exploring. Using the best estimate of PLA growth CapEx, it is a greater share of their total budget. Including maintenance CapEx adds a 15% share of the DOD budget (16.5% to 31.4%), but only a 10% share of the PLA budget (20.9% to 30.0%) (USDOT, 2023; SIPRI, 2021). This makes sense, as the DOD has a larger maintenance burden with expensive legacy programs (3rd to 5th generation fighters; aircraft carries and nuclear-powered submarines; strategic bombers; the "Big 5" Army programs; and the nuclear triad). For various reasons, the PRC either could not or decided not to invest in such programs (sometimes

due to lack of ability or funding, sometimes as a deliberate decision to invest in less expensive asymmetric threats) (Doshi, 2021). As the PLA budget was relatively even smaller decades ago, their path-dependent maintenance obligation is a smaller portion of their current budget.

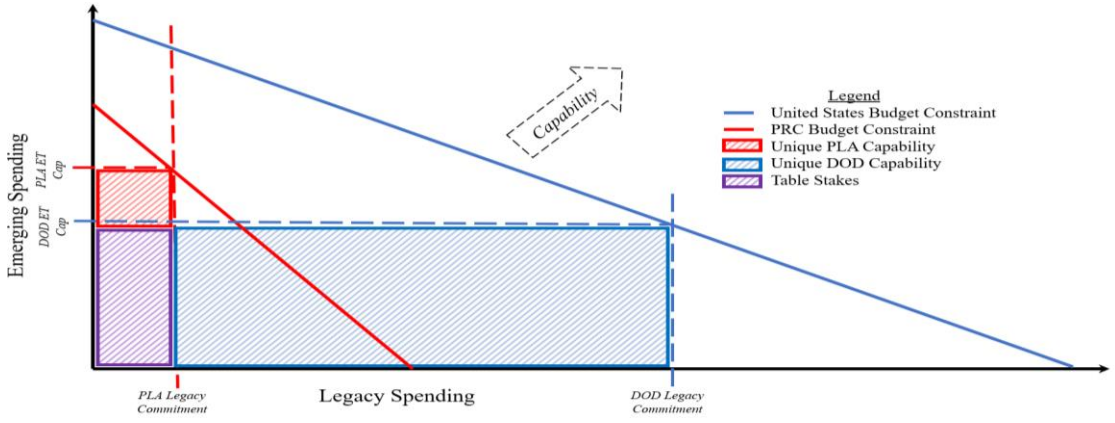
TABLE 3
SUSTAINABLE GROWTH RATE FINDINGS ($bn)

	US	PRC
Budget	$ 989.76	$ 291.96
Growth CapEx	166.10	58.39
Growth CapEx % of Total Budget	16.78%	20.00%
Realized (not stolen) growth CapEx	163.34	61.15
Realized Growth CapEx % of Total Budget (low est.)	16.50%	20.94%
Growth & Maintenance CapEx	310.94	87.59
Growth & Maintenance Capex % of Total Budget (high est.)	31.42%	30.00%
Defense ROE* (low)	15.23%	21.89%
Defense ROE* (high)	30.04%	37.67%
Sustainable Growth Rate (g) low	**2.56%**	**4.38%**
Sustainable Growth Rate (g) high	**9.44%**	**11.30%**

Consumer Choice Theory

While there are multiple political science theories regarding state armament, in an economic lens consumer choice theory (where an actor with a budget constraint faces a decision to purchase various combinations of goods – in this case, legacy or emerging / asymmetric equipment) serves as a useful lens. In this case, even if the DOD budget constraint is nominally larger, it also must program a larger share of that budget to maintain existing programs of record. It is also often incredibly difficult to end programs before their planned retirement due to largely parochial interests (although it is unknown to what degree this exists in China) (Brose, 2020). However, the PLA has more flexibility to spend on emerging technology toward a desired future force. This is a very reductionist model about the decision between "legacy" and "emerging" investment. Also, the reality is not this discrete; it misses the chance of modifying existing equipment for greater capability (e.g., an existing rifle with the best sight available).

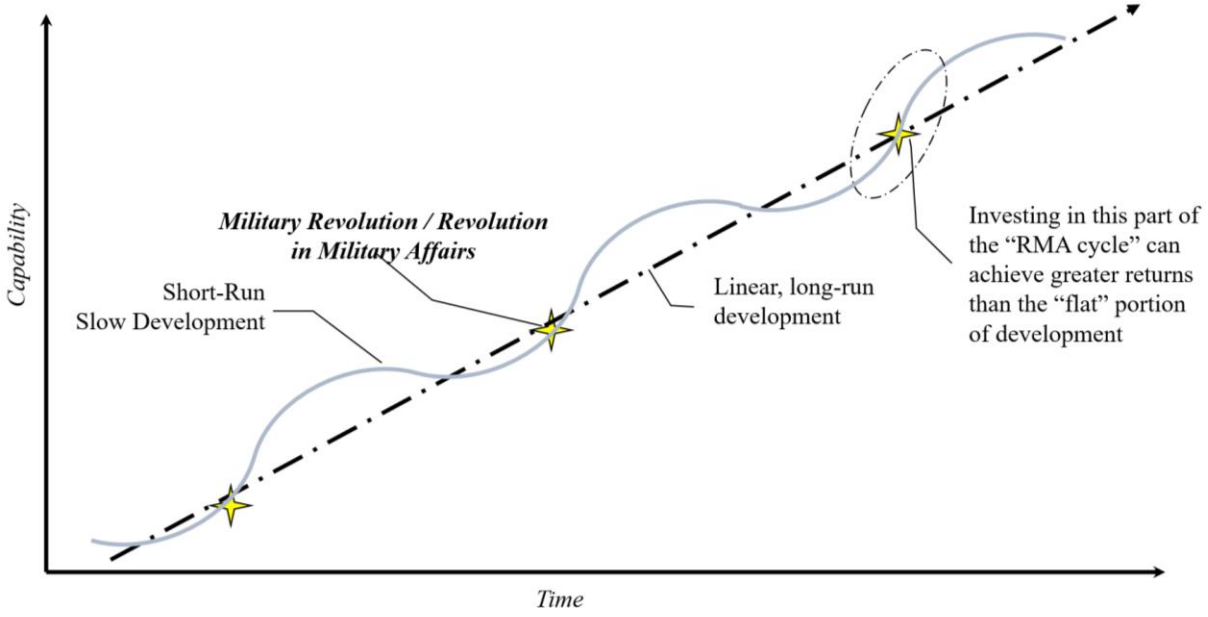
FIGURE 7
VISUALIZATION OF CONSUMER CHOICE FOR DOD & PLA



Sector Rotation

Complimenting sustainable growth forecasts and consumer choice theory is the concept of sector rotation with investing. Many investors weigh their portfolio across a variety of sectors based on where they think the economy is in the business cycle; underweighting sectors that do poorly at a certain phase and overweighting those that are set to grow (or minimize loss). This concept of a business cycle and sector rotation is also analogous to the study of military revolutions (MR) and revolutions in military affairs (RMA) (Knox, 2001). Whether the current change in conflict constitutes a MR or an RMA is left to the experts. However, it is irrefutable that the "fourth industrial revolution" of the internet of things with 6G, artificial intelligence, quantum, cyber, space, micro and biotech, materials and other technologies will transform security in every sense. The key point is that the evolution of military capability is not linear, and the point in the MR/RMA cycle that states decide to invest determines the outcomes they will realize. In a financial sense, this is like seeking to maximize return on investment (ROI). The return is higher when capital is allocated in the nascent stage of growth, or in this case, a MR/RMA.

FIGURE 8
VISUALIZATION OF NON-LINEAR CAPABILITY DEVELOPMENT



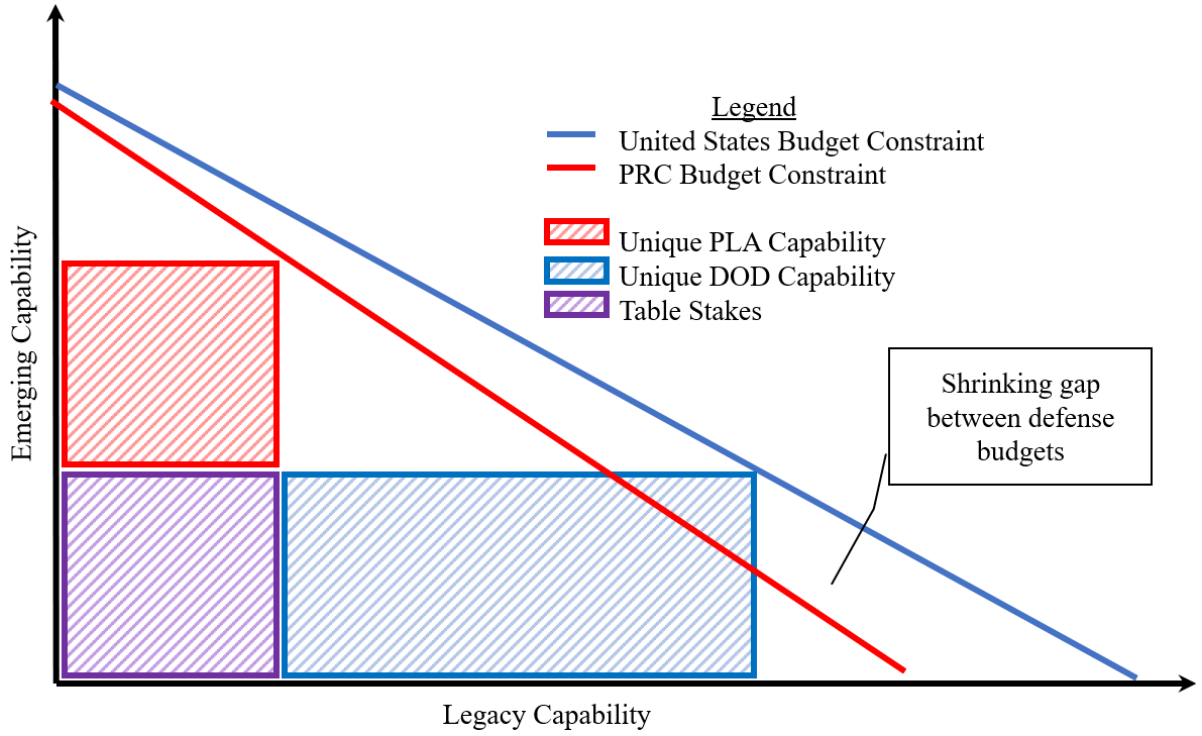
Combining

The PRC's current position regarding sustainable growth, budget flexibility, critical technologies, the relative greater intent and ability for the CMC / PLA to invest in asymmetric and emerging capabilities, and doing so in the onset of another industrial revolution is concerning. While its economy is currently showing some structural issues (and there is skepticism regarding reported data), China is still an emerging economy. Emerging economies traditionally grow at faster rates than developed ones (US), and can allow governments to grow spending at faster rates as well (World Bank, 2024; Prasad, 2023; Kennedy, 2023). Even if the DOD nominal budget remains greater, the PRC defense budget has grown 10.86% on average since 1989 compared to 3.25% for the US, and these factors may result in total capability convergence (SIPRI, 2023).

It is also true that the relative "productivity per worker" in the DOD is likely higher than the PLA (i.e., the lethality of one servicemember given the capabilities at their disposal). However, it is well known the PRC will gladly trade long-range hypersonic missiles for destroying aircraft carriers, and wages for equal-ranking servicemembers are magnitudes different. A larger budget constraint may not offer the security some may think. Especially when the PLA can invest a larger share in emerging and asymmetric threats

and the DOD is even more constrained with legacy programs of record and parochial interests preventing their retirement.

FIGURE 9
VISUALIZATION OF CAPABILITY CONVERGENCE



CONCLUSION

There are many better informed on specific policy changes that could and should be enacted to allow the United States to better compete with China in the 21st century, especially beyond defense. This paper aims to offer analysis used by those in finance and business of the current and projected position of these two states in a "decisive decade" of that competition.

The DOD's budget is only 17 - 35% greater than the PLA, not three times as some data suggests. At best for the US, even when using budgets with a difference of three times, the returns on those budgets are at best equal to China's. Focusing on compliance with antiquated processes causes the budget to hemorrhage value, despite the deepest capital markets in the history of the world.

While the Chinese approach assumes shared and idiosyncratic risks, it certainly can coordinate decisively and potentially conserve value better than the US. It achieves equal if not better returns, especially if in conflict resources can shift from domestic stability to external combat operations. The CMC's fiscal flexibility and intent to continue to invest in critical technologies at a larger proportion of its budget at an inflection point of military capability expansion risks capability convergence.

Simply spending more will not fix the underlying issues and increases risks given the United States fiscal position. Not considering what this perspective financial analysis can offer risks strategic narcissism and a rude future awakening for America and allies. Price [a budget] is what you pay [spend] – value is what you get.

ACKNOWLEDGEMENT

The views expressed are those of the author and do not reflect the official policy or position of the United States Military Academy, the US Army, Department of Defense or the US Government.

ENDNOTES

1. SIPRI's report "A New Estimate of China's Military Expenditure" details their methods in detail. Starting with reported data (such as with every available country), SIPRI quickly reports the opaqueness and credibility of the data and includes estimates of other expenditures not reported in PRC or PLA self-reported figures.
2. The top publicly traded companies appearing both on the SIPRI Top 100 arms companies for Asia and Oceania and the Disfold largest Aerospace & Defense Companies in China report formed the PRC defense primes sample. Margin data retrieved from S&P Global's CapIQ database using the most LTM as of APR23 data for US and PRC publicly traded defense primes. While these firms do not comprise the entirety of either countries defense vendors, they do provide major end items and used as an average.
3. For the United States, the USDOT Government Spending Explorer offered a granular way to capture what growth and maintenance CapEx in financial terms. While using open-source material for DOD budget categories is also an option, the way the DOD categorizes spending is not the same. For example, parts are operational costs according to the DOD, but financially maintenance CapEx as it is maintaining an existing system. This was also the opaquest part of the PLA defense budget and only a best approximation. PLA CapEx estimates had to be backed out based on the SIPRI analysis "A New Estimate of China's Military Expenditure."
4. While other portions of the paper speak of value and returns, effective budgets are not intended to go beyond a method of arriving at what unlike budgets are in like terms. There is an entire field dedicated to the comparisons of numbers and effectiveness of personnel and equipment.
5. Again, USDOT Government Spending Explorer offered the best way to examine spending across multiple departments and is why the top line that includes all national security spend is different than the US figure in SIPRI.

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APPENDIX

UNITED STATES GLOBAL OBLIGATION CALCULATION

US		Mutual Defense Treaties, Countries Listed with population (thousands - only listed once if parties to multiple treaties)						Non-Treaty Bases / Other	
World Population (thousands - 2021)		NATO		Rio Treaty		ANZUS		Aruba	106.54
7,888,408.69		Albania	2,811.67	Argentina	45,808.75	Australia	25,688.08	Bahrain	1,463.27
US Population (thousands -2021)		Belgium	11,592.95	Bahamas	407.91			Bosnia & Herz	3,270.94
331,893.74		Bulgaria	6,877.74	Brazil	214,326.22	Philippine Treaty		Burkina Faso	22,100.68
		Canada	38,246.11	Chile	19,493.18	Philippines	113,880.33	Cameroon	27,198.63
Allies Only Population		Croatia	3,899.00	Colombia	51,516.56			Curacao	152.37
1,491,946.37		Czech Rep	10,505.77	Costa Rica	5,153.96	SE Asia		Djibouti	1,105.56
		Denmark	5,856.73	Dominican Rep	11,117.87	Thailand	71,601.10	Greenland	56.65
Allies + Ambiguous Population		Estonia	1,330.93	El Salvador	6,314.17			Iraq	43,533.59
1,530,291.58		Finland	5,541.02	Guatemala	17,109.75	Japanese Treaty		Jordan	11,148.28
		France	67,749.63	Haiti	11,447.57	Japan	125,681.59	Kenya	53,005.61
All Involved Population		Germany	83,196.08	Honduras	10,278.34			Kosovo	1,786.04
1,816,386.98		Greece	10,641.22	Panama	4,351.27	ROK Treaty		Kuwait	4,250.11
		Hungary	9,709.89	Paraguay	6,703.80	ROK	51,744.88	Niger	25,252.72
US % of World		Iceland	372.52	Peru	33,715.47			Oman	4,520.47
4.21%		Italy	59,109.67	Trinidad & Tobago	1,525.66	*Ambiguous*		Qatar	2,688.24
		Latvia	1,884.49	Uruguay	3,426.26	Israel	9,634.00	Saudi Arabia	35,950.40
Obligation to Allies		Lithuania	2,800.84	Venezuela	28,199.87	New Zealand	5,122.60	Seychelles	99.26
18.91%		Luxembourg	640.06			Taiwan	23,588.61	Singapore	5,453.57
		Netherlands	17,533.04					Syria	21,324.37
Obligation to Allies + Ambiguous		North Macedonia	2,065.09					Tunisia	12,262.95
19.40%		Norway	5,408.32					UAE	9,365.15
		Poland	37,747.12						
Obligation to All Involved		Portugal	10,325.15						
23.03%		Romania	19,119.88						
		Slovak Rep	5,447.25						
Seaborne Trade		Slovenia	2,108.08						
60-90%		Spain	47,415.75						
		Sweden*	10,415.81						
		Turkey	84,775.40						
		UK	67,326.57						

PEOPLE'S REPUBLIC OF CHINA OBLIGATION CALCULATION

PRC	Mutual Defense Treaty		Bases	
World Population (thousands - 2021)	DPRK		Cambodia	16,589.02
7,888,408.69	DPRK	25,971.91	Cuba	11,256.37
PRC Population (thousands -2021)			Djibouti	1,105.56
1,412,360.00			Myanmar	53,798.08
			Pakistan	231,402.12
Allies Only Population			Tajikistan	9,750.06
1,438,331.91				
Allies + All Involved Population				
1,762,233.12				
China % of World				
17.90%				
China obligation (allies only)				
18.23%				
China Obligation to World (all involved)				
22.34%				
Seaborne Trade				
30%				

US AND PRC PRIME MARGIN DATA

Company Name	Known As	Listed	Symbol	LTM Total Revenue	LTM Gross Profit	LTM Gross Margin %	LTM EBITDA Margin %	LTM EBIT	LTM EBIT Margin %	LTM Net Interest Exp.	LTM EBT	LTM EBT Margin %	LTM Income Tax Expense	LTM Effective Tax Rate	LTM Net Income	LTM Net Income Margin %
General Dynamics Corporation	General Dynamics	NYSE	GD	39,896.0	6,612.0	16.6%	13.3%	4,418.0	11.1%	(357.0)	4,067.0	10.19%	677.0	16.65%	3,390.0	8.50%
Lockheed Martin Corporation	Lockheed	NYSE	LMT	66,146.0	8,524.0	12.9%	13.1%	7,531.0	11.4%	(690.0)	6,613.0	10.00%	925.0	13.99%	5,688.0	8.60%
Northrop Grumman Corporation	Northrop Grumman	NYSE	NOC	36,602.0	7,474.0	20.4%	21.0%	6,338.0	17.3%	(506.0)	5,836.0	15.94%	940.0	16.11%	4,896.0	13.38%
Raytheon Technologies Corporation	Raytheon	NYSE	RTX	68,572.0	14,081.0	20.5%	17.3%	7,752.0	11.3%	(1,268.0)	6,566.0	9.58%	884.0	13.46%	5,539.0	8.08%
The Boeing Company	Boeing	NYSE	BA	70,538.0	7,343.0	10.4%	3.6%	608.0	0.9%	(2,545.0)	(3,900.0)	-5.53%	336.0	0.00%	(4,130.0)	(5.86%)

Summary Statistics	LTM Total Revenue	LTM Gross Profit	LTM Gross Margin %	LTM EBITDA Margin %	LTM EBIT	LTM EBIT Margin %	LTM Net Interest Exp.	LTM EBT	LTM EBT Margin %	LTM Income Tax Expense	LTM Effective Tax Rate	LTM Net Income	LTM Net Income Margin %
High	70,538.0	14,081.0	20.50%	21.00%	7,752.0	17.30%	(357.0)	6,613.0	15.94%	940.0	16.65%	5,688.0	13.38%
Low	36,602.0	6,612.0	10.40%	3.60%	608.0	0.90%	(2,545.0)	(3,900.0)	-5.53%	336.0	0.00%	(4,130.0)	-5.86%
Mean	56,350.8	8,806.8	16.16%	13.66%	5,329.4	10.40%	(1,073.2)	3,836.4	8.04%	752.4	12.04%	3,076.6	6.54%
Median	66,146.0	7,474.0	16.60%	13.30%	6,338.0	11.30%	(690.0)	5,836.0	10.00%	884.0	13.99%	4,896.0	8.50%

Company Name	Known As	Listed	Symbol	LTM Total Revenue	LTM Gross Profit	LTM Gross Margin %	LTM EBITDA Margin %	LTM EBIT	LTM EBIT Margin %	LTM Net Interest Exp.	LTM EBT	LTM EBT Margin %	LTM Income Tax Expense	LTM Effective Tax Rate	LTM Net Income	LTM Net Income Margin %
AECC Aviation Power Co.,Ltd	AECC	SHSE	600893	5,357.7	533.4	10.0%	7.1%	133.2	2.5%	46.62	224.9	4.20%	29.62	13.17%	183.1	3.42%
AVIC Shenyang Aircraft Company Limited	AVIC	SHSE	600760	6,200.5	598.5	9.7%	7.1%	335.1	5.4%	36.08	396.5	6.39%	44.13	11.13%	351.8	5.67%
Avicopter Plc	AVIC PLC	SHSE	600038	3,043.6	289.4	9.5%	2.5%	49.1	1.6%	(0.08)	55.2	1.81%	(1.25)	0.00%	56.3	1.85%
CETC Acoustic-Optic-Electronic Technology Inc.	CETC	SHSE	600877	226.0	73.1	32.3%	18.0%	36.9	16.3%	1.49	33.5	14.82%	1.26	3.76%	32.2	14.26%
China Aerospace International Holdings Limited	CAI Hold.	SEHK	31	573.4	126.0	22.0%	7.5%	17.4	3.0%	(4.98)	(41.5)	-7.24%	(9.3)	0.00%	(15.3)	(2.66%)
China Avionics Systems Co.,Ltd.	CASC	SHSE	600372	1,615.6	497.5	30.8%	14.0%	136.6	8.5%	(17.83)	133.7	8.28%	3.44	2.57%	125.9	7.79%
China CSSC Holdings Limited	AECC	SHSE	600150	8,678.6	625.3	7.2%	(0.8%)	(349.7)	(4.0%)	410.21	363.9	4.19%	168.73	46.37%	182.9	2.11%
China Shipbuilding Industry Company Limited	CSIC	SHSE	601989	6,479.4	552.4	8.5%	(0.8%)	(329.1)	(5.1%)	10.04	(365.4)	-5.64%	(16.36)	0.00%	(325.2)	(5.02%)
Norinco International Cooperation Ltd.	NORINCO	SZSE	000065	1,940.1	266.6	13.7%	10.4%	167.1	8.6%	-	139.4	7.19%	23.42	16.80%	91.9	4.73%
Yangzijiang Shipbuilding (Holdings) Ltd.	YS	SGX	BS6	2,990.3	461.7	15.4%	14.9%	382.5	12.8%	35.25	477.0	15.95%	97.85	20.52%	405.5	13.56%

Summary Statistics	LTM Total Revenue	LTM Gross Profit	LTM Gross Margin %	LTM EBITDA Margin %	LTM EBIT	LTM EBIT Margin %	LTM Net Interest Exp.	LTM EBT	LTM EBT Margin %	LTM Income Tax Expense	LTM Effective Tax Rate	LTM Net Income	LTM Net Income Margin %
High	8,678.6	625.3	32.30%	18.00%	382.5	16.30%	410.2	477.0	15.95%	168.7	46.37%	405.5	14.26%
Low	226.0	73.1	7.20%	-0.80%	(349.7)	-5.10%	(17.8)	(365.4)	-7.24%	(16.4)	0.00%	(325.2)	-5.02%
Mean	3,710.5	402.4	15.91%	7.99%	57.9	4.96%	57.4	141.7	5.00%	34.2	11.43%	108.9	4.57%
Median	3,017.0	479.6	11.85%	7.30%	91.2	4.20%	10.0	136.6	5.30%	13.4	7.45%	108.9	4.08%

Select US - PRC Comparisons	LTM Gross Margin %	LTM EBITDA Margin %	LTM EBIT Margin %	LTM Net Interest Exp.	LTM EBT Margin %	LTM Effective Tax Rate	LTM Net Income	LTM Net Income Margin %
US MEAN	16.16%	13.66%	10.40%	(1,073.2)	8.04%	12.04%		6.54%
PRC MEAN	15.91%	7.99%	-5.10%	57.4	5.00%	11.43%		4.57%
DIFF	0.25%	5.67%	15.50%	1,130.6	3.04%	0.61%		1.97%

UNITED STATES NATIONAL DEFENSE BUDGET CALCULATIONS BY FUNCTION AND DEPARTMENT

By Budget Function

Country	Function	Sub-Function	$	
US				
	Intelligence	ODNI / IC Budget	65.700	65.700
	Justice	CBP Operations, DHS	17.961	
		SS Operations, DHS	2.663	
		DHS Operations	1.857	
		Procurement, CBP, DHS	1.230	
		R&D, DHS	0.552	
		Operations, Science & Tech Directorate, DHS	0.382	
		C-WMD Operations, DHS	0.160	
		C-WMD R&D, DHS	0.069	
		SS Procurement	0.062	24.936
	IA	International Security Assistance	16.910	16.910
	Space flight, research & supporting activities	Safety, Security and Mission Services, NASA	4.388	
		Space Operations, NASA	4.159	
		Space Technology, NASA	1.111	
		STEM Engagement, NASA	0.132	9.789
	Science & Research	Major Research Equipment and Facilities, NSF	0.190	0.190
	Energy	Emergency Energy Preparedness	0.352	0.352
	National Defense	Defense Related Activities	135.765	
		Atomic Energy Defense Activities	35.451	
		DOD - Military	**989.760**	1160.976
Total National Security Related Appropriations by Function			1278.853	
		Sum non-DOD-Military	289.093	
		DOD-Military	989.760	
		Budget Centralization (Def Budget / NatSec Budget)	77.39%	

By Agency

Country	Agency	Sub	$	
US				
	Intelligence	ODNI / IC Budget	65.700	65.700
	DOT	Maritime Academy	0.373	
		Maritime Security Program	0.308	
		Port Infrastructure	0.220	
		Pipeline Safety	0.186	1.088
	DHS		133.188	133.188
	DOE	Weapons Activities, NNSA	18.469	
		High Energy Physics	1.321	
		Adv. Scientific Computing Research	1.159	
		Fusion Energy	0.919	
		Nuclear Physics	0.880	
		Safeguards and Security	0.168	
		Other Defense Activities	3.057	
		Defense Nuclear Nonproliferation, NNSA	2.506	
		Naval Reactors	1.840	
		Stragegic Petroleum Reserve	0.270	
		Cybersecurity, Enegy Security and Response	0.153	
		Naval Petroleum and Oil Share Reserves	0.009	30.750
	DOS	Consular and Border Security	3.232	
		Non-Proliferation, A/T, Demining Programs	1.200	
		Narcotics Control, L/E, and Int'l Security Assistance	1.177	
		International Peacekeeping Contributions	0.867	
		Peacekeeping Operations	0.421	
		Protection of Foreign Missions and Officials	0.049	6.946
	DOJ	FBI - C/T and C/I	4.473	
		Intelligence	1.989	
		Afghanistan Supplement Fund	0.049	
		Ukraine Emergency Supplement Fund	0.015	
		DEA - International	0.481	7.007
	USAID	International Development Assistance	9.097	
		Complex Crises Fund	0.876	9.973
	Corps of Engineers		27.393	27.393
	NASA	Safety, Security and Mission Services	4.388	
		Space Operations	4.159	
		Space Technology	1.111	9.657
	FCC	Emergency Connectivity Fund	4.599	4.599
	NSF	STEM Education	1.196	
		Major Research and Equipment Facilities	0.191	1.387
	EOP	National Security Council	0.014	
		National Cyber Director Office	0.013	
		National Space Council	0.002	
		IP Enforcement Coordinator	0.001	0.030
	OTHER	U.S. Agency for Global Media	0.874	0.874
		Peace Corps	0.445	0.445
		Defense Nuclear Facilities Safety Board	0.039	0.039
		Selective Service Commission	0.032	0.032
	DOD	Defense Related Activities	135.765	
		Atomic Energy Defense Activities	35.451	
		DOD - Military	**989.760**	1160.976
Total National Security Appropiations by Department			1460.082	
		Sum non-DOD-Military	470.322	
		DOD-Military	989.760	
		Budget Centralization (Def Budget / NatSec Budget)	67.79%	

(source: USDOT)

PRC NATIONAL DEFENSE BUDGET CALCULATIONS HIGHT AND LOW

Low Estimate, $m, 2022			
CMC	PLA - including CCG & PAP (SIPRI)		291,958.43
NSC	MSS (est. 1/3 of US)		21,900.00
	MPS (adj. 2019 CSET)		2,895.86
MFA	Peacekeeping (adj. 2019, CSET)		4,659.69
MS&T	(adj. 2019, CSET)		8.58
		non-PLA spending	29,464.13
		Total	321,422.56
		Budget Centralization	90.83%

High Estimate, $m, 2022			
CMC	PLA - including CCG & PAP (SIPRI)		291,958.43
NSC	MSS (est. 2/3 of US)		43,800.00
	MPS (Nikkei Asia / PRC MOF, 2020 adj.)		212,058.00
MFA	Peacekeeping (adj. 2019, CSET)		4,659.69
MS&T	(adj. 2019, CSET)		8.58
		non-PLA budget	260,526.27
		Total	552,484.70
		Budget Centralization	52.84%

US GROWTH CAPEX, MAINTENANCE CAPEX, AND IP THEFT $/ AMOUNT CALCULATIONS

FCG Analysis - Growth and Maintenance CapEx	
Total Defense Budget	989.7600
RDT&E, Army	52.5272
RDT&E, AF	43.5898
RDT&E, Defense-Wide	29.4330
Other Procurement, AF	26.9024
RDT&E, Navy	22.1116
Shipbuilding and Conversion, Navy	21.3251
A/C Procurement, AF	16.7295
A/C Procurement, Navy	16.4919
RDT&E, Space Force	12.5533
Other Procurement, Navy	11.4697
Other Procurement, Army	9.6956
Procurement, Defense-Wide	8.4728
Missile Procurement, Army	5.3276
National Sea-Based Deterrence Fund, Navy	4.7077
Weapons Procurement, Navy	4.2589
Weapons and Tracked Combat Vehicle Procurement, Army	4.2584
Procurement of Ammunition, Army	4.1441
A/C Procurement, Army	3.5971
Procurement, Marine Corps	3.4183
Procurement, Space Force	2.8507
Missile Procurement, AF	2.5609
Procurement of Ammunition, AF	1.1435
Procurement of Ammunition, Navy and Marine Corps	0.8979
NG and Reserve Equipment	0.7432
Operational Test & Evaluation, Defense	0.2812
Defense Production Act Purchases	0.2529
U.S. Relocation to Guam Activities	0.2512
Space Procurement, AF	0.2442
National Defense Sealift Fund	0.2112
U.S. Relocation Activities	0.1946
DOD Acquisition Workforce Development	0.1251
National Defense Stockpile Transaction Fund	0.0546
Defense Production Act Program	0.0023
DOD Rapid Prototyping Fund	0.0014
National Science Center, Army	0.0002
Office of Strategic Capital* (FY2024)	0.1150
Total Maintenance and Growth CapEx	310.9443
Total Defense Budget	989.7600
Future Capability Growth Ratio (high)	31.42%

FCG Analysis - Growth CapEx Only	
Total Defense Budget	989.7600
RDT&E, Army	52.5272
RDT&E, AF	43.5898
RDT&E, Defense-Wide	29.4330
RDT&E, Navy	22.1116
RDT&E, Space Force	12.5533
National Sea-Based Deterrence Fund, Navy	4.7077
Operational Test & Evaluation, Defense	0.2812
U.S. Relocation to Guam Activities	0.2512
National Defense Sealift Fund	0.2112
U.S. Relocation Activities	0.1946
DOD Acquisition Workforce Development	0.1251
DOD Rapid Prototyping Fund	0.0014
National Science Center, Army	0.0002
Office of Strategic Capital* (FY2024)	0.1150
Total Growth CapEx Only	166.1025
Total Defense Budget	989.7600
Future Capability Growth Ratio (low)	16.78%

IP Theft Analysis (2016)	
US GDP (nominal, $bn)	18565.6
Theft, Low estimate one ($bn)	100
Theft, Low estimate two ($bn)	225
Theft, High estimate ($bn)	600
Theft % of GDP, low #1	0.54%
Theft % of GDP, low #2	1.21%
Theft % of GDP, high	3.23%
Mean	1.66%

(source: USDOT)

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