



Webinar
Brief 90:2022



**A Lecture By Keith Hartley,
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At The University of York.**

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**PAKISTAN INSTITUTE OF
DEVELOPMENT ECONOMICS**

Pakistan Institute of Development Economics (PIDE) has invited **Keith Hartley, Professor Emeritus, Economics Department at the University of York and former special adviser to the Defense Committee of House of Commons** to talk on the subject of Defense Economics, its contents, contributions and the future of Aerospace and Defense Industry. Dr. Nadeem ul Haq, Vice Chancellor PIDE has moderated the webinar.

Key objectives

1. Understanding what is Defense economics? And how it stands apart as a distinct field of study?
2. The contributions Economists have made to the field.
3. Augustin laws, rising per unit costs of defense production and the future
4. Technology, Government and aerospace industry.

Key points

1. *Wars don't come cheaply.* The economy pays huge costs for wars. Both Military Replacement of destroyed armaments, weapons, jets, tanks and non-military (infrastructure destroyed, communication networks, buildings destroyed and have to be rebuilt). But it's not just the money costs, it's the human lives too.
2. What economists have contributed to defense economics is the ascertaining and determination of these costs. Defense economists have placed a valuation on human life. According to 2015 estimates, a US Life valued at 10 million US\$ and Russian life was valued at 72000 US\$.
3. *Another important contribution of Defense Economics is to the study of terrorism.* Professor Hartley gave an example of substitution effect, i.e. you control one aspect of terrorism and another one will rise. For example, controlling hijacking might lead to more terrorist activities inform of Bombings/assassinations.
4. *Three General principles of Professor Hartley*, which need to be applied to use defense economics for defense policy making.
 - a. Emphasis on Final Outputs rather than inputs
It's the final output of the defense industry that matters. Economists make the mistake of emphasizing too much on the inputs. The number of soldiers, tanks aircrafts don't really matter, what matters is the end product i.e. Peace protection deterrence. There should be a valuation based on outputs rather than inputs.
 - b. Substitutions-Alternate solutions
The rapidly advancing technology offers alternate solutions. For instance, Nuclear forces replacing large army-infantry units or drones replacing manned aircraft for maritime patrol.
 - c. Competition: Competition is key to achieving efficiency

The defense production sector has a heavy government footprint. The sector therefore is a very protected one, this implies that there are lots of opportunities if the sector is made contestable. Rivalry and contestability is expected to ensure cost efficient solutions. For instance, refueling operations being contracted out to private companies.

5. Augustine's contributions to the defense and aerospace industry offer a greater understanding of the future Aerospace Industry globally. The aerospace industry is characterized by decreasing inter-generational costs but rising intra-generational costs.
6. Escalating costs will lead to a decreasing/smaller units produced which may translate into a smaller defense industrial base.
7. This decrease in units produced will lead to decrease in learning so the customary learning curve of 80% may not hold. For example, the learning curve for F-35 is estimated to be around 90% while the F-22 is around 85%. The future defense production especially Aircrafts and aerospace products will therefore have smaller learning curves.
8. Augustine Weapon System (AWS) is a new class of economic good characterized by rising costs, complex & sophisticated technology and smaller volumes. And defense economists need to take AWS into consideration.
9. Smaller volumes due to complex technology will lead to more lethal weapon systems which may be smaller and costlier than their predecessor but far more effective. As an example, a single 5th generation fighter jet is far more lethal and effective than 5th generation fighter jets. Look at the spitfires for which unit cost was \$9700 a total volume was around 20,351 Aircraft in 1949-50, progressing to the lightning era in 1959 the unit cost for the aircraft was \$16000 and total units fell to 337. The RAF operates the Eurofighter Typhoon and the total number of units in service of RAF today are 160. So as Augustine suggested/predicted that weapon systems will become costlier, sophisticated, tech intensive and smaller in size and volume of production.
10. Professor Hartley, brawer and Stephen Makowski believe AWS is something that Defense economists should take seriously. Yes, there are a few areas where they believe AWS may not fully explain the future, they report their reservations as follows:
 - a. Unit costs have not risen by a factor of 4 as predicted by Augustine.
 - b. Rising costs are correlated with performance of a jet for example speed, maneuverability, range, altitude, strength etc. (Augustine says they aren't, but Hartley's research suggests otherwise).
 - c. Even though there is an absence of a satisfactory measure of output, defense economists shouldn't forget the out implications of AWS.
 - d. Production and labor costs are expected to rise for new entrants as happened with westland in case of spitfires where unit costs rose by 18 percent and unit labor cost by 155% compared to supramarine original developer. The same happened in the case of the hunter. This means, there are significant entry costs that would act as barriers for new firms in the aerospace industry.

11. Implications of AWS for future Aerospace and defense industry
 - a. Sophisticated and complex technology, more technology intensive
 - b. Greater demand for technology and technical labor.
 - c. Smaller volumes.
 - d. Smaller learning curves.
12. Difficult choices to be made in the future. Tradeoffs are going to be there. Defense economics has to take that into account and cost-benefit-analysis should be a means to understand the viability and feasibility of policy decisions.
13. Aerospace industry has two very important characteristics:
 - a. *Massive technological progress.* In early 1900 flying was a dream, a fiction. A few decades after that in the world wars, we had propellers and then jets. And in the 60's man lands on the moon. Today in 2020 you have F-35's and multi role jet fighters. This trend will continue. It will be a technology driven industry.
 - b. *Governments are an important player, and they can determine the size structure and ownership of the industry.* The Government is an actor that plays a big role in the aerospace industry. They determine entry and exit, they determine who can bid, this raises important questions for defense economists such as how and what to regulate i.e. prices, profits or conduct of the firms. Government's role in its understanding and analysis is of vital importance for defense economists in understanding the future of the defense industry.

Conclusion

Defense economics is a distinct field of economics and has a lot to offer in terms of policy guidance and academics. Economists have made valuable contributions to the study and formulation of defense policies including the operations of the defense industry in general and aerospace industry in particular. Defense economists should focus on the final output rather than the inputs & the final output i.e. peace, security, protection, deterrence, and even export in the thing that matters.

The Aerospace industry is characterized by complex and sophisticated technology. Weapon systems are becoming more complex as days pass and the escalating unit costs lead to smaller volumes. So, even if Augustine's prediction are not 100 percent accurate, he is right about one thing that the future aerospace industry will reflect sophisticated advancement in technology, costlier weapons which are smaller in number and volume compared to predecessors yet more lethal.

Professor Hartley also believes that the government has a big role in the defense industry and defense economists should recognize that role as it affects contestability, entry and exit and efficiency. This role will decide the structure, operations and size of the defense and aerospace industry. Therefore, defense and aerospace economists should focus on the role of government, trends in technology, introduction of competition, efficient alternate solutions and most importantly the final output rather than inputs.



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