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Understanding Military Economics

Neither the study of strategy nor of economics provides clear policy answers. They are primarily ways of thinking: analytical frameworks that identify the crucial trade-offs and illuminate the choices in a way that should help decisions. There are rarely unambiguous right and wrong answers; the trade-offs mean that you have to weigh gains against losses. This is no easy matter. The losses may be apparent and salient, the gains not so obvious, or vice versa. Who gains and who loses matters. A proposed policy may have large net benefits; but if those who lose are politically powerful, it is unlikely to be implemented. One reason strategy and economics can never provide clear policy rules is that they are largely competitive activities. If they did provide a set of rules, and you followed those rules, your economic or strategic competitor, knowing the rules, could predict your actions and thwart them. While there are sensible rules – invest in training and make sure that you have adequate supplies and reserves when you go into economic and military battles – they are rules for avoiding guaranteed failure rather providing guaranteed success. Thus there are no conclusions to this book in the usual sense, no suggestions as to how to stop the killing or save the world, rather there is a discussion of how one can understand military economic issues. The academic term for the focus of this chapter is methodology, the study of the methods one uses to understand a particular subject, though in some disciplines, methodology is used in a narrower sense as the study of the statistical methods used.

There are three dimensions to understanding: description, prediction and prescription. One may be able to understand enough about the operation of a process to describe how it works, but not be able to predict what it will do next, or make prescriptions about how to change it. Efficient market theories are of this sort. If the theory is correct

price changes are unpredictable. On the other hand one may have no understanding of the mechanisms involved, but be able to prescribe effectively. For instance, on the basis of empirical observation, aspirin was widely prescribed as an analgesic, long before anyone could describe how it worked.

At the level of description, there are two main annual sources of factual information that are very useful. The SIPRI Yearbook gives figures on military expenditure, the arms trade, arms production and the number of conflicts as well as much other material on armaments and disarmament. The IISS *Military Balance* gives figures on the number in the armed forces and holdings of various weapons as well as figures on military expenditure. For individual factual items Google, or other search engines, and Wikipedia are very useful. Some academics are rather dismissive of Wikipedia because the material is not edited and peer-reviewed. On checking subjects that I knew about, for this book, I found it largely accurate. The Internet is introducing a free-market in information, displacing the traditional regulation of editors, but it brings both liberty and license so a degree of scepticism is required. Disciplines differ on the importance of peer-review. Because publications lags in economics are longer than most other subjects, economists tend to distribute and extensively cite working papers, which have not been refereed; there are a number referenced in this book.

More generally, the literature that is relevant to the subject is very large. The intersection between economics and the military has many pathways that go off in different directions: such as sociology, psychology, law and the environment. I have mainly given references to non-technical literature that is directly relevant to the issues being covered, but the literature is much wider than my references. I have largely treated peace as the absence of conflict, and there is a large prescriptive literature on conflict resolution, devoted to creating that absence of conflict, such as Crocker, Hampson and Aal (2007).

As noted in the Introduction, much of the recent work in defence economics is quite technical using fairly advanced mathematical and statistical tools. But often the main point of the argument can be got from the verbal discussion and the equations can be skipped. The text books by Sandler and Hartley (1995) and Anderton and Carter (2009) are excellent introductions to the technical literature and the two *Handbooks of Defence Economics*, Volume 1, edited by Hartley and Sandler (1995), and Volume 2, edited by Sandler and Hartley (2007), are essential reference works. Many papers on defence economics are published in journals like *Defence and Peace Economics*, *The Journal of*

Peace Research, Economics of Peace and Security Journal and *The Journal of Conflict Resolution*, though many are technical. Military-related journals like *International Security, Survival* and the *RUSI Journal* often contain less technical articles on the economics of security.

Within the large literature that is relevant to this subject, there are a range of methods or approaches. There are case-studies of particular events, historical or contemporary; there are verbal theories that explain the events; there are statistical analyses of qualitative or quantitative aspects of those events; and there are mathematical models of the processes that generate those events. These four approaches are often presented as substitutes, the proponents of a particular method denouncing the alternatives, often very stridently as academics are prone to do. The approaches are better seen as complements: each has its advantages and disadvantages and an analysis which can draw on all four approaches is likely to be stronger, benefiting from synthesising the different insights each provides. This synthetic approach is becoming more common. For instance, the book by Stephen Biddle (2004), *Military Power: Explaining Victory and Defeat in Modern Battle*, begins with a verbal description of his theory; goes on to consider three historical case-studies chosen to provide crucial evidence for or against the theory; conducts a range of statistical tests using a large sample of battles; and finally uses a formal mathematical model of military capability in combat. The book also has a useful discussion of the relative advantages and disadvantages of the four methods and how they should be applied.

The details of any particular example matter and these details can only be found from case studies, either historical or contemporary. The distinction between historical studies and contemporary case studies lies largely in the nature of the source materials; over time more information tends to become available. Because of secrecy crucial pieces of information may not be in the public domain and contemporary accounts which ignore them will be misleading. For instance, some of the history of World War II was seriously wrong until the details of Ultra, the Allied decryption of Axis codes, were revealed. Primary sources are original documents or accounts of eyewitnesses, secondary sources assemble the primary evidence. This book relies almost entirely on secondary sources; historians tend to emphasise the importance of using primary sources. Documents tend to be given a privileged status as evidence, but many important things are not written down. Such tacit knowledge, undocumented information available to participants, is crucial to the operation of technology and organisations.

Theory, often implicit, provides focus, allowing one to abstract the crucial features, and determine what is important, relevant to the purpose of the particular analysis. The theory can be made more explicit, through definitions of the relevant concepts and an account of how they are related. Making theory explicit makes it easier to evaluate its logic, accord with evidence and possible biases. Some theory is necessary; since it is impossible merely to describe what happened, some selection is inevitable. Including everything is not only impossible, but of no more use than a one-to-one scale map, the same size as reality. But focus can bring biases. If what is regarded as important is what ruling-class white men do, then a lot is ignored. The aspects of the military that interest most men tend to be technology, training and battles. Elements like the role of women and logistics get less attention, but are often crucial. Every fighter pilot has a huge team that gets their aircraft armed and into the air. Military history traditionally focused on battles and operations, but these always happen in a wider context. For example, N.A.M. Rodger (1997, 2004) in his history of the British navy has chapters not only on operations, but also on technology, the ships and weapons; administration and finance; and social history. Each of these has their own evolution and dynamic which impact on the military. Thus although they are less glamorous; administration, finance and social forces need to be analysed in their own right, because they often shape operations.

One generally needs different descriptions for different purposes; what a logistics specialist needs to know about a war is different from what the diplomat needs to know. There are also advantages in the division of labour, since it is difficult to master both differential equations and the details of Soviet archives. Thus various perspectives are important. The need for various perspectives also applies to the range of theories used, hence the fairly eclectic approach in this book.

The verbal theories and the mathematical models are sometimes seen as theoretical, providing explanations; the case studies and statistical analyses as empirical, providing evidence about the facts. While this distinction between the theoretical and the empirical is useful, it cannot be drawn too sharply since they overlap. Theories are heavily influenced by perceptions of the facts and which facts are recorded and thus perceived is heavily influenced by theory, explicit or implicit. The impact of explicit theory on observation is most obvious with quantitative data. The national accounts measures that we have used, like GDP, are based on an explicit theory of the economy. With a different theory one would use a different measure of the output of an economy as the Soviets did,

using Net Material Product (NMP). Counts of the number of wars rely heavily on theories of what constitutes a war, for instance that wars involve states and a certain number of people dying. What might usually be called wars might not count because as in Somalia there was no state, or as in the Cod Wars between the UK and Iceland not enough people died. Although it is less obvious, and the theory is less explicit, the same applies to history and case studies, where theory shapes what is regarded as important enough to report and analyse.

At some stage, it becomes difficult to analyse complex chains of interactions in words and it is much easier to do it in equations. Consider two countries in an arms race. One might think that the growth in spending on arms by each country reflects three factors. There is some baseline level; there is a feedback effect in response to the level of arms in the other country; and there is a fatigue effect: as the level of arms gets greater, taking more of national output, it becomes harder to increase arms at the same rate. This would be a verbal theory. Lewis Fry Richardson, the Quaker meteorologist, recognised that this verbal description can be captured by a pair of interacting partial differential equations, very similar to the equations he knew from physics. This allowed him to make more precise statements which depended on the size of the parameters, such as the strength of the feedback and fatigue effects. In particular, it allowed him to examine what combinations of parameters would lead the arms race to explode into exponential growth and what combination would lead it to settle down to some stable equilibrium. This formulation then spurred statisticians to see whether the data on military expenditures or stocks of arms for pairs of countries shed any light on the values of the parameters and whether the arms race was explosive or stable. Having an explicit model makes evaluation easier. Allied casualties in the 1991 Gulf War were lower than most people or models had predicted. With the models, one could find out exactly which assumptions were wrong. Biddle (2004) discusses the reasons for the lower casualty rate.

For those with some mathematics, T.W. Korner's *The Pleasures of Counting* (1996) is an excellent introduction to the application of mathematics. It uses a range of military, peace and other examples where mathematics has been applied including the work of Richardson. Richardson's work on war and peace also had profound implications for mathematics. One of the factors that Richardson identified as influencing the probability of war between two adjacent countries was the length of their border. In collecting the data he noticed that different countries gave different lengths for their common border, the

smaller neighbour usually thinking their common border was longer than that of the larger neighbour. He then started to think about how one might measure uneven shapes like borders. Lines are one dimensional, flat surfaces are two dimensional, but squiggly lines like borders have dimensions between one and two. Richardson's work, on non-integer dimensions, was read by Benoit Mandelbrot, who developed fractals. These were introduced in a paper titled *How Long Is the Coast of Britain? Fractals* rapidly moved from being a mathematical curiosity to the basis for the computer generated images, CGI, of modern movies. CGI, which some see as a crucial technology, was a spin-off not of the military research but of peace research.

While mathematical models certainly help one to follow through complicated chains of interaction with precision, they are only as good as the accuracy of the model as a representation of the phenomena of interest. There are also measurement issues in how you match the variables in the model to available data, particularly when intangible factors are important. The rule 'garbage in, garbage out' applies. There are two responses to the poor quality of much of the data on military issues. Some believe that it is so bad that only the simplest statistical techniques can be applied; some believe that it is so bad that the most advanced statistical techniques are required to separate the signal from the noise. Both have arguments on their side.

Whether one is using historical or statistical evidence there is a fundamental problem of induction. There is no logical basis for drawing general lessons from particular instances. However, many times that you have observed an empirical regularity in the past, there is no guarantee that it will hold in the future. The turkeys, who inferred from observation the general law that every morning the farmer would feed them, were somewhat surprised by what he did the morning before Christmas. In economics this is often summarised by Goodhart's Law that 'any well established econometric relationship will break down as soon as it is used for policy purposes.' Charles Goodhart was Chief Economist at the Bank of England and is a professor at London School of Economics (LSE).

Consider an example of an empirical generalisation, which suggested that globalisation reduced the likelihood of war. Thomas Friedman (1999) noted that no two countries that each had McDonald's had gone to war. However, the fact that the association had held in the past could not be any guarantee that it would hold in the future: Georgia and Russia both had McDonald's when they went to war in 2008. The association between peace and McDonald's was not intended to be a causal relationship; there was no suggestion that eating burgers

promoted pacifism, or pacifism promoted a demand for burgers. Rather the argument was that peace and the presence of McDonald's were indicators of a third factor: certain characteristics such as the existence of a sizeable middle class and integration into the world system which were associated with a reduced likelihood of war. Nor was it intended to be a deterministic relationship. It was not suggested that war was impossible if both had McDonald's, merely that the probability of war was lower. A particular counter-example cannot falsify a probabilistic relation, though it can reduce its plausibility.

Inferring causal relationships from the evidence and making predictions is made more difficult because there may be more than one causal relationship between the variables and they operate in opposite directions. A number of such cases have arisen, including the relationship between military expenditure and growth. Trying to separate such relationships is a major task, which in economics is called the identification problem. Consider another example. Suppose an army, fighting guerrillas, decides to put more troops and effort into killing or capturing insurgents. Would one expect more insurgents to be neutralised or fewer? On one hand, a greater proportion of insurgents in the area are likely to be killed or captured. On the other hand, there are likely to be fewer insurgents in the area, since they will melt away in anticipation of the government offensive. It could go either way.

In analysing war and peace there are many dimensions; conflict and the military are linked to society in a large variety of ways. The economic dimension is important because fear and greed are important motivations and power and money are inevitably inter-twined. Understanding this dimension can illuminate many military issues and identify how conflict shapes the economy. However, it cannot be relied on to provide guaranteed predictions or policy solutions; all it can do is illuminate a range of possibilities.

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Abbreviations

ABM	Anti-Ballistic Missile
AK47	Kalashnikov Assault Rifle
AVF	All Volunteer Forces
BAE	BAE Systems, a British arms-aerospace firm
CADMID	UK description of the weapons life cycle: Concept, Assessment, Development, Manufacture, In-service, Disposal
CAS	Close Air Support
CBO	Congressional Budget Office
CEP	Circular Error Probable
CERN	European Centre for Nuclear Research on the French-Swiss border.
CGI	Computer Generated Images
CIA	Central Intelligence Agency
COCOM	Coordinating Committee for multilateral export controls that Restricted Trade to the Soviet Union
COEIA	Combined Operational Effectiveness and Investment Appraisal
COTS	Commercial Off-the-Shelf
COW	Correlates of War project
DARPA	US Defence Advanced Research Projects Agency
DEL	Department Expenditure Limit, UK public finance control
DGA	Delegation General Pour Armements, French arms procurement body
DIB	Defence Industrial Base
DoD	US Department of Defence
DRC	Democratic Republic of Congo, formerly Zaire
EADS	European Aeronautics, Defence and Space, arms-aerospace firm
EU	European Union
FDI	Foreign Direct Investment
fMRI	Functional Magnetic Resonance Imaging
GAO	Government Accountability Office (previously called the General Accounting Office), US government auditors
GATT	General Agreement on Tariffs and Trade
GDP	Gross Domestic Product, a measure of a country's output or income
GNP	Gross National Product, another measure of a country's output
GPS	Global Positioning System
IEA	International Energy Authority
IED	Improvised Explosive Device
IISS	International Institute for Strategic Studies, London
IMF	International Monetary Fund
IPR	Intellectual Property Rights
IRA	Irish Republican Army
IT	Information Technology
JDAMS	Joint Direct Attack Munitions
JSF	US Joint Strike Fighter, F35 Lightning II

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LIBOR	London Inter-Bank Offered Rate, the interest rate at which banks lend to each other
MIC	Military Industrial Complex
MoD	UK Ministry of Defence
MOTS	Military Off-the-Shelf
MTCR	Missile Technology Control Regime
NAO	National Audit Office, UK government auditors
NATO	North Atlantic Treaty Organisation
NCO	Non-Commissioned Officer
NGO	Non-Governmental Organisation, such as charities like Oxfam
NMP	Net Material Product, Soviet measure of output
OECD	Organisation for Cooperation and Development, rich countries club
OPEC	Organisation of Petroleum Exporting Countries
OSCE	Organisation for Security and Cooperation in Europe
P5	Five Permanent Members of the UN Security Council
PFI	Private Finance Initiative
PPBS	Program, Planning and Budgeting System
PPP	Purchasing Power Parity (also used for Public Private partnerships in the UK)
PRIO	Oslo International Peace Research Institute
QALY	Quality Adjusted Life Year
RAB	Resource Accounting and Budgeting, UK public finance system
RAND	US think-tank that has done much military research
R&D	Research and Development
RDTE	Research Development Testing and Evaluation
RoE	Rules of Engagement
RUSI	Royal United Services Institute, the oldest military think-tank
SALW	Small Arms and Light Weapons
SIOP	Single Integrated Operating Plan for US nuclear targeting
SIPRI	Stockholm International Peace Research Institute
SSR	Security Sector Reform
UCDP	Uppsala Conflict Data Program
UN	United Nations
UOR	Urgent Operational Requirements
WCMD	Wind Corrected Munition Dispenser
WMD	Weapons of Mass Destruction
WTO	World Trade Organisation, also used for the Warsaw Treaty Organisation, called the Warsaw Pact in this book.

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