

Colonizing Military History: A Millennial View on the Economics of War

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We briefly illustrate the application of fundamental principles of economics to three episodes of military history for the second millennium AD. The periods, principles, and cases examined are, first, the European Middle Ages (1000-1300; opportunity cost; siege warfare); second, the Enlightenment and the Age of Battle (1618-1814; expected marginal costs/benefits; the decision to engage in battle); and third, the Cold War (1945-1989; substitution; France's nuclear *force de frappe*).

Keywords: principles of economics; military history; siege warfare; the decision to join battle; *force de frappe*

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INTRODUCTION

This paper begins an audacious project in economic imperialism, i.e., the extension of economic theory to non-economic disciplines (Radnitzky and Bernhold, 1987; Lazear, 1999). Economic thinking has been applied to fields as diverse as law (e.g., Posner and Parisi, 1997), sociology (e.g., Becker, 1976), health care (e.g., Fuchs, 1975), military strategy (e.g., Schelling, 1960, 1966), and many others. While explicit economic reasoning has been applied to history (e.g., Fogel and Engerman, 1974), to our knowledge it has not yet been applied to military history as a field.² In this paper, we revisit some military history of the 2nd millennium AD from an economic point of view. Our procedure is to select a number of fundamental economic principles and to apply them to illustrative cases of military history. Our purpose is to demonstrate that

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² There have been applications of economics to particular historical instances and episodes (see, e.g., Conybeare, Murdoch, and Sandler, 1994) but not to military history as a field of study. Our claim is not that a particular event might be usefully illuminated by recourse to economic principles but that the entire field would so benefit.

economics can usefully illuminate military history, and that new insights can be gained.

The basic argument is simple enough. Planning and prosecuting war requires choices. But the analysis of decision-making is the provenance of economics. Hence history, military history in particular, is amenable to economic analysis. We hope to lay the foundation for a new method in the analysis of military history in which principles of economics serve as guidelines of analysis.

There is no universal agreement on what the principles of economics are but few would dispute that the following would be among them:

- 1 THE PRINCIPLE OF OPPORTUNITY COST. To use limited resources in the face of unlimited wants necessarily implies that one needs to choose. To choose any one option from among the alternatives implies foregoing or sacrificing the benefits the other options would have yielded. A battalion applied to one segment of the front thus cannot be applied to another at the same time. Many a long passage in an account of military history can be summarized simply by the underlying principle that the actors in question had to choose how, where, and when to apply limited military resources to cover multiple objectives. We illustrate the operation of this principle with a look at fortresses, castles, and siege warfare during the European Middle Ages (1000-1300).
- 2 THE PRINCIPLE OF EXPECTED MARGINAL COSTS AND EXPECTED MARGINAL BENEFITS. Ultimately, what guides one's choices? Economists answer that choice is driven by expected marginal costs and benefits: if the expected cost of an action outweighs its expected benefit, then do not engage in that action, and vice versa. For example, when resources available for defense (including technological and organizational capabilities) are too limited to effectively face a threat, it is best to decline to offer battle, or if already engaged in it, to withdraw or to surrender. This principle applies at all levels of decision-making. Of course, decision-makers may view expected costs and benefits differently. A ruler may decide to engage in battle, but the commander may decide not to. The ruler may then replace the commander, but individual soldiers may decide to decline battle and desert. We illustrate the operation of this principle by examining battles and maneuvers of the Enlightenment centuries (1618-1814; the Thirty Year's War to Napoleon I's abdication).
- 3 THE PRINCIPLE OF SUBSTITUTION. The principle of substitution says that if two goods yield comparable benefits users will drift toward the good with the lower relative price. This principle predicts increasing substitution of military labor with

military capital if the price of capital falls relative to that of labor (including the perceived cost of war-casualties). We illustrate this with a look at France's substitution of strategic nuclear forces for increasingly expensive conventional forces during the Cold War years, 1945-1989.

There are of course other fundamental principles of economics. For example, the principle of diminishing returns states that applying more of any one input may, *ceteris paribus*, at first result in rising output but eventually must yield increasingly smaller increments of output for equal increments in input, i.e., diminishing returns. Economic theory therefore predicts an intrinsic drive to go from a difference of degrees (more input of the same kind) to a difference in levels (change to inputs of a different kind), i.e., technological and strategic innovation in warfare. Other fundamental principles pertain to the role of incentives, principal-agent problems, and the importance of information in decision-making. Our claim is that military history can fruitfully be viewed through the lens of economic principles such as the ones delineated here, and that this lens provides a different and insightful analytical cut at probing that history.

ECONOMICS AND MILITARY HISTORY: A CONCEPTUAL MATRIX

Our analysis of military history can be conceptualized as a matrix which takes several dimensions (see figure 1). Along the rows we place a set of economic principles which could of course be expanded further. Along the columns we divide military events into requisite inputs (manpower, logistics, and technology) on the one hand, and into the planning and operations stages, on the other hand. At any given time, manpower, logistical capabilities, and technology are "fixed" and planning and operations (the actual maneuvers) must proceed with what's at hand. This defines the economic short-run. But in the long-run, manpower, logistics, and technology are "variable" and will affect the planning and operations of future campaigns. The task is to fill in the matrix, i.e., to take a set of cases from military history and to (re)interpret the events in light of the economic principles.

To illustrate our approach we offer in this paper selected cases from some of the major periods in military history of the 2nd millennium AD. More detailed studies could of course examine entire wars, particular campaigns, or individual countries' military histories for a particular time period. We use the following periodization: (a) the European Middle Ages, 1000-1300; (b) the Renaissance, 1300-1600; (c) the

	Manpower	Logistics	Technology	Planning	Operations
Opportunity cost					
Expected marginal costs/benefits					
Substitution					
Diminishing returns					
Incentives					
Information					

Figure 1: A matrix on the economics of military history

Enlightenment and the Age of Battle (1618-814); (d) the Age of Revolution (1789-1914);³ (e) the World Wars (1914-1945); and (f) the Cold-War period (1945-1989). In light of the limited space available here we restrict ourselves to an illustration of three of the several cases we have developed.⁴ One may object and say that we selected the illustrative cases to fit our views, but then our challenge to critics is to pick other cases and to show that economic principles have had no bearing on the matter at hand at all.

³ There is a periodization overlap, involving Napoleon I. For our purposes, his rule at the end of the Enlightenment still lies within the Age of Battle. But the next period, the Age of Revolution, precedes Napoleon (e.g., the American and French revolutions, 1776 and 1789, respectively) as well as continues after him (e.g., the failed German, 1848, and the successful Russian revolutions, 1905).

⁴ We are preparing a monograph-length treatment of the economics of military history. In the book, we study six cases each corresponding to one of the six time-periods. We then apply the entire matrix (figure 1) to *each* case. For example, for the World Wars period, the case of the strategic bombing of Germany involves much more than the principle of diminishing marginal returns to increasing amounts of bomb tonnage dropped on the country. Incomplete information, for instance, forced decision-making under uncertainty and played an important role in target selection. Similarly, consideration of opportunity cost (bombers flying to target A today cannot also fly to target B today) obviously were important. Likewise, the other principles listed in figure 1 played significant roles in the overall strategic bombing event.

THE EUROPEAN MIDDLE AGES, 1000-1300: THE MEDIEVAL CASTLE AND THE OPPORTUNITY COST OF SIEGE WARFARE

Did medieval leaders think on a level sufficiently rational and sophisticated to consider how choosing one option would rob them of another? The popular image of the Middle Ages stereotypes this long age's denizens as superstitious and ignorant, their military trials tests of strength and courage but not of planning and strategy. Fortunately, medieval historians have effectively destroyed this flawed vision. "[C]ommanders, then as since, were quite capable of carefully weighing up the position and coming to sensible and practical decisions" (Bachrach, 1994, p. 126, quoting Jim Bradbury). Medieval rulers had to decide how to spend their scarce resources – and none could spend with gay abandon. Medieval rulers "all were driven to desperate expedients to make ends meet" and these "ends" usually involved military expenditures. Even the powerful Edward I of England, immortalized in the (awful) film *Braveheart*, could not afford to finish his great castle at Beaumaris (France, 1999, p. 132). For the medieval leader, money was tight. Why, then, did they spend so much on castles, even as they struggled to finance their episodic, rudimentary armies?

Our knowledge and understanding of the Middle Ages is in flux. Regarding warfare, "an entirely new state of the question must be formulated regarding the military in medieval Europe." Siege warfare, despite its ubiquity, received inadequate study because of an overemphasis on battle (Bachrach, 1994, pp. 119-121, 133). Yet despite these historiographic problems, we can make some fairly incontrovertible assertions. The castle was everywhere; despite rising construction costs, it was built in ever greater numbers in the High Middle Ages (1000-1300); and the cost of doing so was immense. The significance of the castle in this age is beyond dispute. The political dominance of land owners and the limited authority of medieval government made the castle a necessity. Military activity revolved around it; without securing it, mastery of the land disappeared (France, 1999, pp. 2, 77, 103). The castle was "not a place of refuge, but a centre of military power" (Wise, 1976, p. 134). Castle-building could be used to develop and secure a major principality, as Count Fulk Nerra of Anjou (987-1040) did (Bradbury, 1992, pp. 60, 62). Even when conducting sieges, attackers sometimes built counter-fortifications to support the attack, demonstrating how central fortification was to the age (Bradbury, 1992, p. 63; Rogers, 1997, p. 95).

This centrality was obvious to the people, the rulers, and – later – the military historians. By the beginning of the second millennium the castle had become the "dominant feature on the political and physical landscape," and to the medieval mind it "was the most intimidating force on earth next to the wrath of God ..." (Donnelly and Diehl, 1998, pp. 29, 71). Rulers saw without enthusiasm how rebellious nobles could

secure their independence as political powers slipped to castle-controlling counts and castellans (Bradbury, 1992, p. 53). Kings often did not look beyond their immediate domains because “there was always a nearby castle of a rebellious baron to be reduced” (Baumgartner, 1991, p. 123). Not surprisingly, kings attempted to control castle-building and used their authority to demolish “unlicensed” castles whenever possible (Baumgartner, 1991, p. 119; Bradbury, 1992, p. 77; Warner, 1968, p. 12). Certainly the events surrounding castles often decided wars. Successful sieges were frequently the “decisive point” of a war, while failures denoted defeat because they wasted resources, lowered morale, and left “behind an intact hostile garrison” (Bradbury, 1992, p. 72).

Yet this does not explain the ubiquity of the castle and why nobles spent so much on them. Why not simply maintain larger standing armies with a good siege train – especially as an army can move where it wishes, while castles tend to be immobile?⁵ This is especially interesting as castles became vastly more numerous precisely during the age when costs spiraled upward. Before the tenth century, Europeans relied on existing Roman forts and threw up occasional timber and earth walls. After 950 “motte and bailey” castles, based on an earthen mound and a wooden palisade, were built in “vast numbers” across western Europe. This design was relatively cheap and fast to construct. In the 11th century, however, stone castles began to appear. The crusaders brought back many innovations from the Middle East, which significantly improved military potential but were expensive to build. Motte and bailey castles did not disappear, but were reconstructed with an expensive stone “curtain wall” around the entire structure. Walls and towers were redesigned to give them more firepower, towers were built to provide flank fire, and costly – but nearly impregnable – round towers became the norm by the mid-13th century (Baumgartner, 1991, pp. 111, 112, 113, 116; Bradbury, 1992, p. 48; Wise, 1976, pp. 136, 139-43, 146, 148; Rogers, 1997, p. 1).

So complexity and costs were rising – in many cases outstripping the growth of royal treasuries. Yet kings and nobles continued to spend their pounds, marks, and florins more on walls than on troops. Tradition is not a good explanation. The mounted knight, the social and military focus of Europe, played no role in the omnipresent war for castles (Bachrach, 1994, p. 125). To understand why the rich and powerful continued to allocate their scarce resources to castles, we have to consider the castle’s advantages and disadvantages, and also why a larger standing army was not chosen as an alternative even by rulers who had the resources and strategic position to do so.

⁵ Not always: William the Conqueror brought a prefabricated wooden castle to England. See Baumgartner, 1991, pp. 112-113.

The first advantage of a castle was its versatility, its immobility notwithstanding. Militarily it offered much:

The castle was also a storehouse for munitions, an advanced headquarters, an observation post in troubled areas, the home of a lord, and a place where he could be secure from attacks by his enemies. Royal castles could in times of emergency act as havens for the king's field army, or supply the men to raise a new army if the field army was defeated. In the advent of an invasion castles drew off large numbers of men from the invading force, which had to capture or at least contain the castles being left in the rear or on the flanks to maintain supply and communication lines (Wise, 1976, p. 135).

In addition, the castle functioned as a symbol of power, an administrative headquarters, and a jail. According to the *Anglo-Saxon Chronicle*, the castle was used to oppress and exploit the people, imprisoning those who might have goods of interest to the landlord. William of Malmesbury wrote in 1140 that there were "many castles throughout England, each defending their neighborhood, but, more properly speaking, laying it waste" (Warner, 1968, pp. 1-2; Donnelly and Diehl, 1998, p. 3; Bradbury, 1992, p. 70).

This latter tendency was a function of tactics, not robbery. Laying waste to the land was a strategy castellans used when the castle girded itself for its most obvious function: defense. The dominance of siege warfare in the Middle Ages is remarkable. Whether this was so because there were so many castles, or whether there were so many castles because of the importance of sieges, is hard to say. Regardless, to some military historians medieval warfare seemed little more than a "succession of sieges" (Bachrach, 1994, p. 120, quoting Philippe Contamine). Sieges "largely displaced field battles" because victory required that a region's castles "be captured and controlled." As a result, "the existence of well fortified and provisioned castles became the basis of warfare" (Rogers, 1997, p. 5; Bradbury, 1992, p. 72; Donnelly and Diehl, 1998, p. 47).

But does this explain the investment in castles? At first glance, no. Castles were not invulnerable. "No matter how strong, an isolated castle was vulnerable," unless it was supported by a field army. "[T]here was never an impregnable castle ... [T]he lesson of history was that no man can make a defence that other men cannot break through" (France, 1999, p. 95; Warner, 1968, p. 3). This was driven home during one of the most famous sieges of the age. In 1196-1198, Richard I, the Lion-Hearted, built an immense, strategically located castle at Gaillard in Normandy, at the "astonishing cost of £11,500." (Bradbury, 1992, p. 69). This was well over an entire year's income for the king. Yet only five years after its completion this "most advanced castle of its time" was captured by the French. This shocking and costly loss has been blamed on a flaw

in Gaillard's construction, undermanning (at surrender it contained only 140 men), tactical mistakes by the garrison, and ineptitude or lack of will on the part of the much-maligned King John of England (Bradbury, 1992, pp. 131-133; Baumgartner, 1991, p. 121; France, 1999, p. 87). Yet whatever the alibi, Gaillard had fallen. Warner suggests a modern message here:

The last round in this phase may be a castle in the air in a practical sense. Space satellites are said to be the ultimate in military sophistication, and as such unassailable. So, of course, was chateau Gaillard (Warner, 1968, p. 204).

It is interesting that none of John's successors in the 13th century thought the loss of Gaillard a reason to shift resources away from castles. They recognized that although a single fortress could not decisively influence events by this time, it could impose a crippling cost on its attacker. The cost of taking Gaillard had been huge as the the siege lasted six months. And as was often the case, the struggle ended in a negotiated surrender, not a storming. Here lay the trump card of every castle: whatever it cost to build, the difficulty of mounting a successful siege was enormous.

There were several reasons why this was so. First, the well designed and built castles could not be taken except by prodigious efforts, even when garrisons were small. Odiham castle resisted a French army for two weeks in 1216 despite having a garrison of only 13. Harlech, although once captured by the Welsh, withstood a rebellion in 1294-1295 with a garrison of only 20 or 37 (sources differ). Caernavon withstood two sieges in 1403-1404 despite at one point only having 28 men; the attackers lost 10 times that number. Long sieges did not always help attackers. The walls were immune to everything except mining, and small garrisons used up their food stores only very slowly. Nobles used this to their advantage. One castle in France, built 1223-1230, allowed its owners to defy royal commands for two centuries; there was simply no way to attack it. Many of the best fortresses were not even attacked. By 1300 the odds of a successful attack on a castle were worse than they had been in 1000. One English castle even survived a 17th-century attack in which cannon were used. Defenders cheerfully threw tradition to the winds when necessary. In 1088 a king led an attack on a castle gate, but a woman, described as "female in sex but not in spirit," threw down a millstone on the king's head and killed him (Baumgartner, 1991, pp. 114, 115, 118, 119, 120; Warner, 1968, pp. 138, 156; Bradbury, 1992, pp. 72, 144).

The attacker had three obvious problems. One was the supply of the army (more on this below). Another was the numbers required. A traditional estimate is that an attack on a castle required a 10 to 1 superiority, although one authority has suggested

that occasionally a ratio as low as 4 to 1 might work (Baumgartner, 1991, p. 123; Bachrach, 1994, p. 132; Warner, 1968, p. 1). Finally, time worked against the invader, who might have other rebellions to crush or castles (or towns) to attack, or deal with other armies. The English king Stephen (1135-1154) was able to attack his rebellious barons one by one (they made no attempt to organize an army) but his progress “was slow, and much of the realm was still in rebel hands at his death” (Warner, 1968, p. 2; Baumgartner, 1991, p. 120).

The business of laying siege to a castle was a highly complex and costly affair and was not undertaken lightly. Frequently such sieges involved so many men and so much *materiel* that no other action could be undertaken by the army involved and once committed to a siege there arose the problems of guarding against an attack by a relieving force, maintaining adequate supplies of food and forage, and epidemic diseases caused by the concentration of a large body of men in a small area for a long time (Wise, 1976, p. 161).

Small wonder that so many sieges failed. No one has ever calculated exactly how many did; in many cases, defenders did wear out the attackers, or a relief army came in time. It is difficult to be more precise because the definition of “success” is not as obvious as might seem (Baumgartner, 1991, p. 123). Sieges frequently ended not in a storming, or destruction, but by negotiation. William the Conqueror was credited with never failing to take a castle, but almost invariably he “took” the fort after negotiating. For example, he besieged Guy of Burgundy for *three years* before the latter was faced with famine. William realized this and perhaps could have stormed the castle, but decided it was too demanding on time and resources, and this most ruthless (but calculating) leader offered (and honored) terms (Bradbury, 1992, pp. 53, 61, 63-64). The key was not that a castle was impregnable, but that the costs of attacking were so great – greater than the attacker might be willing to pay. Stephen spent £10,000 for the attack on Exeter castle – and only succeeded because the castle’s wells dried up (Warner, 1968, pp. 4, 94). Even the wealthiest rulers had to pause when considering such expenses – and who could afford to maintain a substantial army for such a long period?

In the Middle Ages, almost no one could. Nor did castle spending eliminate the possibility of taking the offensive. A castle was never built as a purely passive entity. Even when defending itself, the castle garrison’s focus “was not passive defence but action and destruction” (Donnelly and Diehl, 1998, p. 36). More to the point, castles were excellent secure bases for armies uncertain of victory. The Roman military writer Vegetius, who was well known to the medieval military mind, advised that good generals fight only when certain of victory. “Most medieval field battles had been a simple matter of ratios and numbers” (Warner, 1968, p. 2; Donnelly and Diehl, 1998,

p. 49). Hence there was no reason to offer battle when outnumbered; the castle provided the perfect secure base in which to retreat. Hence the castle was viewed in its day not as a purely defensive bastion, but as a threat to its neighbors and a menace to its enemies (France, 1999, pp. 77-78, 105).

These many benefits of castles did not come for nothing. Construction could be “expensive and complicated” – even if they were basic square stone keeps. Later adaptations could be costly as well (Jeffreys, 1973, p. 9; Warner, 1968, p. 2; Baumgartner, 1991, p. 115). The Norman nobles in England were able to lower their costs somewhat by relying on the many stonemasons engaged in church building (Baumgartner, 1991, p. 114). Even so, the cost figures were impressive. Kings strained to meet the expense; other nobles simply could not meet it. In the 12th century only 35 percent of the English baronies had a true castle (many did have fortified houses). A large castle like Dover (built 1180-1190) cost £6-7,000; a single good tower keep like Orford cost £1,400 over 10 years. A “modern” fortification cost around £1,000, while an economy stone castle could be thrown up for £350. Yet most barons could not afford it and the number of baronial castles actually fell. The average baron was earning £200 per year; seven received more than £400, but at least 20 could not squeeze their peasants for more than £20. The monarchy, with £10,000+ at hand, gained the edge. Nor was this pattern limited to England. The counts of Champagne, for example, bought castles from nobles in financial distress (France, 1999, pp. 83, 85, 86; Warner, 1968, p. 116).

Yet the monarchy could not make casual decisions about castle building. The three largest castles used to pacify Wales (Conway, Caernavon, and Harlech) each cost a year’s treasury income. “Not only England but also Europe was scoured to obtain the right quality and quantity of designers and masons. Each castle probably absorbed 10 per cent of the national work force so the economic strain that this programme imposed may easily be imagined” (Jeffreys, 1973, p. 15; Baumgartner, 1991, p. 116; Warner, 1968, p. 155). Not surprisingly, the designer of these costly forts was highly regarded and became the recipient of riches and honors (Jeffreys, 1973, p. 4). Ironically, the huge construction costs of castles meant that garrisoning had to be done as economically as possible. The exact size of many garrisons is unknown, but kings and nobles alike sought to use feudal duties to staff castles. Knights and men at arms also had to be hired; rulers sometimes raided their garrisons to flesh out the field armies, trying to make one soldier do the job of two (thereby, incidentally, risking the loss of the castle). Few castles seem to have had over a hundred men at arms (although garrisons of several hundred were not unknown) (Bradbury, 1992, pp. 73-74, 75).

So medieval rulers were short of money, short of troops, and yet built expensive

castles. Why not solve the first two problems at the expense of the third by maintaining a larger standing army? Certainly rulers tried. Both Henry II and Richard I of England tried to raise money for standing forces; hired soldiers would not be subject to the limits on length and type of service imposed by feudal traditions (Warner, 1968, p. 113; France, 1999, p. 230). The general failure to build large armies can be attributed to the following factors: cost, tradition, and supply. “The sheer cost of war meant that nobody could afford to maintain regular standing forces ...” (France, 1999, p. 230). It seemed best to raise troops when necessary, but then to pay them off as quickly as possible. Universal service obligation simply did not exist (France, 1999, pp. 132-133, 230). There were requirements to go and fight an invader, and Henry II did require his freemen to own certain weapons, but this does not equate with the modern draft (France, 1999, pp. 66, 67-68). Feudal obligations regarding offensive warfare were limited (Baumgartner, 1991, p. 81). This weakened the field army but strengthened the position of the defending castle.

The paid soldier presented problems of his own. Mercenaries did mutiny, especially when their pay was not forthcoming. Even “stipendiary” knights and soldiers, paid but considered better than mercenaries, expected a daily wage – and it was not a trivial sum. During the Hundred Years’ War, for example, a knight received 2 shillings (28 pence) per day, while a man at arms received a shilling; at the same time, a master carpenter received 3 pence per day, and land could be rented for an annual fee of 4 pence an acre. Attempts to save money by recruiting “sergeants” who received lifetime land holdings were not very successful. Compelling men to serve for sieges by recourse to feudal service requirements encountered an unusual drawback: once their required length of service ended, they had to be paid the daily wage, or they could legally depart (France, 1999, p. 65; Donnelly and Diehl, 1998, p. 49; Wise, 1976, p. 145; Gravett, 1990, p. 17).

There were also certain indirect costs associated with field armies. First, if the castle enhanced the lord’s position, mass armies might weaken it. Precisely because the elite claimed a monopoly on war, it had little interest in a ‘nation in arms.’ Richard I’s plan for a regular, tax-supported army “sank without a trace” because it “would have struck at the influence of the great” (France, 1999, pp. 5, 230). A more prosaic problem was supply. A force of 3,000 men would need 140 horses for a single day’s food (not counting the horses’ own fodder). Wagons could solve this problem – a single two-horse wagon could carry enough food for 500 men for a day – but roads in 12th-century Europe left a lot to be desired. This was one reason that kings relied as much as possible on fleets, and many of the most important campaigns involved coastal targets (France, 1999, pp. 10, 35-37).

The result was that large armies were rare, and they were rarely used. A few large

armies did appear, such as when the Normans sent 14,000 men to England, or 20,000 crusaders fought at Hattin. But the larger armies represented an investment of such “enormous resources” that they could be risked in battle only in “extreme circumstances” (France, 1999, pp. 8, 12-13). The typical army in this age remained small. “Only the richest monarchs could afford to maintain a permanent fighting force greater than a personal guard of a few hundred soldiers” (France, 1999, pp. 2-3, 5; Donnelly and Diehl, 1998, p. 48). When armies were brought together, they were *ad hoc* assemblies, “motley agglomerations” of knights, mercenaries, auxiliaries, and irregulars, joined by a “fragmented chain of command” reflecting the powers of individual nobles and towns (France, 1999, p. 6; Wolfe, 1995, p. 12). Eventually, increasingly wealthy rulers were able to change this situation and the modern army appeared. The castle began losing its central role in the 14th century, not so much because of new weaponry (although that played a role), but because of political, social, and economic change. More wealth made larger armies possible; only the great kings could afford the large armies and the most expensive equipment (France, 1999, pp. 32-34; Bradbury, 1992, p. 128).

It should be noted that the medieval ruler, while choosing to spend more on castles than armies, regarded both as absolutely necessary. We know little about the exact decision process but the external evidence suggests that the strategic thought process was rational and intelligent. Certainly medieval military leaders understood the relationship between field war and siege warfare. On many occasions there was no clear distinction. Sieges were, in a sense, “a specialized form of battle” (France, 1999, p. 14). The siege of a castle often depended on the outcome of a battle, because a siege was one means of forcing an adversary to come forth and do battle to save a castle, rather than hiding behind fortified walls (Bradbury, 1992, pp. 62, 71). Battle was the

... last phase of a complicated wargame of challenge and withdrawal. To challenge an opponent the most obvious ploy was to besiege one of his castles. It was a challenge to his lordship. If your opponent wished to retain power, he must demonstrate his ability to protect the castle and the area ... If the challenge were accepted, a relief force would indeed be sent ... It was only at this point, when all the challenges were accepted, and provided the challenger did not now back down, that there would be battle ... Siege was almost the invariable preliminary to battle ... [But there were] many cases where the intention was not fulfilled (Bradbury, 1992, p. 71).

As a result, medieval warfare was mostly siege, raid, and ravage, with battle as the exception. This was a function of the decision that medieval rulers invariably made – to spend scarce resources on castles, rather than concentrating on their armies. The

universality of this decision shows that it was a near-inevitable response to the clear fact – clear after the 10th century, anyway – that the advantages of strong castles were too great to pass by. The decisions were military, but the thinking was clearly within the calculus of opportunity cost.

ENLIGHTENMENT AND THE AGE OF BATTLE, 1618-1814: THE MARGINAL COST/BENEFIT DECISION TO OFFER BATTLE

The application of the principle of marginal costs/benefits to the decision to seek battle is both simple and complex. At its simplest, we are looking at something that approaches a truism, namely, that commanders do not attack unless they expect to gain something, or expect an intolerable loss (prestige, morale, territory, reputation) if they avoid battle. Far more complex is the issue of what costs and benefits influence the decision-making process, when and how they are considered, and how they change over time.

The period reviewed here was chosen because it represents an age in which battles occurred as discrete events, divided by periods without combat and distinct from campaigns (although this is less true after 1800). During the Enlightenment, generals were more cautious about seeking battle than their Napoleon-influenced successors, but in all times battle was seen as a means of deciding an important issue, perhaps even an entire war. It was also perceived as a possible precursor to disaster. Hence the need for rational calculation permeates almost every discussion of choices related to battle. Raimondo de Montecuccoli compared the decision to a legal brief:

Assess your forces and compare them to those of the enemy the way a distinguished judge composes the arguments of the parties in a civil case ... If your army is strong and battle-hardened, and the enemy's weak, recently raised, or softened by idleness, you should seek battle ... if the enemy has the advantage in that area, avoid battles ... and be content to prevent him from advancing ... [The commander should] change the form of war ... [and] avoid risking the safety of the republic (Chaliand, 1994, pp. 566-567).

To the new class of career officers this emphasis on calculation had considerable appeal. Educated officers recognized that “indiscriminate violence was likely to prove strategically counterproductive” (Weigley, 1991, p. 542). This did not mean that battle should be avoided:

The quest for decisive battle was the educated soldier's rationalist effort to make war cost-effective, the promptness of the decision through battle promising to prevent an inordinate drain upon the resources of the state ... [The] strategy of annihilation was a rational response to the difficulties of achieving the objects of policy through war (Weigley, 1991, pp. 536-537).

Rational calculation often led to decisions to avoid battles, however. Some of the best generals of the 17th and 18th centuries avoided more than they fought. They were not opposed to fighting, but rather to indiscriminate fighting. Maurice de Saxe explained his maneuver-oriented approach:

I do not mean to say by this that when an opportunity occurs to crush the enemy that he should not be attacked, nor that advantage should not be taken of his mistakes. But I do mean that war can be made without leaving anything to chance (Chaliand, 1994, p. 594).

His successors preferred battle but agreed that all depended on correct calculations. Napoleon concluded that “in war nothing is gained except through calculation” (Wasson, 1998, p. 22) and that “military science consists first in accurately calculating the odds and then weighing up exactly, almost mathematically, the contribution of chance.” This mathematical metaphor was taken up by Clausewitz (Chaliand, 1994, pp. 648, 715).

A change in the perceived marginal cost/benefit ratio could lead to a rapid revision of the decision to fight – if possible. Even a minor advantage for one army could have a decisive impact on the outcome. Napoleon understood this with exceptional clarity and hence stressed the need to mass force at the point of attack, thereby often nullifying his enemies’ numerical superiority (Chaliand, 1994, p. 647). Revolution-era conscription allowed him to take such a risk and lower the cost of defeat. His predecessors preferred to err on the side of caution. Montecuccoli advised his readers to give battle “where you have the advantage” but avoid it otherwise, perhaps retreating into fortifications. De Saxe recommended much the same thing. (Chaliand, 1994, pp. 567, 588). Aggressive generals of the age, like Marlborough, were frustrated by governments which discouraged “their generals from fighting on any but the most advantageous terms.” (Chandler, 1973, p. 65). Governments calculated costs differently. It is noteworthy that of the four most aggressive generals of the age (Gustavus Adolphus, Marlborough, Frederick the Great, and Napoleon), three were heads of state, while the fourth – Marlborough – virtually controlled his.⁶

The analysis of decision in terms of costs must overcome two obstacles: locating the decision, and understanding its basis (the costs and benefits). Locating the decision is sometimes complicated because there is often not a discrete moment at which one general or the other opts for the fight. Decisions are made as part of a constant chain

⁶ Gustavus II Adolphus (1594-1632); Marlborough (1650-1722); Frederick the Great (1712-1786); Napoleon I (1769-1821). John Churchill Marlborough’s titles are 1st Duke of, Marquess of Blandford, Earl of Marlborough, Baron Churchill of Sandridge, Lord Churchill of Eyemouth, Reichsfürst.

which deal with every matter from the great to the mundane. There may be no true decision at all. Frederick the Great reminded his officers of the many things that cannot be anticipated or controlled. Jomini notes many “unexpected battles” (Chaliand, 1994, pp. 608, 739). The greatest battle in North America, Gettysburg, was the result of an unexpected collision.

The measurement of costs and benefits changes with time, place, and rank. A faraway government or even a detached professional general might see less cost in a battle than the common infantryman to whom “the death cries and shattering gunfire seemed a hell” (Walter, 1993, p. 54). The calculations were based on imperfect information and the results rarely rose to the expected level.

War between 1631 and 1815 revolved around grand-scale battles because, in that age, more than any other, the economic, social and technological circumstances of war permitted the massing of tens of thousands of soldiers on a single field for the test of battle, while at the same time military strategists hoped by means of battle to secure decisions in war, and thereby to secure the objects for which men went to war, with a quickness and dispatch that would keep the costs of war reasonably proportionate to the purposes attained (Weigley, 1991, p. xii).

This rarely worked, and costs rose grotesquely. This experience bred caution. The Dutch restrained their ally Marlborough because they wish to “keep casualties and expenditures as low as possible” (Chandler, 1973, p. 322). By the mid-18th century patience with the cautious approach had worn thin, but this did not mean that costs were ignored. Frederick the Great’s notorious aggressiveness, which led him to attack even when inferior (Chaliand, 1994, p. 606), reflected the high costs and deterioration of his army that long wars caused (Fuller, 1970, Vol. 1, pp. 556-567). Even Frederick cautioned that one should “never give battle if it does not serve some important purpose” (Luvaas, 1966, p. 139). Guibert, who recommended an aggressive approach, suggested that the avoidance of battle in the Enlightenment was only superficially cheap because no grand solutions ever resulted (Fuller, 1970, Vol. 2, p. 36).

Yet Napoleon, who followed much of what Guibert recommended, often exhausted his army so much in battle that decisive pursuit was impossible (Liddell Hart, 1967, p. 117). On the other hand, the costs of pursuit were considered high, and even Wellington – hardly a passive general – sometimes deliberately avoided it (Paget, 1990, p. 97). When he campaigned aggressively, he did so with a specific purpose, namely, to force the French to divert troops to defend their southern border (Chaliand, 1994, p. 644). Of course, Wellington could not replenish his formations as rapidly as Napoleon. He was in the same position as the generals of the Enlightenment, whose

“golden rule” was “that highly trained soldiers were too costly too be squandered” (Liddell Hart, 1967, p. 93). Even Napoleon’s 19th-century students were careful to justify their losses in terms of cost-benefit thinking. Sherman explained his infamous head-on attack up Kennesaw Mountain (1864) as still better than a flank attack, because his enemy had gotten too used to thinking that he would not attack them (Marszalek, 1993, p. 272).

Napoleon’s behavior was more comparable to the commanders of the 30 Years’ War (1618-1648):

The economics of war made it more expedient to use many unskilled men instead of fewer well-trained ones. And since little expense had been invested in training their men, the commanders were not reluctant to waste them in large numbers in bloody battles (Baumgartner, 1991, p. 249).

This does not entirely explain the military tenor of those times because Gustavus Adolphus, commanding the best-trained army of the age, sought battle “eagerly” (Fuller, 1970, Vol. 1, p. 253). His “persistence in seeking and fighting battles” was a realistic response to his enemy’s greater long-term resources (Weigley, 1991, pp. 18-19). He accepted battle on unfavorable terms at Lützen (1632) because the enemy army was gaining strength, his own prestige was in decline, his allies were of questionable long-term loyalty, but perhaps most of all because he had the “pugnacious instincts of the fighter” and the “warlike spirit” often present in a commander (Weigley, 1991, p. 31).

The devastation of the 30 Years’ War combined with the cost of trained armies and the expense of supplying them to produce an era of limited war (Fuller, 1970, Vol. 2, p. 36). Fighting did not disappear. Even the cautious Montecuccoli noted that “[t]o imagine that you can achieve great things without fighting is an illusion” (Chaliand, 1994, p. 568). Although Weigley argues that the “so-called period of limited war reverberates with a roll call of battles by land and by sea” he concedes that the era of limited war was a reality (Weigley, 1991, p. 537). “Europeans of the eighteenth century were expected to wage war with moderation and within civilized limits.” Marlborough restored decisiveness in battle, but not in war (Weigley, 1991, pp. 103, 195). Generals might want to fight, but they did not want to fight until their armies were in complete battle order (Baumgartner, 1991, p. 297). De Saxe took limited war – and hence, the avoidance of battle – to its logical limit:

I do not favor pitched battles, especially at the beginnings of a war; and I am convinced that a skillful general can make war all his life without being obliged to fight any (Chaliand, 1994, p. 594).

Frederick the Great and Napoleon had a drastically different view. Battles were essential and unavoidable. Costs were not ignored, but calculated differently. According to Frederick,

War is decided only by battles, and it is not finished except by them. Thus they have to be fought, but it should be opportunely and with all the advantages on your side (Chaliand, 1994, p. 608).

Napoleon was even more “battle-oriented” than Frederick. He waged war with the “single end of bringing his enemy to battle” (Liddell Hart, 1967, p. 126). His calculation of marginal costs and benefits was vastly different from the traditional viewpoint. His huge armies could not sit and maneuver patiently because of their immense supply requirements. In addition, he could afford losses. In 15 years, he raised two million conscripts. The long-term cost was enormous, as French population growth fell dramatically behind Britain’s, Prussia’s, and Germany’s (Walter, 1993, p. xv), but that was not a cost he personally had to bear. Nor was his aggressive and disastrous march to Waterloo ignorant of costs/benefits. He had relatively few soldiers and could not afford to give his enemies a chance to combine (Keegan, 1976, pp. 121-122).

Whether the accuracy of the calculations improved in the more scientific times of the 19th century may be questioned. The new generation of generals aimed all of their planning toward a battle of destruction, reflecting their desire to emulate Napoleon (Luvaas, 1966, p. 139). The results were mixed. The Germans did achieve decision through battle in the Franco-Prussian war, but the Americans utterly failed to do so in their Civil War. These shifts over time reflect changes in the way that costs and benefits were calculated, but not at any time the abandonment of their calculation.

THE COLD WAR, 1945-1989: CAPITAL-LABOR SUBSTITUTION AND THE CASE OF FRANCE’S *FORCE DE FRAPPE* ⁷

The application of the principle of substitution to the acquisition of nuclear weapons is complex. Nuclear weapons provide enormous firepower in relation to their cost: they provide, as it was phrased during the Eisenhower administration, “more bang for the buck.” But the substitution of nuclear for conventional weapons involves more than firepower. Nuclear weapons have capabilities that are greater than and different from

⁷ *Force de Frappe* = “strike force.” Harrap’s *Shorter French and English Dictionary* (Edinburgh, UK: Harrap Books, 1991).

conventional weapons and forces. A nation may choose to maintain its full conventional force while increasing its nuclear weapons stockpile (i.e., the Kennedy administration's policy). In the case of France, however, this was not done. The *force de frappe* was developed against a background of conventional decline (e.g., Kolodziej, 1974). A counterpoint must be acknowledged, however. As the French empire was shrinking, it could be argued that France's conventional needs were as well, and that hence the nuclear force's acquisition was unrelated to conventional decline. In this situation a change in force composition will have taken place but the principle of substitution would not apply because the benefits of the two choices (nuclear versus conventional) would no longer be comparable. This will be addressed later.

The *force de frappe* originated after World War II. Military journals began advocating nuclear weapons in 1946 (Browder, 1964, pp. 6, 108). For a decade development concentrated on atomic energy and physics generally, until in 1958 Premier Felix Galliard made the official decision to manufacture atomic bombs (Holmquist, 1969, p. 12). The Algerian war slowed development somewhat, but operational status was achieved in the early 1960s (Browder, 1964, pp. 35-36; Theleri, 1997, p. 2). France began by developing a force of strike bombers (the Mirage IV), and later followed with land-based IRBMs and nuclear submarines, the latter still being in service today (Theleri, 1997, pp. 385-386; Browder, 1964, p. 49). Although France maintained a relatively large force of conscripts and did engage in some upgrading of conventional forces, particular during Valéry Giscard d'Estaing's presidency (Chicken, 1996, p. 96; Howorth, 1996, p. 33), nuclear weapons were clearly the focus of security policy. As French nuclear strategy architect André Beaufre has noted, France searched constantly for the one policy or innovation that would create security. "In the old days it was the continuous front and the power of the defensive; today it is the nuclear weapon" (Beaufre, 1966, p. 126).

Why did France pursue a nuclear capability? Were nuclear weapons developed as substitutes for conventional weapons? Even before Charles de Gaulle's presidency, national prestige played a large role (Browder, 1964, pp. 37, 71). The director of the Institute of Atomic Physics argued in 1949 that "without atomic bombs [France] is a second rank power." De Gaulle made clear in 1959 that nuclear weapons were designed to make France a major power by increasing its independence, status, and self-esteem. In the 1960-debates the government based its policy on international political implications, not on the force's military feasibility. World politics and global strategy were more important than deterrence *per se* (Browder, 1964, pp. ii-iii, 15, 47, 53, 79). Pierre Gallois, another architect of the *force*, explained that the "gap between the great powers and the rest was widening" to justify its acquisition (Chaliand, 1994, pp. 1065-1066).

Yet this was not enough of an argument to sustain support for nuclear arms. More practical arguments had to be found. One obvious point was that the remaining colonies could not be protected with France's conventional forces. A major debate over atomic weapons took place during the siege of Dien Bien Phu in 1954 (Browder, 1964, p. 6). A more compelling argument was that atomic weapons made the *metropole* more secure. The Bomb became a new Maginot line: "Both are concerned with the protection of French boundaries from invaders" (Holmquist, 1969, p. 8). The realization that France was competing with great powers whose populations and GNPs far outstripped its own mingled with traditional fears. In 1955, Premier Edgar Faure tried to make German rearmament more acceptable by noting France's growing atomic power (Browder, 1964, pp. 20, 65-66, 107). Tactical nuclear weapons looked particularly interesting to France's soldiers because they provided "a local persuasive or deterrent power ..." (Chaliand, 1994, p. 1062). Not all supporters of the *force* considered this significant. Beaufre argued that a military invasion of Europe had "lost almost all credibility" (Beaufre, 1966, p. 138).

One thing that the possession of atomic weapons could do, however, was make France less dependent on other countries. Alliances had saved France from one German aggression and rescued her from another, but post-war French leaders deplored the increasing loss of control over French destiny. This became a particularly heated topic during the Suez fiasco in 1956 (Browder, 1964, p. 33). Gallois went so far as to argue that "alliances are dead because of nuclear weapons" (Holmquist, 1969, p. 40). De Gaulle did not go that far, but he did demand a greater role for France in NATO before he pressed on with his own armaments program (Browder, 1964, pp. 41-43). Certainly the alliance structure had its problems. The decision time required for the use of a tactical nuclear weapon in NATO is 24 hours, mainly because of the number of levels and agencies involved (Cimbala, 1988, p. 125).

The ally that mattered the most, and whose behavior was appreciated the least, was America. There were two aspects to the relationship that concerned the French. First, the American nuclear deterrent had become less credible by 1960. By then the Soviet Union appeared to have the capacity to strike the United States directly, and De Gaulle and others doubted whether the United States would risk devastation for the sake of European security. Second, the USA wanted to share control of European weapons, but did not want to surrender unilateral control of its own nuclear armaments. Hence France felt dependent on America and was constantly reminded of its military inferiority (Browder, 1964, pp. 17, 139; Holmquist, 1969, *passim*). This logic persuaded many Frenchmen, but non-Gaullists argued that the presence of US troops was a better guarantee of security than the hypothetical impact of the *force de*

frappe (Dollfus, 1960, p. 21).⁸

Peculiarly, it took time before the new weapons were studied in terms of their actual military advantages. French military thought gravitated to the view that war now existed on two planes – guerrilla and total – neither of which could be fought effectively by a traditional army. French (and Soviet) strategists thought that a European war would inevitably escalate to the nuclear level (Holmquist, 1969, pp. 20, 83). Beaufre believed that the possession of tactical nuclear weapons would be the best means of deterring a particular attack, because of the total unpredictability of the result. He also suggested that a conventional arms race – the usual proposed alternative – could lead to unstable strategic conditions and hence to an even higher risk of war (Beaufre, 1974, pp. 17-18).

There was certainly a consensus – regardless of which of the above justifications was used – that a French army with atomic bombs was stronger than one without. Nuclear weapons were seen across Europe as a tool for redressing the conventional imbalance (Paret, 1986, p. 746). France was particularly sensitive to this issue, not having been able to handle its security needs alone since the mid-nineteenth century. The humiliations were fresh. In two decades, France was defeated in Europe, Indochina, Suez, and Algeria. In 1956, the defense minister argued that in the future “an army not having the atomic bomb will count for little.” In 1961, De Gaulle argued that nuclear weapons would enable the French army to be once again a leading military force in Europe. Heeding his words, the army integrated nuclear weapons into its maneuvers of 1962 (Browder, 1964, pp. 25, 97-98, 100-101, 134).⁹ Even a *force de frappe* critic conceded that France “cannot sufficiently mobilize men to oppose the conventional armies of the continental countries” (Dollfus, 1960, p. 13).

This implies that nuclear weapons were indeed viewed as a natural substitute for the huge and costly conventional force that France would otherwise have to develop to compensate for its existing strategic inferiority. The mathematics of nuclear firepower were overwhelming. The defense of Europe, American strategists reckoned, would require 100 active divisions, a force that could not even be established if World War II reservists were recalled (Paret, 1986, p. 781). This was a major issue because the Warsaw Pact kept so many troops fully mobilized (Dollfus, 1960, p. 51). Beaufre noted that even the great powers had to reduce their conventional efforts, while Germany (as of 1965) could field only 12 divisions, France only 5 or 6 (Beaufre,

⁸ A frequent theme of the critics was that the French force would be far too small to mean anything to the great powers.

⁹ The inclusion was somewhat hypothetical, as France did not yet possess the weapons.

1966, pp. 127-28). The compensatory advantage of nuclear firepower was crushing. Beaufre elsewhere noted that a 20-kiloton weapon generated a force equal to a salvo by 4 million 75-mm cannons (Beaufre, 1974, p. 44). He and others commented on how a single bomb could accomplish what had required entire air fleets in the past. The conventional raid on Tokyo had killed as many people as Hiroshima – but it had required 279 bombers, small compared to air raids in the European theater. A single hydrogen bomb could exceed the entire weight of explosives dropped on Germany in World War II (Aron, 1965, p. 2). The 50-bomber French Mirage IV fleet could destroy seven of Soviet Russia's largest cities (Browder, 1964, p. 130). Even skeptics conceded that atomic bombs would significantly reduce the size of the (immensely expensive) strategic air fleets (Paret, 1986, p. 779). Advance bases would not be needed either (Chaliand, 1994, p. 997). Gallois claimed that “the accumulation of men and materiel is no longer necessary” which was all to the good, as European countries “could not afford the cost ...” (Gallois, 1961, pp. 2, 168). More prosaically, defense minister Pierre Messmer noted in 1962 that even the expensive Pierrelatte U-235 plant cost less than the equipment for two armored divisions (Browder, 1964, p. 91).

The mathematics predetermined the outcome of the debate. Even the great powers had to engage in military capital-labor substitution and France's situation was even worse than the typical medium-sized power. In 1958, while financing the Algerian war, France's military budget was only 73 percent that of Britain's, even though it represented 29 percent of the country's government spending and 9 percent of its national income – figures greater than any major western nation except America (Dollfus, 1960, pp. 41, 70-71, 100-101; Gallois, 1961, pp. 106, 205). In other words, France could not afford to spend much more, if any. As a result, for forty years, nuclear forces reigned supreme in the French military establishment (Theleri, 1997, p. 386). The military was organized around its nuclear forces, a 150,000-man intervention force, and a 25-battalion territorial defense. Spending focused on nuclear forces and operations, with conventional improvements made when possible – after the other two bills had been paid (Holmquist, 1969, p. 63, note 44; Dollfus, 1960, p. 69; Browder, 1964, p. 55).

The evidence of this substitution is not just financial. The conventional forces suffered. Some military officers and politicians worried that modernization and operational effectiveness would suffer as funds shifted to the nukes (Browder, 1964, pp. 54, 95-96; Holmquist, 1969, pp. 7, 11). Paradoxically, De Gaulle used the *force de frappe* as a means of appeasing the military, giving it a spectacular new weapon which, allegedly, could be used to protect the ground forces in wartime. Privately, the President was also thinking of substituting the West German army for huge and hugely expensive French conventional forces, but that he kept to himself (Holmquist, 1969,

pp. 28, 62-63; Browder, 1964, p. 105). De Gaulle promoted pro-nuclear officers and the military threw itself into the *force* business. Problems became evident as time went by. In 1960 a critic already lamented that “our conventional army dates from another era” (Dollfus, 1960, p. 71). Reliance on nuclear weapons increased security problems (Paret, 1986, p. 778). The Gulf War “revealed the parlous state of French non-nuclear forces ...” (Fysh, 1996, 184; Chicken, 1996, p. 94).

There was considerable argument about the actual financial benefits of substitution. Raymond Aron addressed this point directly by questioning whether the development of the deterrent was “compatible with [the] indispensable minimum” of conventional forces (Aron, 1965, pp. 113-114). Well over half of De Gaulle’s 5-year modernization plan was devoted to the *force de frappe* (Dollfus, 1960, p. 70). The problem was a basic paradox of the nuclear bomb; the weapons are relatively cheap to produce, but the front-end development costs are stupendous. Nor could France afford the operational expenses being paid by the great powers (Dollfus, 1960, p. 70; Browder, 1964, p. 113).

Nevertheless, a strong argument can be made that substitution did take place. It occurred in four ways. First, nuclear weapons were substituted for a prohibitively large conventional military, in particular for air fleets, overseas bases, and ground force firepower. Second, the *force de frappe* substituted for military alliances and allowed France to withdraw from the NATO military command. Third, the weapons altered France’s relationship with America and to an extent were substituted for dependence on the Americans. Fourth, the possession of even a medium-sized nuclear deterrent was substituted for the maintenance of a fully mobilized conventional army.

There are two counter-arguments to the presence of substitution that need to be addressed. First, the French government was not very explicit about this substitution. Even De Gaulle had to appease the soldiers, so being explicit was not always an option. Second, France undoubtedly sought benefits that even a large conventional army could not have brought. Yet France’s nuclear weapons were clearly integrated with the conventional forces and – given that they constituted a relatively small strategic force – could only have been replaced by large and expensive conventional weapons.

CONCLUSION

Our aim was to revisit military history from an economic point of view, and our purpose was to demonstrate that economics can usefully illuminate military history. New insights can be gained. Although not obvious from the paper, when the authors first met to discuss the larger project, the economist asked the historian to simply name important military episodes, events, or characteristic features for various time-periods

in the 2nd millennium. Next, we checked whether adequate background material could be found for the listed cases, selected the final cases, and then decided which principle of economics to apply to which episode before actually sitting down to research and write the respective sections. Other authors have looked at specific aspects of military history from an economic point of view, but none, we believe, have attempted to apply a variety of economic principles to the entire sweep of a millennium's worth of military history as we have.

Figure 2 summarizes the cases for the larger project. The assignment of cases to cells is somewhat arbitrary. For example, the case of the medieval castle carries implications with regard to campaign planning and operations but the focus of our initial discussion – as reported in this paper – was on the castle as an instance of military technology and logistics. A fuller story would flesh out the other aspects and that is, as explained, what we are doing in the monograph. To take another example, for the case

	Manpower	Logistics	Technology	Planning	Operations
Opportunity cost		1000-1300 The European Middle Ages Medieval castles and siege warfare			
Expected marginal costs/benefits					1618-1814 The Enlightenment To do battle or not to do battle?
Substitution	1945-1989 The Cold War The nuclear age		1945-1989 The Cold War The nuclear age		
Diminishing returns			1914-1945 The World Wars Strategic bombing		
Incentives	1300-1600 The Renaissance The <i>condottieri</i>				
Information				1814-1914 The Age of Revolution The American Civil War and information asymmetries	

Figure 2: A matrix on the economics of military history

of France's *force de frappe*, it appears as if the "planning" column is empty, but the decision of whether or not, and to which degree, to substitute nuclear weaponry for manpower obviously involved long-range planning. The full story will therefore apply the *full* matrix to *each* of the six cases we selected for in-depth study.

We now briefly summarize this paper's findings. Economic reasoning helps explain the medieval preference for *castle building*. Two of the three reasons found for the prevalence of castles and the non-emergence of field armies (cost, supply, tradition) are economic in nature. Despite the immense expense, the cost of a single siege could match or exceed the cost of building a castle. Thus, from the point of view of opportunity cost, the castle – despite its expense – was the preferable form of military investment.

Regarding the *decision to do battle*, many well-known commanders have claimed that their decision-making stemmed from rational calculation. Considerations of marginal costs and benefits clearly affected military decisions. Does the application of this type of analysis help us understand decisions? Probably so, although the role of psychology and intuition is important.¹⁰ One interesting aspect of marginal cost/benefit calculation is that, in all cases where both opposing commanders opted for battle, at least one – and possibly both – must have miscalculated. This reflects the lack of accurate information for commanders, not any intellectual shortcomings, and emphasizes that decisions are made under *expected* costs and benefits, i.e, under uncertainty. Still, even miscalculation is calculation.¹¹

The application of the principle of substitution to the French acquisition of *nuclear weapons* depends on whether the decision to acquire them was based on the bombs' incredible firepower or on their capacity to do things that no conventional weapon can

¹⁰ There is of course a literature (primarily in evolutionary biology) on the economic rationale of intuition. Intuition is a quick, cheap way to make decisions, based upon the evolutionary history of the species. If chicken had to perform a set of expected cost/benefits computations each time a fox came by, chicken would be extinct. Some cost/benefit computational routines therefore become hard-wired over evolutionary time; they become "intuitive," "instinctive," or "emotional" responses. As rules of thumb these work well for the species but, in any given instance, might not work well for an individual member of the species.

¹¹ Additionally, one can invoke more advanced principles of economics such as those relating to signaling, credible threats, reputation effects, and so on, that are derived from the theory of repeated games. Also, in deciding whether to offer a particular battle, a commander needs to simultaneously to bear in mind how concurrent and future battles (i.e., space and time) may affect his own and the opposing forces in the potential battle at hand. Incomplete information will likely skew the decision-making but the decision-making will nonetheless be based on rational thought of expected costs and benefits.

match. Substitution is easier to establish in the former case than the latter. We conclude that the French *force de frappe* was a substitute for both ground and air power. The decline in French conventional strength cannot be explained, incidentally, as a result of a shrinking empire. France historically maintained virtually separate colonial and metropolitan armies, and the latter's size was not linked to colonial problems. The Soviet threat should have caused it to grow – but the Bomb was obtained instead, and the army shrank. A clearer case of substitution is difficult to imagine.

Critics may suggest that we are imposing a modern framework of thought on an age in which these principles were not known. But if economics, like physics, consists of universal laws (principles) of nature, then they may be applied to all times, past and future, irrespective of whether or not the laws were known and understood. Thus, our project is in fact intended to assist military historians to better analyze past events and decisions. It is to impose structure on description. In each case described in this paper, economic principles were found to be useful. They pose different questions to ask of history, they provide a different reading of history, and they provide a different analysis of history. The extent to which economic principles explain decision-making behavior suggests a highly fruitful avenue for the analysis of military history.

NOTES

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