

IN DEFENSE OF HOMELAND, PORK, OR IDEOLOGY?
A STATISTICAL ANALYSIS OF CONGRESSIONAL SUPPORT FOR BALLISTIC MISSILE
DEFENSE SYSTEMS

by
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Congress and the executive support the continued development of ballistic missile defense systems. Since the Bush administration came into office in 2001, the United States has pulled out of the Anti-Ballistic Missile (ABM) treaty and revamped research and development funding for this defense initiative, asking as much as 9 billion dollars per year. This thesis analyzes the strategic problems associated with the implementation of these systems and moving the United States from a deterrence-based nuclear posture to a defense-based one. It concludes with a statistical analysis of factors in each US Senator's background that might have influenced the probability of their voting against constraining the program in June 2004 using probit regression methodology.

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INTRODUCTION:

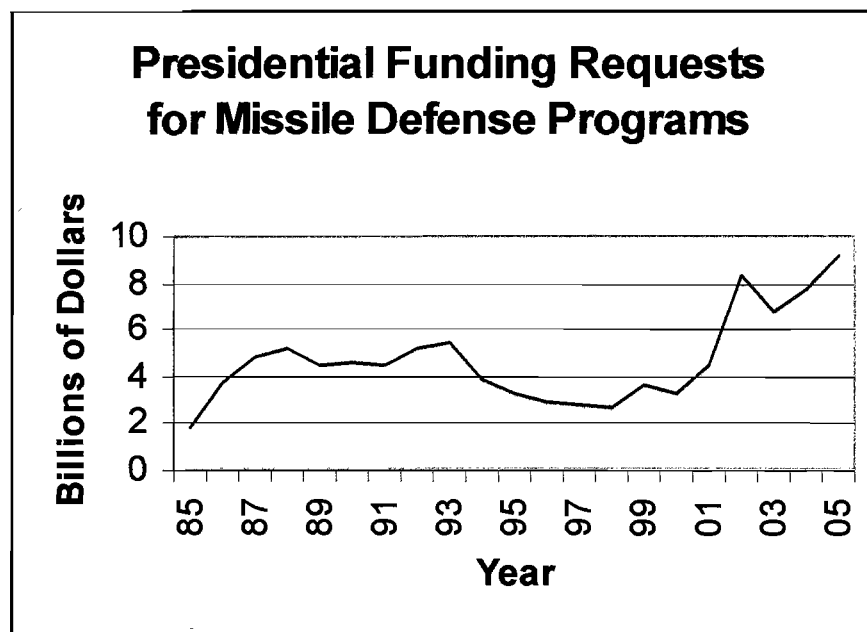
The argument over whether or not the United States should fund, build, and deploy a Ballistic Missile Defense (BMD) system has been going on for decades. The change in the distribution of world power caused by the end of the Cold War and the 1991 dissolution of the Soviet Union led many to believe that the United States would be less vulnerable to attack from an Intercontinental Ballistic Missile (ICBM) in the coming decades. Reports like the 1996 National Intelligence Estimate (NIE) supported this theory, postulating that the United States would be increasingly less vulnerable to an ICBM attack as the 90s progressed into the 2000s.¹ Such analyses stated that new types of threats would likely emerge as primary US security concerns, and that the threat of a nuclear attack from another state would dwindle as the themes of globalization, low-intensity conflict and terrorism carried us on into the next decade. Following this trend, funding for missile defense programs was cut by the first Bush administration. Even with a relative funding increase in 1997, funding during the Clinton administration was lower per year than it had been for the entire Bush administration. The general decreased funding pattern for BMD programs continued on through the Clinton administration, until in 2000 Clinton decided to leave the final decision about whether to deploy missile defense programs to his predecessor.²

¹ The General Accounting Office (GAO) corroborated the soundness of 1996 NIE predictions in testimony to the US Senate Committee on Intelligence in 1996. The release date for the transcript of this testimony was December 4th, 1996, and a copy is available from the GAO at: <<http://frwebgate.access.gpo.gov/cgi-bin/getdoc.cgi?dbname=gao&docid=f:ns97053.pdf>>

² Hadley, Stephen J. "A Call to Deploy". *The Washington Quarterly*. 23:3. pp.95-108

The 2001 ascent of the second Bush administration, however, has led to a *dramatic* increase in funding for Ballistic Missile Defense programs, as the administration to date has asked Congress for more funding (\$32 billion) for missile defense development than the Clinton administration did in eight years (\$26.7 billion).³ Figure 1.1 displays the sharp funding increases that BMD programs have enjoyed after 2001.⁴

Figure 1.1



The fact that BMD has received large amounts of funding over the past several years means that key congressional members on Capitol Hill agree that BMD programs are a good use of taxpayer dollars. Understanding what *has led* to the congressional determination that BMD programs are valuable, however, is the

³ As reported by Boese, Wade. "U.S. Missile Defense Programs at a Glance". *Arms Control Today*. August 2004

⁴ US Government: Missile Defense Agency. MDA Online. 20 Oct. 2005. <<http://www.mda.mil/mdalink/pdf/histfunds.pdf>>

purpose of this thesis. To this end, we will look at a series of Senate votes in 2004 and statistically analyze them controlling for the ideological rankings and special-interest factors that are part of each senator's profile.

Is recent support for BMD programs driven by strategic need, or is it simply a massive pork-barrel program designed to bring jobs and prime defense contracts home to Senators' states? How much do factors like the amount of military personnel in a Senators' state or their membership on select defense committees affect the probability that they will vote to support or expand existing missile defense programs? The following sections of this paper will provide the background, methodology, and tools used in attempting to answer these questions.

Section II: Historical Background, will set the context for the vote analyses. Here we will define the strategic concepts of *defense* and *deterrence*, and outline the major strategic arguments for and against missile defense systems in both the Cold War and post-Cold War eras. Also included in this section is a survey of the historical information and strategic arguments that comprise the debate about missile defense programs today, and this background will propel us into the formation and execution of a quantitative statistical models to study these effects. This segment concludes with a synopsis of several empirical economics papers, highlighting the sections in each study that will later become components of the statistical model herein.

Section III: Research Design, describes the general theory behind regression analysis and the reasons why the Linear Probability Model (LPM) is not the best choice for our purposes. The logit and probit models are introduced, and several

equations are presented to show the reader the underlying concept of the probit model and to address the way that unit-changes in the probit regressions will be derived and interpreted. This leads us into the next section, which primarily deals with the data we will use in our experiments.

Section IV: Data, outlines the variables that we use in our final regressions. The qualitative variables are three senate votes which have been translated into 0,1 dummy variables for the ease of calculation, and a context for each vote is provided along with its introduction. The quantitative variables are also described, and the final justifications for their inclusion and the sources they are derived from is laid out for the reader.

Section IV: Empirical Models, is a short section that formally puts the variables described in section three into theoretical equation form. This transitions us to the actual implementation of the regressions in section V.

Section V: Results, contains the results of six derivative-probit form equations (two for each of the three 2004 votes) run using Stata Version 8 statistical software. The important and insignificant variables are cited for each equation, and these results are interpreted within the context of each of the actual votes.

Section VI: Conclusion, brings the findings in section V back to the original question of the thesis, determining whether our regression results support or detract from theories about the factors currently contributing to congressional support of missile defense programs. An analysis of voting patterns for three BMD votes in the U.S. Senate unearthed some significant positive relationship between membership in the Senate Armed Services Committee and a tendency to vote pro-BMD. Because the

second and third votes seemed to be competing partisan responses the outcome of the first vote, Senate Vote 124 appears to be the only vote which unearths some general trends in voting behavior, aside from partisanship. Section VI then offers suggestions for possible statistical remodeling using a larger n vote sample and also using house votes instead of senate votes, but also notes reasons why this type of quantitative analysis may not be the best way to unearth correlations between voting outcomes and factors like the amount of BMD prime contracts that are committed to a state. Section VI ends by offering ways this study might be further expanded and differently modeled for future, further investigation of BMD program support patterns.

II. HISTORICAL AND STRATEGIC BACKGROUND:

Before delving into the specifics of missile threat strategy that provide the background for this thesis, it is important to clarify a few key terms. *Deterrence* is a strategy where one gains security through conveying a credible threat to potential enemies that an attack will be met with a devastating response—a response so overwhelming that an enemy is dissuaded from attacking in the first place. *Defense* is the ability to counter an enemy attack while it is being inflicted, a strategy which makes security contingent upon one’s immediate response to the attacker while they are attacking.

To understand the strategic debate about BMD systems, we must understand the key theoretical differences between deterrence and defense. Imagine, for example, a city simply named “AB”. City AB is divided into two parts, A and B,

where each half of the city is geographically 50 miles apart. Each half enjoys communication and interaction with its other half, but the sections of the city are too far apart to be united by any common troop presence or military power linking them. For the sake of illustration, let's also say that both sections A and B are surrounded by enemy territory. Now imagine that half A houses an armory, a barracks and a large company of soldiers, and that the entire half of the city is surrounded by a moat and high exterior walls. Half B, on the other hand, is comprised only of civilians with no military experience, and it has no moat, walls, or armaments like its counterpart does.

Though both A and B are surrounded by enemy territory, and B has no military power on site, and the enemy in the neighboring territory has military might that could attack and overwhelm B, neither city half is attacked by the enemy. Given the apparent weakness of B, how could this be possible? In this simple example, the answer illuminates both deterrence and defense as useful security concepts. Outside forces do not attack A because they have calculated that A's defenses—the moat and large wall—are so robust that the enemy could not successfully wage an attack on half A. City AB's security strategy to protect section A is defense, in that it has built a response to a foreseeable attack from the outside that would render an attack from the enemy territories useless.

Outside forces do not attack half B because they are "deterred". The enemy may know that they are stronger than B, and that they could effectively take over that section of the city. If section B were attacked, however, section A would retaliate—sending their troops and technology to inflict a devastating blow against the attackers,

who would ultimately lose in such a conflict. Because the enemy is assured of a loss, they decide that any attack on B would be fruitless. Thus A gains its security from defense, while B gains its security from deterrence.

As a final point of terminological clarification before we embark on the rest of our strategic and historic survey, we should distinguish “Theater Missile Defense” (TMD) systems from “National Missile Defense” (NMD) systems. Theater missile defense systems describe missile intercept programs designed to prevent an enemy from launching a short or long-range missile (not ICBMs) from hitting strategic regional or battlefield areas. While such capabilities might have specific uses in war fighting, there are potential concerns about the way these capabilities could affect US strategic relationships in the global security context.

One variety of a TMD system focuses on the boost-phase of missile launch. Boost-phase TMD systems are mobile and not likely based on the US mainland. These are very short range and require military planners and policymakers to identify a state as a potential enemy so that their launches can be intercepted very quickly. NMD systems, on the other hand, are designed to protect the entire US homeland from enemy launches. NMD systems may or may not include TMD systems as part of the strategy for intercepting ICBMs, but the objective is to be able to reliably intercept an ICBM from any country that launches at the territorial US. The term BMD refers to both NMD and TMD systems, as part of the overall strategy of intercepting enemy missiles and shifting from a deterrence strategic doctrine to a defensive one.

BMD programs have received so much attention over the last half-century because they offer a strategic choice—is the United States more secure if we choose a doctrine of deterrence, or defense? The familiar term Mutually Assured Destruction (MAD) was first coined by Secretary of Defense Robert McNamara in the early 1960's to sum up the deterrence security-based relationship between the world's two superpowers: The United States and the United Soviet Socialist Republic (USSR). As the Cold War marched on, each nuclear power had developed weapons so terrible and so numerous that either could have launched a nuclear war that could have killed millions—perhaps even annihilating the human race. Deterrence philosophy ruled the day. There was nothing that the United States could have done to prevent Soviet missiles from hitting US soil once the USSR decided to launch an attack against the United States, but the United States in turn had the credible threat that if the Soviet Union were to bomb New York, Washington, D.C. and Los Angeles, the United States would devastate Moscow, St. Petersburg, and Novgorod. The consequences of US retaliation to a USSR attack would be so devastating that seriously engaging the US in a nuclear conflict was almost unimaginable to Soviet leadership, and vice versa.⁵

Events like the Soviet launch of the Sputnik satellite and the proliferation of missiles after World War II instilled fear in many Americans, who were filled with horror at the thought of a Soviet satellite nightly passing over the US homeland.⁶ The

⁵ As argued by Kenneth Waltz in *The Spread of Nuclear Weapons*. pp. 3-45 New York: Norton, 2003

⁶ Yenne, Bill. *Secret Weapons of the Cold War: From the H-Bomb to SDI*. Pp.140-142. New York: Penguin, 2005.

lack of US defense against a USSR missile launch left many citizens feeling like nuclear war could come at any time.

However, some academics argue that the nuclear age was a security paradigm unlike any other, and that nuclear weapons (when used responsibly) are essentially peace-causing.⁷ These scholars argue that nuclear weapons offered human civilization, for the first time, a security environment where a state could feel more secure than in the past because the outcome of large-scale confrontation was predictable. The possible repercussions of a state action were completely unambiguous, and arguably this led to a more stable security environment.⁸ Conquest or large-scale war between either superpower would be absolutely and inarguably foolish, because each state could clearly see that the outcome of any such conflict, once initiated, was absolute destruction. Winning was not possible in a deterrence-based Cold War world, and everybody knew it.

Missile defense research was begun in order to counter the fear that deterrence was a potentially volatile security doctrine, the argument being that the US should not base its security strategy on the whims of another nuclear power like the Soviet Union. To this day, supporters of BMD want to develop a system of intercepts that could counter any missile launch from a neighboring country, enabling the US to shoot out of the sky any warhead headed for our homeland territory or larger sphere of influence—although the current discussion includes the idea of a “limited” BMD system that would not be expected to counter enemy missiles with 100% reliability.

⁷ Waltz, *ibid.*

⁸ As described by Van Evera, Stephen. Causes of War: Power and the Roots of Conflict. pp. 140-153. Ithaca: Cornell University Press, 1999.

As President Bush said in an April 28th, 2005 press conference: “One of the reasons why I thought it was important to have a missile defense system is for precisely the reason that you brought up, that perhaps Kim Jong-il has got the capacity to launch a weapon, and wouldn't it be nice to be able to shoot it down.”⁹

Before we continue, it should be noted that authors like Van Evera take the opposite view on the question of whether a defense or deterrence-based world is a more volatile security environment. Van Evera argues that war is more likely when conquest appears easy—the corollary also being that war should seem less likely in a deterrence-based security structure where “winning” is virtually impossible. Closely related is the idea that deterrence-based security frameworks also clarify security situations by allowing all players a vision of the same endgame (nuclear annihilation), while defense-based frameworks may cause war to seem more reasonable because an unsure outcome means that there is some chance an aggressive state could win. Waltz joins Van Evera in pointing out that nuclear weapons make war calculations clearer than at any other time in human history, arguing that war is less likely when the outcome is easy to determine, as states are less likely to fall prey to engaging in wars of false optimism.¹⁰ From this vantage point, then, the position that shifting from nuclear deterrence to the old rules of offense and defense would make the United States less subject to potential enemy “whims” does not make a great deal of sense. One wishing to reduce the likelihood that a state would irrationally launch a nuclear weapon at the United States should also want to reduce the likelihood that a

⁹ Bush, George W. *Press Conference of the President: April 28th, 2005*. The White House; Office of the Press Secretary. <www.whitehouse.gov>

¹⁰ Waltz: 9. Van Evera: 14-34.

state could calculate any potential advantage from missile launch. Attacks based on false optimism would be more likely to occur in a defense-based security environment rather than a deterrence based one, because winning is only a possibility (however slim) in the latter situation.

The pursuit of measures that could counter the national security threat posed by the existence of ballistic missiles began during the Eisenhower administration, when President Eisenhower authorized development of the Nike-Zeus nuclear-tipped interceptor missile and supported Project Defender, a program to develop the apparatuses for a NMD system.¹¹ The search for a NMD system was furthered during President Richard Nixon's tenure, when the Russian development of an Anti Ballistic Missile (ABM) system around Moscow triggered his approval of deployment of the US "Safeguard" ABM system. The US Safeguard ABM system was plagued by concerns about its effectiveness and strategic vulnerability by both elected officials and those in the defense establishment. The system, however, was ultimately influenced by diplomatic as well as technical and political factors. It was finally approved to ensure that the US would not be in a weaker, NMD-less negotiating position during Strategic Arms Limitation Talks (SALT) in the early 70's.

1972 was an important year in the history of NMD programs, as the USSR and the United States announced successful negotiations of the SALT I Treaty and included the linked and vital ABM Treaty. In the ABM Treaty, both states agreed "that effective measures to limit anti-ballistic missile systems would lead to a

¹¹ Cirincione, Joseph. "Brief History of Ballistic Missile Defense and Current Programs in the United States." Published by The Carnegie Endowment for International Peace, 2005. Full text at: <http://www.carnegieendowment.org/npp/publications/index.cfm?fa=view&id=133>

decrease in the risk of outbreak of war involving nuclear weapons.”¹² This was because both the US and USSR agreed that the deterrence-based security framework between them was safer and more stable than a defense-based system would be.

It is important to note that these treaties were attained because both US and Russian negotiators believed that the continued development of ballistic missile defenses would lead to even greater arms racing between the two superpowers. Negotiators on both sides knew that the easiest and cheapest way to overcome another state’s NMD system would be to simply build more missiles than the defending country had interceptors for. While the ABM Treaty’s main objective was to prevent either the US or the USSR from deploying a NMD system over its territory, the treaty did permit each state to pursue limited deployment of a partial NMD system designed to defend a specific city and TMD to intercept short or medium-range ballistic missiles, but not ICBMs.

During the Ford Administration, military advisors and civilian government officials determined that the types of missile defenses allowable under the ABM treaty were too attack-vulnerable to be worth maintaining. The Safeguard system, while legal under the ABM treaty, had a strategic flaw in that it was dependent on ground-based radar centers that could easily have been targeted by the Soviet military in a nuclear offensive. In addition, maintenance of Safeguard was extremely expensive. Ultimately, the system operated for only a few months before being shut

¹² The full text of the ABM Treaty is available at:
<<http://www.state.gov/www/global/arms/treaties/abmpage.html>>

down and discarded forever, cancelled because of its ineffectiveness and huge operational costs.¹³

NMD research continued under the Carter Administration, at a cost to taxpayers of just under \$1 billion a year. The research which grew under the Carter administration continued on into the Reagan Administration, and from the outset of the Reagan Administration there seemed to be an agreement within the US defense community that national Ballistic Missile Defense, even if desirable, was not technologically feasible.

Nevertheless, several NMD programs were flirted with early in the Reagan administration, despite general lack of support from Defense Department officials. One such program was “High Frontier”, proposed to the Reagan Administration by retired General Daniel Graham. High Frontier was an ambitious program where a network of hundreds of rocket-interceptor carrying satellites would circle the earth and shoot down any missiles launched by a Soviet offensive. The High Frontier Program was coldly received by the US defense community at multiple levels of bureaucracy, all the way up to Reagan’s Secretary of Defense Casper Weinberger. A second NMD program using space-based lasers was also presented around the same time despite the testimony of expert panels such as the Department of Defense’s Science Board, which unanimously concluded that: “It is too soon to attempt to accelerate space-based laser development towards integrated space demonstration for any mission, particularly ballistic missile defense.”¹⁴

¹³ Cirincione, *ibid.* pg. 6

¹⁴ Ulsamer, Edgar. “The Long Leap Toward Space Laser Weapons,” *Air Force*, pg.2. August 1981.

On March 23, 1983, President Reagan gave a speech that brought the issue of BMD into the public spotlight as never before. That night the President spoke to the US public, noting how desirable it would be if national security were not subject to deterrence and thus the whims of the Soviet Union, and calling upon scientists to take up the cause of NMD in the interest of furthering national security and reducing the threat of nuclear weapons.¹⁵ BMD development and research during the Reagan Administration was done under the umbrella of the Strategic Defense Initiative (SDI) program, which integrated Research and Development (R&D) across the different armed forces interests in the Defense Department which contributed to the program.

Ballistic Missile Defense programs and SDI were downgraded under the George H.W. Bush Administration, and were only partially funded but not entirely killed under the Clinton Administration. Apparently believing that it was impossible to realize Reagan's attempts to make nuclear weapons "impotent and obsolete" with the SDI program, George W. Bush told the New York Times during his first presidential run that "SDI was very expensive and had technological problems."¹⁶ He then proceeded to cut the BMD budget by 1 billion dollars, a number which was increased even further by congress. However, perhaps because those in Washington hoped to continue BMD research so that it might someday yield some offensive capabilities, the program did not entirely "die" under either administration. Making the argument that maintaining some form of the program could *only* be useful for offense is rather

¹⁵ Reagan, Ronald. "Address to the Nation on Defense and National Security". March 23, 1983. Full text available through the Reagan Presidential Library at:

<<http://www.reagan.utexas.edu/archives/speeches/1983/32383d.htm>>

¹⁶"The Star Wars Mess". The New York Times. 04 Feb. 1990.

< <http://query.nytimes.com/gst/fullpage.html?res=9C0CE3DB173FF937A35751C0A966958260>>

easy, since the idea of a full and working missile defense program that would get the US out of deterrence-based strategic framework seemed to have been abandoned. In any case, each program could only pursue “limited” capabilities that by definition ran contrary to the program’s original defensive rhetoric. The Clinton and H.W. Bush Administrations, however, were careful to keep NMD programs within the terms laid out by the ABM treaty, politically maneuvering a rhetorical distinction between Theater Missile Defense systems and National Missile Defense Systems so that research could continue under the ABM treaty umbrella.

The current Bush Administration has arguably taken one of the largest policy shifts since the NMD question has been debated, pursuing multi-layered NMD systems which include NMD and TMD components designed to counter long, short, and medium-range warheads, and withdrawing from the ABM treaty.

As shown earlier by Figure 1.1, the 2002 fiscal year marks a sharp rise in the amount of missile defense funding requested by the executive branch. The fact that these Bush Administration requests have been met almost one for one with congressional appropriations mean that the last several years have produced a marked expansion in missile defense programs, which has renewed the national debate about the strategic desirability and technical feasibility of these programs.

The technical issues surrounding NMD development have not yet been resolved, and though the Bush plan calls for ground, sea, and air-based defense systems, only the ground systems have been tested by the military at all.¹⁷ The ground, sea, and air-based systems are meant to intercept ICBMs in any of their three phases of flight: The

¹⁷ Arms Control Today. “Fact Sheets: US Missile Defense Programs at a Glance”. Jan. 2005. <<http://www.armscontrol.org/factsheets/usmissiledefense.asp>> Aug. 2004

“boost phase” that occurs from launch to the missile’s ascent into earth’s atmosphere, the “midcourse phase (mid-phase)” that consists of atmospheric entry until atmospheric exit, and the “terminal phase”, comprised of the missile’s exit from the atmosphere and the final descent to its target.¹⁸ This layered approach means that the military is responsible for integrating efforts of the Army, Air Force, Joint Staff, and Missile Defense Agency components.¹⁹ While a thorough analysis of the technical problems with intercepting a missile at each respective phase is beyond the scope of this thesis, program reviews in 1998²⁰ and 2002²¹ reveal that technical questions are still large. Along these lines, a 2004 GAO report states that “the performance of the [Missile Defense Agency’s] system remains uncertain and unverified.”²²

There are also several strategic problems with BMD systems. The first is that BMD systems are incredibly expensive to build but are potentially easily overridden—this concern has existed for decades, as reflected by the ABM treaty agreement. Let’s look at an example. Suppose two nuclear states, X and Y, interact with one another after X acquires some BMD capability. Let’s say that country X has 20 hit-to-kill anti-ballistic missiles which could nullify missiles fired offensively by country Y. Country Y’s counter strategy to this, however, would be to simply build 40 offensive missiles, so that if even country A responded with anti-ballistic missiles

¹⁸ “BMD Basics”. Department of Defense: Missile Defense Agency.
<<http://www.mda.mil/mdalink/html/basics.html>>

¹⁹ Boese, Wade. “Missile Defense Funding Trimmed.” Apr. 2005.
<www.armscontrol.org/act/2005_03/MissileDefense.asp?print> Mar. 2005

²⁰ United States General Accounting Office. “Even With Increased Funding Technical and Schedule Risks are High.” GA 1.13:NSIAD-98-135. June 1998.

²¹ United States General Accounting Office. “Review of Allegations About an Early National Missile Defense Flight Test.” GA 1.13:GAO-02-125. February 2002.

²² United States General Accounting Office. “Defense Acquisitions: Status of Ballistic Missile Defense Program in 2004.” GA 1.13:GAO-05-243 March 2005.

at 100% hit-to-kill accuracy, country Y's 20 extra missiles would do horrendous damage. Country X, then, might build 40 anti-ballistic missile missiles, to counter Y's 40 offensive missiles and once again reestablish a credible anti-missile line of defense. Y could then build more missiles at a much lower cost, and so on and so forth.

This scenario represents two of the primary concerns about the strategic effectiveness of a BMD system, even if the government could develop reliable technology to accomplish the difficult task of hitting an enemy warhead. The first concern is that however technically effective our system ultimately is, an enemy state could always defeat a BMD shield through engaging in arms racing. As far back as the ABM treaty (which will be covered in the Historical Background section of this prospectus), concerns have existed about NMD's potential to create arms racing because all a state would have to do in order to defeat a missile "defense" shield would be to lob more missiles than the shield has interceptors for.

The second strategic concern illustrated by the scenario above is financial. Building more missiles is relatively cheap, while NMD research has already proven to be a phenomenally expensive program. If states built up arsenals in order to overcome a US NMD system, the United States would have to match that proliferation with a proliferation of interceptors, putting the United States in a bizarre security situation where we had chosen a policy that was cheap for other states to overcome and incredibly expensive for us to expand in response. This occurs because AMBs are relatively "smart" and much more expensive to build, while ICBMs are technologically much "dumber". According to the CBO report, a low estimate for the

cost of one interceptor is \$25,000,000,²³ while globalsecurity.com estimates that the cost to produce a Minuteman III ICBM is about \$7,000,000.²⁴ Estimates like this mean that defense would be as more than 3x as expensive for the US as offensive would be for its potential enemies, and this calculation was arrived at using the cheapest option for interceptor cost that the CBO considered and an advanced US missile as an ICBM example. It is very conceivable than reasonable scenarios using higher estimates for ABMs and cheaper examples of ICBMs would yield an even larger spending discrepancy.

Such an asymmetrical military spending scenario may be unwise to voluntarily embark on, even given the present wealth of the US economy. If the economy crashed or if for some reason the government let the working NMD system lapse, the US would arguably be in the same security situation it is presently in except worsened, because the United States would have further inflamed the international community by having pursued a seemingly unilateralist policy and undermined credibility we may have had as a militarily restrained state.

Finally, it seems unlikely that the post-9/11 global threats the United States will be facing are going to come from ICBMs. Instead, cruise missiles are perhaps the biggest threat. Cruise missiles, which are GPS guided and fly at slower speeds about 50 feet above the ground, are undetectable by most forms of radar and therefore

²³ Congressional Budget Organization. Alternatives for Boost-Phase Missile Defense. July 2004. 05 May 2006. Appendix, 9. <<http://www.cbo.gov/showdoc.cfm?index=5679&sequence=6>>

²⁴ Air Force Link: Official Website of the United States Air Force. "LGM-30 Minuteman III." 05 May 2006. <<http://www.af.mil/factsheets/factsheet.asp?fsID=113>>

could not be countered by a NMD system.²⁵ Cruise missiles are also much cheaper, and could be launched off a boat just offshore from the US mainland without giving off the telltale heat signature that would let existing US systems know where an ICBM was launched from. This more clandestine type of launch seems like it would be much more appealing to terrorist organizations or states hoping to get away with attacking the US without retaliation.

While the administration has been a vocal supporter and catalyst for revamping BMD spending, many top military officials have lent support for BMD that is lukewarm at best. Lt. General Jay Montgomery Garner told *Washington Post* reporter George C. Wilson in 1997 that “there is no mechanism in place to make agencies like...Ballistic Missile Defense Organization [now MDA] efficient. They just pass on their inefficiencies on to the armed services and we have to pay for them. If I couldn’t eliminate them, I would at least put them on an operating account where they had to give so much service for a fixed amount of money.”²⁶

Given a recent New York Times article by William Broad, General Garner’s observations regarding lack of accountability for the BMD program seem to show some greatness of mind.²⁷ Broad’s article reports that Subrata Ghoshroy, a senior GAO investigator assigned to look into one of the primary technical components of the BMD system, accused the GAO of falsely informing Congress and the public in a 2002 report on the status of the BMD project and covering up information and

²⁵ Southworth, Samuel A. *U.S. Armed Forces Arsenal: A Guide to Modern Combat Hardware*. pp. 60-65. Cambridge: Da Capo Press, 2004.

²⁶ Wilson, George C. *This War Really Matters*. Washington, D.C.: CQ Press, 2000. 55.

²⁷ Broad, William J. “Accountability Office Finds Itself Accused.” *The New York Times*. 02 April 2006. A18.

disturbing test results that would have looked unfavorable to the project. Broad quotes Ghoshroy as saying that he found it "totally amazing" that the G.A.O. refused to admit that its report misinformed Congress and the public and that he was "concerned that there's no one out there to oversee the overseer."

During the same round of interviews with George Wilson, General Shalikashvili, Chairman of the Joint Chiefs of Staff, also told Mr. Wilson that "to decide to deploy a missile defense before the technology is proved effective 'seems to me to be less than a prudent way to go. Find out that it works before deciding to deploy.'"²⁸

Around the same time as the Shalikashvili interview, Congressman Obey (D-WI) also gave Wilson his own opinions about the missile defense programs.²⁹ Obey served as the chairman of the House Appropriations Committee in 1994, and was a key player in "top budget negotiations". Having served in Congress from 1969 and been the overseer of many congressional budgets, Obey had firm views about what the US military needed to best respond to the threats the nation would face in the years ahead.

In his interview with Congressman Obey, Wilson asks: "Is the case for a missile defense stronger in the twenty-first century than it was in the twentieth century when the United States decided to forgo deploying a missile defense even though the Soviet Union had thousands of nuclear warheads aimed at us?"

'I don't think it is,' Obey replied. 'But the argument the [Star Wars] advocates will make is that Russia was never going to use them, but some of these

²⁸ Wilson., 74.

²⁹ Ibid, 127.

terrorist countries are more likely to behave irrationally. The argument is persuasive enough to people to resurrect this stuff. Let's grant their premise. There is no evidence to indicate that you can afford to put an additional dime in that program right now because it has not progressed far enough technically...For those systems to work, everything has to work the first time and it will never have been tested in battlefield conditions.'

Here Congressman Obey echoes two concerns about the viability of the BMD program that mirror many of those same questions that plagued Reagan's Star Wars system in its day. For those proponents who believe that defense rather than deterrence would lead to a greater security paradigm, a NMD system would have to work 100% of the time to get the US out of a deterrence-based nuclear posture, and even *if* the technology could work it will have never been tested in battlefield conditions, making it difficult to rely on in wartime.

Contrapuntally, however, former Defense Secretary William Cohen supported the late-1990s/early 2000s drive towards BMD development. Though a long-time supporter of deterrence and US-Soviet arms control agreements, Cohen saw the drive towards BMD deployment as something that was inevitable and not necessarily mutually-exclusive with deterrence. Wilson asked Cohen whether he thought that the US "should deploy a missile defense in the new century," and Cohen responded by saying,

Given the nature of the technology that is being spread around the globe I don't see how we can avoid it. For me the question is: Is it there yet? Will it be there by next year? We're going to see the threat increase. We cannot protect against an all-out Russian assault as such, and that's where our deterrent comes into play. But if you have a North Korea that has nothing to lose, and in a moment of madness unleashes one of the Tae-po Dong 2's or 3's, should they have them, with a chemical or biological warhead, you need some kind of missile defense to stop it. You say, 'wait a minute. The Chiefs are concerned about a suitcase bomb filled with bio or

chemical. Or a tourist puts it out [unsuspectingly brings in a terrorist suitcase bomb. They say that's the more likely threat we face.' And it is.³⁰

Despite this, Cohen believes that a missile defense against Cold War enemies warranted an entirely different strategy than that which applies to our day and age. He acknowledges that while BMD is not the only place where defense spending should go, it is a program that can and should be supported at some level because of its strategic usefulness. Later in the interview, he offers an articulate summary of what will later become the Bush Administration's main argument, that the end of the Cold War and rise in Rogue State threats has created a new national security paradigm where BMD should have a place in state security strategy. Former Secretary Cohen continues:

From an ICBM threat you have a strong deterrent. That's not going to go away. Any country that would think of letting loose an ICBM on the United States will be vanquished in the process. There may be some countries who say we have nothing left to lose. You may have a situation where Saddam Hussein says don't even think about your containment policy because you never know that in a moment I might unleash one [a biological or chemical missile] in downtown New York or Washington or Detroit or wherever it might be. So you want to have something that would give you protection against that kind of threat. And that's something I've always supported.

Similar themes can be found in the Bush Administration's most recent executive document, entitled "The National Security Strategy of the United States of America."³¹ Section five of this text focuses on protecting the US and its friends and allies from threats of weapons of mass destruction. The primary reference to BMD in the policy reads:

³⁰ Ibid., 176-177.

³¹ The United States of America: National Security Council. The National Security Strategy of the United States of America. Feb 29 2006. <<http://www.whitehouse.gov/nsc/nss5.html>>

We must be prepared to stop rogue states and their terrorist clients before they are able to threaten or use weapons of mass destruction against the United States and our allies and friends. Our response must take full advantage of strengthened alliances, the establishment of new partnerships with former adversaries, innovation in the use of military forces, modern technologies, *including the development of an effective missile defense system*, and increased emphasis on intelligence collection and analysis.

Again, the political rhetoric emphasizes rogue states and terrorists obtaining weapons of mass destruction. Given the amount of technology and all of the cheaper alternatives available, it is probably rather unlikely that a terrorist state would design an offense around an ICBM attack on US soil, but it is important to note that the administration's rhetoric also warns of the special circumstances that "rogue states" might carry, marking them as different from the Soviets who were the enemy during the Star Wars era. A 2001 unclassified summary of a National Intelligence Estimate, however, supports the contrary idea that enemy states wanting to seriously harm the US or its interests would be unlikely to choose the comparatively expensive ICBM option.³² The report states that:

Several countries *could* develop a mechanism to launch SRBMs, MRBMs, or land-attack cruise missiles from forward-based ships or other platforms; a few are *likely* to do so—more likely for cruise missiles—before 2015. Nonmissile means for delivering weapons of mass destruction do not provide the same prestige, deterrence, and coercive diplomacy as ICBMs; but they are less expensive, more reliable and accurate, more effective for disseminating biological warfare agents, can be used without attribution, and *would avoid missile defenses*.

³² Director of Central Intelligence. "Unclassified summary of a National Intelligence Estimate: Foreign Missile Developments and the Ballistic Missile Threat through 2015". National Intelligence Council. December 2001. 05 May 2006. <<http://www.fas.org/irp/nic/bmthreat-2015.htm>> (italics added)

Stephen J. Hadley, former Deputy National Security Advisor under Condoleezza Rice and the current National Security Advisor, has written articles in favor of both NMD and TMD systems that predate any of his administration appointments. In a somewhat disorganized attack on the Clinton administration's support of the limited system in Alaska, Hadley writes that,

The system proposed by the Clinton administration would involve up to only 100 land-based interceptors located at a single site in Alaska. This system is intended to provide a very limited defense capable of shooting down 10 to 20 ballistic missile warheads launched at the United States, primarily from North Korea. Such a system would do nothing about the *thousands* of strategic ballistic missile warheads still deployed by Russia and relatively little about ballistic missiles that might be launched at the United States from countries such as Iraq and Iran in the Middle East...³³

Hadley then goes on to cite a 1999 National Intelligence Estimate (NIE) that warns of possible ICBM threats from North Korea, Iraq and Iran through nuclear development programs, illegal arms trading, or both.³⁴ His citations from the NIE thus speak to his claims that a limited missile system in Alaska would not adequately protect the US against the "rogue" threats he perceives from Iraq and Iran, but they do nothing to help his assertion that the Clinton administration was failing in its national security imperative because the US was not developing a NMD system capable of countering thousands of Soviet warheads.

Later in the piece he attempts to assuage critics by saying that an "emergency, limited" capability would not violate the spirit of the ABM treaty because *that* would not be designed to counter the Soviet threat.³⁵ Thus he simultaneously criticizes late 90's BMD efforts for not aiming at the development of full NMD defenses, and

³³ Hadley, Stephen J. *The Washington Quarterly*. 23:3. 95-108. (last set of italics added)

³⁴ "Foreign Missile Developments and the Ballistic Missile Threat to the United States through 2015." United States: National Intelligence Officer for Strategic and Nuclear Programs. (Sept. 1999).

³⁵ Hadley, 102.

assuages readers by telling them that what he proposes is not actually NMD and thus critics should not be up in arms about the strategic consequences of BMD policies. Finally, Hadley changes direction once again and again proposes NMD as part of BMD development, suggesting that we should pacify Russian resentment about the US not being subject to their deterrent by partnering with them to develop TMD systems and then jointly exporting the technology for profit.³⁶ While Cohen's arguments seem well thought out and strategically sound whether or not one agrees with his assessment of the world security situation, Hadley's *Washington Quarterly* piece seems to lack an similar apparent framework for articulating BMD's place in a global security context, despite his long national security resume.

So given the dramatic increase in funding and support for BMD programs in recent years, what has fueled the revamping of this old idea? While technology has improved in recent years, the GAO and CBO reports cited earlier have been critical of overzealous proclamations about the success of BMD prototype components, warning that the costs and risks of the program failing are still very high. Many of the old strategic arguments from the Star Wars days still apply, and legislators like Obey see many similarities between the arguments in the 80's and our arguments in the 21st century. On the other hand, professionals like Cohen and Hadley view the post-Cold War age as a different security paradigm for a variety of reasons, and have many responses for why BMD will be necessary as we move into the next century. Finally, many defense department officials seem unsupportive or at least unenthusiastic about the program, reminding us that such large sums of money could be funding many

³⁶ Ibid., 107.

other principal sources of military need, and that deployment before operational readiness may not be the best way to proceed with weapons system development.

To try to get a more accurate look at what has truly been fueling BMD support since 2001, we put several 2004 Senate votes into a statistical model that controls for special-interest variables like prime-contract awards and the amount of people employed by the DOD in a given state (militarization). We will also try to include variables that test for a causality between the ways that Senators ideologically tend to vote and their associations with each other on things like Senate committees. The following empirical papers help us develop this exact model, and provide the context for the Research Methods we will describe in Section III of this thesis.

Our model for determining the probability of voting outcomes as a function of multiple explanatory variables was inspired by voting behavior analyses in several empirical papers. John Wright of Ohio State University uses a probit method to predict the probability of pro-tobacco votes in the House and Senate given *party affiliation, ideology, tobacco production, tobacco employment, and campaign contributions* from sixteen tobacco industry PACs.³⁷ Wright includes *party affiliation* and *ideology* because he posits a correlation between a congressperson's support for the tobacco industry and which side of the aisle they are on, given that parties form voting coalitions and that parties have subgroups of more liberal and more conservative members, respectively. He includes *tobacco production, tobacco employment, and campaign contributions* in order to see whether factors that might

³⁷ Wright, John. "Campaign Contributions and Congressional Voting on Tobacco Policy, 1980-2000." *Business and Politics* 6:3 (2004). 12 Feb. 2005. Published by Berkeley Electronic Press, 2004. <<http://www.bpress.com/bap>>

affect a congressperson's domestic or monetary campaign support affect their voting habits—the theory being that representatives from districts where a hit against the tobacco industry could hurt employment or tobacco revenue in their area may be less likely to vote against the industry. In some regressions, Wright also includes a variable for whether or not the votes occurred during the Clinton presidency, supposing that white house pressure to vote against the industry might affect voting outcomes. This study also does analyses of pooled and per-vote data, which are logical potential exploration tracks for our study as well. Our study makes similar use of the *party* variable, and also relies on the probit qualitative response model.

Garrett and Sobel conduct a study of Federal Emergency Management Agency (FEMA) disaster relief payments in relation to “private insurance disaster expenditures in state *i* in year *t* (including the observations with values of zero) on private insurance disaster payments, Red Cross Disaster assistance, the number of FEMA disasters declared, regional and year dummies, and oversight subcommittee variables,” among others.³⁸ Garrett and Sobel's inclusion of oversight subcommittee variables is intriguing, given their explanations for why those variables were included in their regressions. While it is possible that FEMA disaster expenditures are solely a function of the magnitude of a given disaster in the United States, they contend that it also may be possible that congressional influence significantly contributes to FEMA relief awards. By researching which house and senate subcommittees had oversight over FEMA payments and including a dummy for whether or not congresspersons

³⁸ Garrett, Thomas A. and Sobel, Russell S. “The Political Economy of FEMA Disaster Payments.” *Economic Inquiry* 41:3 (2003). 496-509.

were members of those committees, they were able to explore a possible connections between committee membership and the magnitude of FEMA relief.

Given that the Senate Armed Services committee is responsible for holding hearings about BMD programs and directly overseeing the effort, membership on this committee seems like a useful variable to include in our regressions. Membership on the committee may mean that those Senators who have committee standing are the best informed about BMD policy, being the politicians who directly interface with the military personnel who are responsible for administering its development. This may mean that members are likely to be less supportive of funding the program without successful tests or adequate testing, or increasing BMD program funding without seeing sufficient evidence that its goals are technologically feasible. Contrarily, the Armed Services Committee may be more likely to fund military projects in general because they are closer to them and more often updated. It is also possible that if the Armed Services Committee members have better connections to DOD officials they may be more aware of a general criticism (revealed in Wilson's interviews with top level officials from many military branches) that MDA funding is a drain from other, more worthy programs. In this case, Armed Services Committee members may be less likely so support BMD programs, in general. In any event, the *armed services committee* variable presents itself as a compelling factor for inclusion.

In a study similar to that of Garret and Sobel, Rawls and Laband analyze whether or not the amount of endangered species listings in a congressional district is

subject to political maneuvering by members of congress.³⁹ In this paper, Rawls and Laband use a League of Conservation Voters' "scorecard" which ranks each congressperson's support for conservation on a scale of 1-100. Our study uses a similar "DW-NOMINATE" score developed by Poole and Rosenthal, which assesses a member's political ideology on a scale from -1 to 1 along a normal distribution curve. Rather than being based on rhetorically devised ideology, the Poole-Rosenthal scores calculate special distances in roll-call data that align congress members along an axis based on the frequency with which they vote "yea" or "nay" compared to all other members. The DW-NOMINATE scores will be further elaborated in Data, Section IV of this thesis, but in theory the DW-NOMINATE scores track how similarly congress people vote when compared to one another, and plot them along a statistical distribution. Going beyond a simple dummy variable for political party, the nominate scores should help isolate the role that ideology plays (if any) in supporting or constraining missile defense efforts.

In a 1970 study, James Clotfelter analyzes the influence of military prime contract awards (contracts directly awarded by the Federal government), the state percentage of the population on the Defense Department payroll, and state civilian defense employment as a percentage of total civilian state workforce to analyze whether the intensity of the presence of the military-industrial complex presents in a state influenced Senators' voting behavior on 11 key defense-related roll call votes in

³⁹ Rawls, R. Patrick and Laband, David N. "A Public Choice Analysis of Endangered Species Listings." *Public Choice* 121: 263-277, 2004.

1969.⁴⁰ Using zero-order coefficients between roll-call scores and each variable, Clotfelter finds that the prime contract variable had the weakest correlation with the roll-call voting behavior, and further that the relationship was not significant at the 0.05 level. He also finds that while the prime-contract variable has a weak correlation with roll-call behavior, the amount of DOD employment within each state had significant effects at the 0.05 and 0.01 levels, meaning that there was an extremely strong correlation between DOD employment and voting behavior on defense issues.

In a more recent study, Derouen and Heo use prime contracts to analyze the relationship between domestic politics and defense spending, albeit on a macro level that relates GDP patterns to presidential manipulations of the national defense budget.⁴¹ To see if patterns like the ones Clotfelter observed hold true in 2004, information on both prime contracts and the amount of persons employed by the military in a given state are included in our data set.

III. RESEARCH DESIGN

In its simplest form, a “regression” calculation studies the correlative relationship between two factors. The simplest two-dimensional graphs use this concept where a movement on the x axis corresponds to a movement on the y axis. Any plotting of an (x,y) coordinate gives us a point that possibly expresses the relationship between the measurements on the x and y axes. This relationship can be as simple as the notation of a decision made at a single moment in time. A correlation can be explained as

⁴⁰ Clotfelter, James. “Senate Voting and Constituency Stake in Defense Spending.” *The Journal of Politics*. 32:4 (Nov., 1970) 979-983.

⁴¹ Derouen, Karl Jr., Heo, Uk. “Defense Contracting and Domestic Politics.” *Political Research Quarterly*. 53:4 (Dec., 2000) 753-769.

evidence of a particular theory, but in and of itself it does not prove causal relationships between phenomena. For example, say we have two planes, hamburgers (x) and soda (y). We can posit that our x axis is causal because hamburgers make one hungry, and thus hamburgers correspond to a dependent value on the y axis. In this example, hamburgers cause thirst at a rate of 1:1. If one orders two hamburgers, then, they will also order two sodas—and we can plot the point (2,2) on our plane.

Because a one-unit increase in hamburgers corresponds to a one-unit increase in sodas, points in our example would be linked by a line with a slope having a positive value of 1 (in this example, we are also ignoring fact that our customer probably does not have an infinite capacity for ingesting soda and hamburgers). Putting this example into a simple algebraic equation, we can use a $y=mx+b$ form to express our possible relationship as

$$S_i=1(H_i)$$

Where S_i is the expected number of sodas for observation i , 1 represents the slope and 1:1 ratio of soda to hamburger orders, and H_i represents the number of hamburgers ordered.

This is the basic idea behind the simplest forms of regression analysis—that an event like soda ordering might be explained by a possible causal factor, like the number of hamburgers demanded in that same order. Thus, given a particular phenomenon, we are able to model events as the result of one or more factors. A person's salary, for example, may be the result of their education, the number of years

they have spent in the workforce, and the area of the country that they live in. The price of a car may be a function of its mileage, automaker, and age. Regression analyses simply give us a coherent way to look at how a multitude of variables and possible causal relationships may affect a particular outcome, rather than just one.

The simplest regression technique is the Ordinary Least Squares model (OLS), which takes the form

$$Y_i = \beta_1 + \beta_2 X_i + u_i$$

Where β_2 is the amount that a one-unit change in a given observation X_i will affect the given outcome Y_i , β_1 is a constant number that is not dependent on X_i or Y_i , and u_i is a stochastic (random) error term. An error term is included here because we know that while in theory it is possible to explain any event in terms of its hypothesized causal factors, in practice a perfect description is very difficult. In a perfect model, u_i would have a value of zero, because our explanation of a Y_i event would have no errors and would be perfectly explained. In practice, experimental error terms are not zero, and smaller error terms are generally assumed to be indicative of better models. Finally, the portion of Y_i that is explained by given variables is called the R^2 value, which is “a summary measure that tells how well the sample regression line fits the data”. The higher a regression’s R^2 value, the better the model explains the variation in the left-hand side variable.

Before we move on from the OLS regression format, however, let’s briefly touch on how one would interpret the results of one of these regressions. Using a made-up example it is easy to see how OLS could actually help us describe something

practical, like the price of a car. Let's use the following model to describe the present value of a car that sold for \$20,000.00 when it was new:

$$P_{\text{car}} = 20,000 - 2\text{Mile} - 1000\text{Age} + u_i$$

Here P_{car} is the price of the car, 20,000 is a constant term (in dollars), Mile is the number of miles a given car has on its odometer, Age is the car's age, and u_i is the error term. The values 2 and 1000 represent the change in the price of a car due to a one unit change in mileage (an additional mile) or a one-unit change in age (an additional year). Our model predicts that a new car's price will be \$20,000.00, and that each additional mile decreases the price of our car by \$2.00, while every additional year of its lifespan will decrease its value by \$1000.00. Since not all variation in used car values can be explained by mileage and age alone, u_i stands in for all of the factors that collectively would help to explain how car value changes, but that are not included in our model.

The sample OLS regression we have used above explains a quantitative change as the result of other quantitative changes. But what if we want to add a qualitative factor into our calculations, like whether the car is or is not a Toyota? A car either must or must not be recognized as a Toyota model, and therefore a variable for brand in our model must be qualitative. Qualitative variables are called "dummy variables" in regression analysis, and simply take the value of zero or one depending on whether the observed characteristic is present. Let's look at our example again, this time with a dummy variable representing whether the car is or is not a Toyota:

$$P_{\text{car}} = 20,000 - 2\text{Mile} - 1000\text{Age} + 1500\text{Toyota} + u_i$$

In this regression, the coefficient on *Mile* still means that a one mile increase will decrease a car's value by \$2.00, and that an additional year of age will decrease its value by \$1000.00. As we have said, the dummy for car brand will either take the value of zero or one—in this case, 0 if the car is not a Toyota, and 1 if it is. This means that our third term will express one of two possibilities, taking the form +1500(0) or +1500(1). This means that if the value of the brand variable is 0 and the car is not a Toyota, there will be no change in the car's price. If the car is a Toyota then the term will read +1500(1), and the value of P_{car} will be increased by \$1,500.00.

Given that brief review of OLS regression analysis, we can now move on to the specific form we will use to model the increased probability of a senator favorably voting to support BMD legislation. The primary distinction between the above regressions and our own will be that our left-hand side, dependent variable will be qualitative rather than quantitative. Because our dependent outcome will be either a favorable “aye”, or an unfavorable “nay” vote, the left-hand side variable will actually be a dummy which takes a value of either 0 or 1. In more technical terms, we must select a “qualitative response” regression model.

OLS done with a qualitative result as the dependent variable is called the Linear Probability Model (LPM), and it is possible to do some probability prediction using

this model. Unfortunately, however, using OLS to predict probabilities is problematic for the following reasons:⁴²

- Non-normality of the disturbances u_i
- Heteroscedastic variances of the disturbances
- Non-fulfillment of $0 \leq E(Y_i | X_i) \leq 1$
- Questionable value of R^2 as a goodness of fit

While it is not necessary to go into great detail about why the preceding four conditions are problematic, briefly touching on them will be important to our understanding of why a different model will be more appropriate for our purposes. The first condition means that any error terms u_i from our models will not be statistically “normally” distributed. Since we are often reliant on the properties of the normal distribution for statistical inference, this could be problematic in modeling accuracy.

Heteroscedastic variance of the disturbances means that the magnitude of the error term could change as the inputs to our model change. In our previous hamburger example, this would mean that predicting the relationship between hamburgers and sodas could be less accurate the more hamburgers we ordered, or vice versa. Clearly, inconsistent expectations of accuracy could seriously undermine our confidence in our calculations. OLS assumes that the extent of a regression error term will not vary as data varies (homoscedasticity), and that the rate of error in a model will be the same no matter what the inputs into the model are. This

⁴² Gujarati, Damodar N. Basic Econometrics: Fourth Edition. New Dehli: Tate McGraw-Hill, 2003. 608-617.

undermines one of the main tenets that OLS modeling accuracy is contingent upon, and could be very problematic.

Non-fulfillment of $0 \leq E(Y_i | X_i) \leq 1$ means that we cannot be sure that every set of model inputs will yield a Y_i value that is either zero or one. We could end up with predictions that say that the probability of an individual getting a certain job are -.06 (-6%), or that the probability of a US Senator delivering a “yes” vote on a particular bill is 4 (400%)—neither of which make any sense. Thus we must look beyond the simple LPM to find a modeling form that will yield more interpretively useful results.

After the LPM, the two main types of qualitative response regression models are the logit and probit models. These models are similar in that they both allow researchers predict probabilities by yielding a value between zero and one, given certain inputs.

In Basic Econometrics, Gujarati explains the motivation behind the probit model in terms of calculating the probability that a family will own a home, given that family’s income. In this home ownership example, we assume that whether or not the i th family will choose to own a home is dependent on a latent variable, or unobservable utility index I_i . This unobservable utility index is “determined by one or more explanatory variables, say income X_i , in such a way that the larger the value of the index I_i , the greater probability of a family owning a house.”

This index I_i can thus be expressed as

$$I_i = \beta_1 + \beta_2 X_i$$

Here, the variable X_i stands for the income of the i th family. The unobservable index I_i is related to the decision to own a home because we can assume that there is a “critical or threshold” level of the index above which the family will choose to own a house, and below which it will not. This threshold index value can be denoted I_i^* . Again, if a family’s index I_i exceeds I_i^* they will choose to own a home, whereas if it is less than I_i^* they will not choose to own a home. Though I_i and I_i^* are unobservable, Gujarati further asserts that we can assume that the observations I_i will relate to I_i^* following a normal distribution pattern.

Given the assumption of normality, the probability that I_i^* is less than or equal to I_i can be represented by⁴³

$$P_i = P(Y = 1 | X) = P(I_i^* \leq I_i) = P(Z_i \leq \beta_1 + \beta_2 X_i) = F(\beta_1 + \beta_2 X_i)$$

Where $P(Y = 1 | X)$ is the probability of an Y event taking a value of 1 given the value(s) of the X (explanatory) variable(s) and where Z_i is the standard normal distribution variable ($Z \sim N(0, \sigma^2)$). Our F stands for the standard normal cumulative distribution function (CDF), which can also be written as⁴⁴

$$F(I_i) = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{\beta_1 + \beta_2 X_i} e^{-z^2/2} dz$$

Using the probit model to fit our observations along the normal CDF, we thus have an estimation method that allows us to predict the probability of a qualitative event occurring, given independent factors. To find the effect of a unit change in any

⁴³ Ibid., 608.

⁴⁴ Ibid, 609.

of our right hand-side variables, we simply have to take the derivative of a dependent variable with respect to an independent variable. An application of this in our study may mean deriving the rate of change of probability of a supportive vote with respect to the amount of prime contracts in a state. That derivative equation would take the form

$$(dP_i / dX_i) = f(\beta_1 + \beta_2 X_i) \beta_2$$

Where $f(\beta_1 + \beta_2 X_i) \beta_2$ is the value of the normal CDF at $\beta_1 + \beta_2 X_i$. The probability calculations we assess later are arrived at using this formula.

IV: DATA

Based on the aforementioned literature review and the hypotheses that economists, political scientists, and politicians have put forth postulating possible factors for congressional support of missile defense programs, we will use the following variables in our calculations:

Dependent Variables:

Three Key Votes. To test congressional voting behavior on missile defense bills as a function of a series of factors, we will use three key senate votes from 2004: Senate Vote 124 on July 17th, 2004, Senate Vote 125 on July 17th, 2004, and Senate Vote 139 on July 23, 2004. All of these bills were votes which moved to constrain or bolster missile defense funding, and refer specifically to that weapons program. This is

important, because a general summary of votes on a variety of defense bills would not allow us to test for ideology or pull factors affecting missile defense programs specifically.

Senate vote 124 was a proposal by California Senator Barbara Boxer to amend Senator John W. Warner's (R-VA) National Defense Authorization Act for Fiscal Year 2005 by stipulating that the bill "allow deployment of the ground-based midcourse defense element of the national ballistic missile defense system *only* after the mission-related capabilities of the system have been confirmed by operationally realistic testing."⁴⁵ Lexis-Nexis Congressional describes the original Warner bill as a general proposal to "authorize appropriations for fiscal year 2005 for military activities of the Department of Defense, for military construction, and for defense activities of the Department of Energy, to prescribe personnel strengths for such fiscal year for the Armed Services, and for other purposes." Thus, the Boxer amendment pointedly caused a specific vote to occur with the intention of constraining some missile defense program funding, by attempting to apply more stringent criteria to the bill than currently existed. The Boxer amendment was rejected 42-57, and the party breakdown of each bill is illustrated in Table 1.1 below.

Senate vote 125 was a roll-call vote on John Warner's Amendment 3543 "to require the Secretary of Defense to prescribe and apply criteria for operationally realistic testing of fieldable prototypes developed under the ballistic missile defense

⁴⁵ Lexis-Nexis Congressional. 13 Dec. 2005. 2004 Congressional Information Service, inc. 18 June 2004. <http://0-web.lexis-nexis.com.janus.uoregon.edu/congcomp/document?_m=8aa9676b2095ed2d4cd0caf4f335aa42&_docnum=3&wchp=dGLbVlb-zSkSA&_md5=fd605117c34bb4caa6cba743841ca80>

spiral development program.”⁴⁶ This was an amendment to amend Senator Reed’s (D-RI) Amendment No.3354, which followed the vote on the Boxer amendment, and aimed to require “baselines for and testing of block configuration of the Ballistic Missile Defense system.” Unlike the Boxer amendment, the Warner amendment did pass by a vote of 55 yeas to 44 nays. This is likely because the language is looser than that of the Boxer amendment, but because it still required more BMD program constraint than any language that was previously stipulated by the senate, it represents a movement towards constraining BMD funding. We should note here that most Democrats which voted for the Boxer amendment voted against this Warner amendment, perhaps because it was viewed as a weaker statement of BMD constraint the most Democratic senators would have liked.

On Senate vote 139, “The Senate rejected Reed Amendment No. 3353, to limit the obligation and expenditure of funds for the Ground-based Midcourse Defense program pending the submission of a report on operational test and evaluation.”⁴⁷ This bill offered the most stringent constraint on BMD programs, because while the Boxer amendment only aimed to limit deployment, this new Reed amendment addressed funding constraints directly. The amendment ultimately failed to pass, though it enjoyed somewhat higher democratic support than did the Boxer amendment. This could be because Democrats who had initially voted against the Boxer amendment had originally thought that the Boxer amendment’s wording was

⁴⁶ Lexis-Nexis Congressional. 13 Dec. 2005. 2004 Congressional Information Service, inc. 24 June 2004. <http://0-web.lexis-nexis.com.janus.uoregon.edu/congcomp/document?_m=8aa9676b2095ed2d4cd0caf4f335aa42&_docnum=4&wchp=dGLbV1b-zSkSA&_md5=1e8ebe0a8738714e78f201a692a3462b>

⁴⁷ Lexis-Nexis Congressional. 13 Dec. 2005. 2004 Congressional Information Service, inc. 24 June 2004. <http://0-web.lexis-nexis.com.janus.uoregon.edu/congcomp/document?_m=8aa9676b2095ed2d4cd0caf4f335aa42&_docnum=2&wchp=dGLbV1b-zSkSA&_md5=d4a4cdaf6282383ef8682ffec5fc6eb>

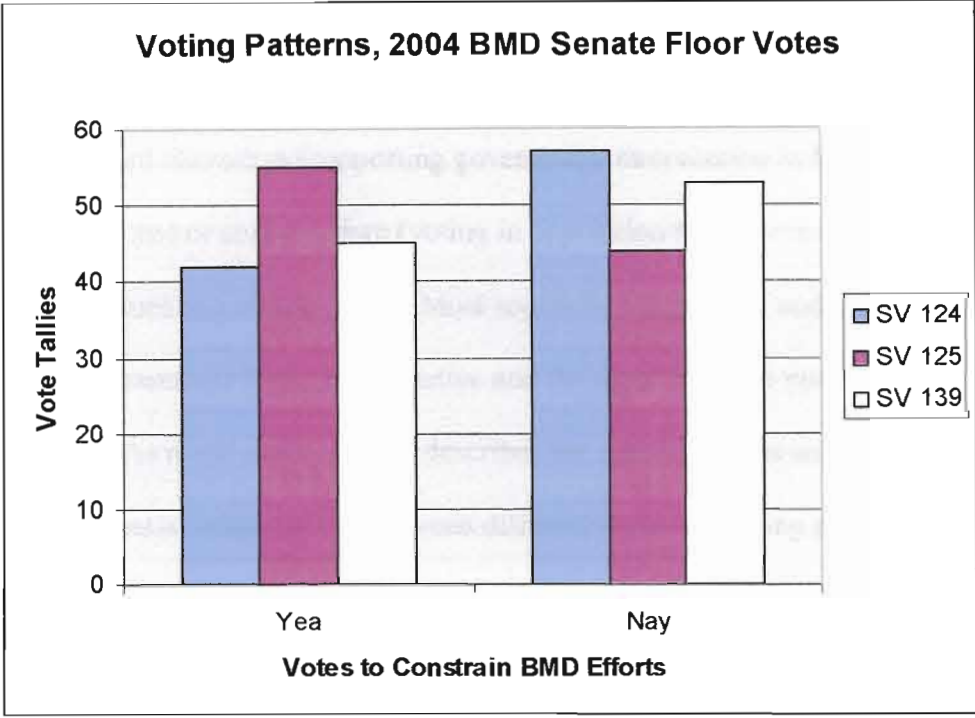
too strong, but after the passage of the Warner amendment they were dissatisfied with Warner's Republican response and wanted to show more robust party support for Reed's second, more constraining amendment.

Table 4.1: Voting Breakdown on Senate Bills 124, 125, and 139, June 2004

Bill	Yea	Nay	D--Yea	D--Nay	R--Yea	R--Nay	I--Yea	I--Nay
2004 Senate Vote 124	42	57	40	7	1	50	1	0
2004 Senate Vote 125	55	44	4	43	51	0	0	0
2004 Senate Vote 139	45	53	44	3	0	50	1	0

To summarize the general outcomes of all three votes, figure 1.2 shows the amount of pro and anti-constraint votes for each BMD floor vote.

Figure 4.2: Graphical Representation of Floor Votes



While these three votes are good choices for study because they directly address BMD support, it may be that the interrelated nature of each will be problematic when we move to do regressions on them. Because the vote on 125 was a Republican response to the failed Democratic 124 amendment, the vote on 125 may reveal partisanship over any other correlations. Similarly, because 139 was a reaction to 125, we would expect the same sort of polarization. Though attaining it is beyond the scope of this paper, our ideal dataset would include information on many more votes in both the House and Senate, to mitigate the complications that might arise from interrelated votes like the three we have chosen.

Independent Variables

DW-NOMINATE Scores. The “nominate” scores are values that political scientists Keith T. Poole and Howard Rosenthal developed that calculate a legislator’s tendency toward liberalism (supporting government intervention in the economy and social institutions) or conservatism (voting in opposition to government intervention), tying these values to a normal CDF. Most scores lie between +1 and -1, with the more positive numbers being conservative and the more negative numbers being more liberal. As noted earlier, Poole describes the coefficients as an ordering between the spatial relationships between different senators’ voting patterns. Because Senator Barbara Boxer votes more similarly to Senator Ted Kennedy they have scores that are -0.601 and -0.566, respectively, along the normal distribution ordering of Senators. Senators Brownback and McConnell also vote similarly, and have calculated scores of 0.457 and 0.473, meaning that they are roughly the same distance from the center and that their voting patterns are seldom different. The correlation coefficient between DW-NOMINATE and PARTY variables is 0.8791—meaning that party is closely tied to the Poole-Rosenthal distribution of ideology, but that it is not a perfect fit. We use the DW-NOMINATE scores here in place of party, hoping to get a better model of the relationship between liberal-conservative ideology and support for BMD funding.

State Prime Contract Awards. In testing whether or not the amount of prime defense contracts awarded in a given state has an effect on the defense-related voting behavior of its senator, it is essential to include the aggregate amount of prime contracts awarded to each state in the fiscal year 2004 as a variable on our model.⁴⁸

⁴⁸ Bureau of Economic Analysis. Dec 20 2005. <www.bea.gov>

While Clotfelter found that the relationship between prime contracts and voting behavior in his era was weak, it may be that this correlation has changed in recent decades due to the proliferation of special-interest lobbying on the hill. Prime contracts may be economic boons to a Senator's state, and Senators from states that receive large prime contracts may be used to considering defense programs as an integral part of their state's economy. Therefore, Senators from states with large general prime contract awards may be less likely to vote against specific programs (like BMD), because they know what kind of money those contracts bring into the state.

On the other hand, it may be the case that state prime contracts might have an effect on voting behavior but that this effect will not be visible in our data, because influence can be manifested in pork-barrel projects and horse-trading efforts between senators that would not be explicitly explained by our method of analysis. In any case, it will be necessary to test whether aggregate state prime contracts are a significant factor in voting to support or constrain existing BMD programs.

BMD Prime Contract Awards. As a corollary to the logic above, it may be that legislators align their voting behavior in support of specific programs that are funded well in their state, rather than responding to the total amount of prime state contracts. Senators from states with contractors that receive large sums of money from components of the BMD program may be less likely to vote to constrain or kill such a program, regardless of its strategic uses. Accordingly, I've used Department of Defense information listing the number and value of prime contracts awarded per

weapons system per state to create variable for the aggregate amount of BMD (BMD only) contract dollars for each state.⁴⁹

Senate Armed Service Committee. As illustrated by the previously mentioned study concerning committee membership and FEMA disaster relief allocations, it is possible that whether or not a senator is a member of the Senate Armed Services Committee will have an impact on their voting behavior for particular weapons programs. While the Senate as a whole can present amendments while voting for the final budget, the Armed Service Committee members are the ones responsible for deeper oversight of defense programs and who presumably have more interface with members of the armed services. Additionally, membership on the Armed Services Committee may be somewhat self-selecting—Senators who may be inherently more pro-defense or inclined to support defense programs may be more likely to get on the committee because armed service funding is a strong interest of theirs. Membership could also be contrapuntally self-selecting, with those senators that most want to check defense spending and oversee defense budgets more inclined to join the Committee. While it is possible that Armed Service Committee members may be more critical of BMD programs and vote to constrain its funding, it is logical to suspect that committee members may be less critical of this large defense program, due to their close interactions with the DOD and propensity to support the armed services in general

⁴⁹ United States Department of Defense: Directorate for Information Operations and Reports. DOD Personnel and Procurement. 18 Jan. 2005. <<http://web1.whs.mil/PEIDHOME/PROCSTAT/st08\ST08-FY2003.pdf>>

Percent Population in the Armed Services. This variable is similar to the one Clotfelter used in his 1970 study, and was calculated by dividing Current Population Survey numbers of the amount of military personnel living in a given state by that state's total population. The idea behind the inclusion of this variable is that senators that come from states with large military populations may be more susceptible to negative support if they vote against key defense projects and are seen as anti-military. In theory, these Senators would come from states with larger voting blocks that pay attention to their support of the defense industry, and they may be hurt more on election day if they support killing or terminating defense projects in their own state. Also, if ending a particular military project will result in job losses within a state, canceling such programs could be seen as "putting people out of work", which again could have serious political consequences.

It should be noted, however, that because BMD is largely a high-tech program which is manifested in billions of dollars for research and development being spread across relatively few specialists and support personnel, it is unlikely that job loss concerns would affect a senator's popularity in the way that canceling or curbing in-state programs that hired more people might. Nevertheless, because this was one of Clotfelter's strongest correlations, it is logical to include so that we can see whether or not the amount of DOD employees in a given state has any influence on voting behavior towards BMD specific bills.⁵⁰

⁵⁰ United States Current Population Survey. [A Joint Project Between the Bureau of Labor Statistics and the Bureau of the Census: Current Population Survey](http://www.bls.census.gov/cps/cpsmain.htm). 20 Dec. 2005.
<<http://www.bls.census.gov/cps/cpsmain.htm>>

Appendix II contains summary statistics for all of the variables used in our regressions. While these are the primary variables used in our regression analysis, a great deal more information was collected for the purposes of this project. Appendix III includes a table of information about additional variables, data, and sources used in the development of this paper.

V. EMPIRICAL MODELS:

Given both the dependent and independent variables chosen, the following two models will each be used in probit regressions for all three 2004 votes. While they are essentially the same, the former is meant to capture any effects aggregate state prime contracts may have on legislators' behavior, while the second is meant to isolate the effect BMD contracts in particular may have.

$$\begin{aligned} \text{VOTE}_n = & \alpha + \beta_1 \text{NOMINATE} + \\ & \beta_2 \text{AMT_DEFENSE_PRIME_CONTRACT_AWARD} + \\ & \beta_3 \text{SENATE_ARMED_SERVICE_COMMITTEE} + \\ & \beta_4 \text{PERCENT_POPULATION_ASERVICE_04} + u_i \end{aligned}$$

$$\begin{aligned} \text{VOTE}_n = & \alpha + \beta_1 \text{NOMINATE} + \beta_2 \text{PRIME_CONTRACTS_BMD_FY2003} + \\ & \beta_3 \text{SENATE_ARMED_SERVICE_COMMITTEE} + \\ & \beta_4 \text{PERCENT_POPULATION_ASERVICE_04} + u_i \end{aligned}$$

VI. Results:

Table 6.1: Senate Vote 124

Variable	Model I	Model II
Dependent Variable: Senate Vote 124 (n=100)		
DW-NOMINATE		
dF/dx	1.378789	1.402691
standard error	0.2830607	0.2818253
z-statistic	4.96**	5.03**
State Prime Contracts		
	7.75E-12	
	1.01E-11	
	0.77	
State BMD Prime Contracts		
		2.19E-11
		3.23E-10
		-0.07
Senate Armed Service Committee		
	0.2135828	0.2196725
	0.974746	0.981247
	2.13*	2.15*
Percent Population Armed Services		
	-13.64576	-14.51465
	8.329946	8.278839
	-1.6	-1.68
LR chi2	91.88	91.34
Prob > chi2	0	0
Pseudo R2	0.6826	0.6786

*significant at the 0.05 level, one-tailed.

**significant at the 0.01 level, one-tailed.

As shown by Table 5.1, the DW-NOMINATE scores and membership on the Senate Armed Service committee both have significant impacts on the outcome of senate vote 124. DW-NOMINATE is significant at the 0.01 level, while membership on the Senate Armed Services Committee is significant at the 0.05 level. This is an interesting result because vote 124 is ostensibly the least partisan, with more democrats voting towards “1” and against constraining BMD programs than in

any other 2004 floor vote. The DW-NOMINATE coefficient suggests that for every one-unit change in a legislator's DW-NOMINATE score, the likelihood that they will vote against constraining BMD programs increases by about 1.3%. (?) Additionally, membership on the Armed Service Committee increased the probability that a Senator would vote against constraints and towards "1" by .2%. This real effect may be due to the fact that membership on the Senate Armed Service Committee is somewhat self-selecting, and that committee members are more likely to support DOD efforts and reject military constraints in general.

The percentage of a state's population that is employed by the DOD also had no significant effect on the voting behavior of its Senators in this instance—and the coefficient is actually negative. As we earlier suspected might have been the case, this insignificance could be because BMD programs tend to employ people in the high-tech, strategic-analytic sectors of the state economy, and not blue-collar workers—meaning that BMD programs may not have the politically positive job-creation effects that other defense programs may create in a state.

This also ties into the sentiment that was revealed during the Wilson interviews of high level officers in each of the service branches, that pro-BMD does not have much of a correlation with being pro-military. Wilson's interviews, in fact, seemed to reveal the opposite dynamic: While each officer advocated that their branch needed more spending money in order for their organizations to optimally function, no high-ranking officials claimed that their branch needed more funding for BMD components or that MDA should be better funded. In general, it may be that the

relationship between state military population and BMD support is unusual because in this case it does not seem to yield a pro-defense program attitude.

Alternatively, it may be that the dynamic between Senators and the amount of military personnel in their state has changed since Clotfelter’s day, and that the number of people employed by the DOD no longer has a substantial on voting behavior in general.

Both of the prime contract variables are not statistically significant, meaning that we are unable to support claims that state prime contract awards in general or weapons system-specific contracts have a substantial effect on the way a Senator supports or constrains existing BMD programs. This goes against claims that pork-barrel spending on BMD programs acutely influences Senators’ voting behavior. However, this does not necessarily mean that such claims of pork-barrel influence do not have merit—as suggested with the introduction of the variable, it may be that because of favor-trading between senators, the prime contract influence does not explicitly appear in our data analysis.

Table 6.2: Senate Vote 125

Variable	Model I	Model II
Dependent Variable: Senate Vote 125 (n=100)		
DW-NOMINATE		
dF/dx	-1.746133	-1.691042
standard error	1.714404	1.608328
z-statistic	-2.86*	-2.81*
State Prime Contracts		
	8.24E-12	
	3.49E-11	
	0.28	
State BMD Prime Contracts		
		1.63E-10
		7.38E-10
		0.25

**Senate Armed Service
Committee**

	-.1292544	-.1183589
	.18636	.1583021
	-1.15	-1.12

**Percent Population Armed
Services**

	7.861245	6.592321
	20.41935	20.44162
	0.42	0.34

LR chi2	125.79	125.73
Prob > chi2	0	0
Pseudo R2	0.914	0.9135

*significant at the 0.05 level, one-tailed.

**significant at the 0.01 level, one-tailed.

For Senate vote 125, the only significant coefficient is the DW-NOMINATE scores. Like vote 124, the armed service population and prime contract variables were not significant, and in this case the Armed Services Committee variable was not significant either. While initially the negative coefficient on the DW-NOMINATE regressor may seem a bit odd, it makes a great deal of sense once we take into account the context of this bill, mentioned earlier in section IV. This bill was a response to the amendment Senator Reed's (D-RI) amendment following the failed Boxer amendment, which once again sought to constrain the funding flow for BMD programs. Senator Warner's (R-VA) amendment served as the Republican response to Reed's Democratic initiative, which presumably most Democrats were dissatisfied with, given the partisan outcome of the vote. The fact that votes 125 and 139 came quickly after 124 may mean that 125 and 139 are extremely skewed because they both appear to be partisan responses in the wake of the failed vote on amendment 124. We will nevertheless analyze them for interesting or telling patterns, bearing in

mind that a larger sample of BMD votes over time may be a logical way to eventually extend this study and mitigate the effect of reactive partisanship between votes.

Only four democratic senators voted for this weaker version of the bill. Because the DW-NOMINATE scores are correlated with party at a zero-order coefficient of about 0.8, it is not surprising that the Republicans' fully backing their weaker bill shows that higher NOMINATE scores push legislators toward BMD constraint in this example, rather than supporting or expanding BMD programs and moving towards "1". Again, this vote is probably indicative of a moment of partisan battling within the US Senate, rather than being a data pool that we can use to try to isolate the effects of party on voting behavior.

Table 6.3: Senate Vote 139

Variable	Model I	Model II
	Dependent Variable: Senate Vote 139 (n=100)	
DW-NOMINATE		
dF/dx	2.041138	2.038153
standard error	0.4917679	0.4646114
z-statistic	4.01**	4.18**
State Prime Contracts		
	1.45E-11	
	1.33E-11	
	1.12	
State BMD Prime Contracts		
		9.80E-11
		4.93E-10
		0.2
Senate Armed Service Committee		
	0.1295326	0.134969
	0.1531938	0.1535773
	0.81	0.84
Percent Population Armed Services		
	-16.06581	-17.36822
	11.35451	11.10617
	-1.24	-1.36

LR chi2	113.31	112.24
Prob > chi2	0	0
Pseudo R2	0.8233	0.8155

*significant at the 0.05 level, one-tailed.

**significant at the 0.01 level, one-tailed.

Our last set of regressions again shows a positive relationship between laissez-faire support of BMD funding (voting against constraints) and DW-NOMINATE scores, as well as a positive relationship between membership on the Senate Armed Service Committee and supportive voting behavior. Like the sets of regressions before it, we can again see no significant relationship between aggregate state defense contracts, a state's BMD system prime contracts, the percent of a state's population employed by the DOD, and the voting behavior of a given state's senator on bills concerning BMD systems. Again, this seems to show that DW-NOMINATE scores rather than variables like prime contract awards affected Senate support for BMD systems in 2004.

Because of the partisan nature of these three sets of votes, it is prudent to look at the profiles of which Senators changed their votes from 124-139. If the effects of defense spending or BMD spending in a state really did influence the votes of some senators, we might presume that those effects might have been masked in the latter two votes as differences seemed to be more partisan and the votes were further indicative of a power struggle. If vote 124 was the least partisan, then, vote 139 was the most so. Looking at the senators who initially voted against their party on 124 and then later voted along partisan lines on 139 yielded some interesting results, provided in the table below:

Table 6.4: Partisan Dissenters, Votes 124 and 139

Senator	Party	With Party SV 124	Support	With Party SV 139	Support	Defense Spending in State	Above Median	BMD Prime Contracts	Above Median	Senate ASC
Campbell, B (CO)	D	No	Pro	No	Pro	\$2,488,211,000	Yes	\$127,158,025.00	Yes	No
Lieberman, J (CT)	D	No	Pro	No	Pro	\$8,064,794,000	Yes	\$371,175.00	No	Yes
Nelson, B (FL)	D	No	Pro	Yes	Anti	\$8,108,095,000	Yes	\$21,295,612.00	Yes	Yes
Nelson, B (NE)	D	No	Pro	Yes	Anti	\$315,300,000	No	\$0	No	Yes
Landrieu, M (LA)	D	No	Pro	Yes	Anti	\$1,914,208,000	Yes	\$794,974.00	No	No
Lautenberg, F (NJ)	D	No	Pro	Yes	Anti	\$3,792,520,000	Yes	\$33,813,530.00	Yes	No
Clinton, H (NY)	D	No	Pro	Yes	Anti	\$4,319,509,000	Yes	\$3,036,296.00	Yes	Yes
Kohl, H (WI)	D	No	Pro	Yes	Anti	\$1,271,145,000	No	\$3,429.00	No	No
Breaux, J (LA)	R	No	Anti	No	Anti	\$1,914,208,000	Yes	\$794,974.00	No	No
Snowe, O (ME)	R	No	Anti	Yes	Pro	\$1,182,274,000	No	\$4,071,675.00	Yes	No

Interestingly, four of the democratic senators who voted pro-BMD were members of the Senate Armed Services Committee. With the exclusion of Senator Lieberman (CT) (who consistently voted pro-BMD), the three senators who voted against their party in the vote on amendment 124 and then came back into party lockstep for the vote on amendment 139 were also members of the Committee. These senators were Senator Nelson of Florida, Senator Nelson of Nebraska, and Senator Hillary Clinton (NY). If not coincidental, this may be indicative of Committee members being more likely to support BMD systems than their colleagues who are not on the Armed Services Committee. These specific results explain the general trend uncovered in the regression for amendment 124, where membership on the Armed Services Committee was a significant indicator of the likelihood a particular Senator would vote to support BMD programs, controlling for other factors. Some brief theories about why this occurred will be presented at the conclusion of this paper.

With the exception of Senators Kohl and Nelson (NE), every democrat who voted against the general trend of the party enjoyed aggregate state defense spending and specific, BMD program spending that was higher than the median for either variable. The median amount of aggregate state prime contract awards was \$1,906,374,500.00, while the aggregate amount of BMD prime contract awards was \$1,604,586.00. Of the seven democrats who voted against party lines in the first vote, 4 had BMD contract awards in their states that far exceeded the median amount of contract awards. While these observations do not necessarily imply that senators with substantial BMD awards well above the median amount were swayed by economic considerations to initially cross party lines in the vote on amendment 124, this could be a revealed correlation between BMD contracts and BMD support. The fact that several of these senators were from states that received *such* high levels of BMD contract dollars could merit more study into whether prime contract funding seems correlated with these senators' voting habits on other cases.

Of the two dissenting Republicans, the aggregate state spending levels and BMD prime contract awards seem to fall short of explaining the story of their voting choices. Senator Snowe's (ME) state represented nearly four times more than the median in BMD prime contract awards, and she appears to have voted anti-BMD support in the first vote and then to have voted along party lines in a pro-BMD manner for the vote on amendment 139. Senator Breaux's state of Louisiana was well above the median in aggregate defense prime contract awards but below the median in BMD prime contracts, and he consistently voted against BMD systems. It is also interesting to note that he voted with the other Louisiana Senator Mary

Landrieu on the amendment 139 vote. This could be completely coincidental, or indicative of some bipartisan efforts between them.

VII: CONCLUSION

Because none of our regressions found any statistically significant relationship between aggregate weapons-system specific or general state prime contracts, there is no evidence in our sample that suggests that pork-barrel considerations have been one of the major factors leading to Senate support for missile defense spending and projects. Another way to test for pork-barrel behavior would have been to compile a list of the prime contractors working on BMD system components, and track their campaign contributions to Senate candidates. That, unfortunately, was outside the time-constraint of this undergraduate study, but this is a methodological addition I would definitely add to the expansion of this study.

It would be interesting to study whether this same pattern holds true for the House of Representatives—whose members may be more susceptible to job losses within their districts because they must be re-elected every two years, and who may be more sensitive to campaign or other moneyed defense-industry interests because of an always-immediate need for campaign funding. Accordingly, a second methodological change I would make in further study would be to compile a larger sample of House votes on the BMD issue. Our regression study of the three 2004 votes did not lend any evidence to the theory that Senators vote towards supporting BMD based on the amount of prime contracts the weapons system may bring to their state, although analyzing specific senator profiles did reveal that three of the

six Democrats who initially defected from their party's position in vote 124 had BMD contracts flowing into their state far above the median amount.

Not surprisingly, the DW-NOMINATE measure of political ideology played a large role in all three votes, and had the largest effects on the outcomes on amendments 125 and 139. Because the nominate scores have become more correlated with party in recent Congresses, it is not surprising that the partisan nature of all three votes was illustrated by the nominate score variable. The use of the scores, however, did illustrate the importance of the Senate Armed Services Committee variable in the first vote, because the effect was not statistically significant in earlier regressions where I used a dummy variable for party to measure political ideology. In the regression on 124, the one instance where any factor but ideology was measurably important, membership in the Committee became significant in rejecting attempts to constrain BMD programs. This may lend some support to theories concerning senate committees, as it may be that the members on the Armed Service Committee are either generally more favorable toward defense or BMD programs (whether because of Committee membership or experience prior to it), or alternatively, that they are initially somewhat self-selecting. Because they are more prone to unilaterally or robustly supporting defense programs initially, the argument goes, they will therefore be more likely to be a key group against budget constraint. It also may be that the Senate Armed Service Committee members are less willing to "tie the hands" of the DOD on programs like missile defense because they are more trustful that the military will spend money wisely because of their generally more consistent interfacing with career military officials. This result could also mean that Committee

members are better informed about BMD programs and are more often briefed about their execution, and that they are thus more supportive of BMD programs because they ideologically believe they are an important part of US national security strategy.

At the outset of this paper I suspected that there would be some relationship between support for BMD program funding and the amount of prime contracts awarded in a state, and despite finding some interesting correlations when looking at profiles of party defectors on vote 124, I did not find measurable evidence of such influence. There are several reasons why this outcome was not unearthed in this study, the first being that it is possible that there is really not much relationship between BMD contracts and Senate voting. As discussed earlier, this could be because BMD programs spend lots of money but employ relatively few people, and therefore constraining BMD in one's state does not have the same political impact as something like a base closing might have. It is also possible the effect of BMD programs on voting is not directly measurable because of horse-trading and behind the scenes negotiations between senators, which would blur the obvious relationships between voting behavior and contributions. Finally, if the high level officials Wilson interviewed are representative of a general attitude in the military towards the MDA, it may be that BMD is a unique program in that pro-defense ideology does not correlate with pro-BMD support. Congress members may heed DOD opinion that BMD is a drain from other, more important parts of the armed services that need funding, and so the correlation may be significantly more complicated and difficult to study.

As noted earlier, the research I have undertaken thus far could be expanded to a study of 2004 House voting behavior using similar variables and a much larger number of issue votes (substantially more than three), and this is the ideal methodological direction for expansion of this study. If there is any correlation between BMD programs in a region and voting behavior (despite the unusual, specifically hi-tech nature of the project), one might expect it to be more directly illustrated in Congress, where members are constantly campaigning and voting against a local program in a smaller, district area might have a more acute reaction from a representative's constituency. It might also be useful to apply those same variables to a series of votes during the later years of the Clinton administration, to see if ideology post-September 11th has lend stronger support for BMD programs, or if that correlative relationship was stronger before those events. A pre and post-Clinton era study of a large number of House votes might also allow us to better control for the effect of partisanship on voting, which could reveal other important factors that would be masked by only being able to study a few votes in 2004. For either of those potential project expansions, this thesis has laid down a solid analysis of 2004 senate votes on BMD that can serve as the basis for future exploration.

Appendix I**Acronym Guide**

ABM	Anti-Ballistic Missile Treaty
BMD	Ballistic Missile Defense
CBO	Congressional Budget Office
CDF	Cumulative Distribution Function
DOD	Department of Defense
GAO	Government Accountability Office
ICBM	Intercontinental Ballistic Missile
LPM	Linear Probability Model
MDA	Missile Defense Agency
NIE	National Intelligence Estimate
NMD	National Missile Defense
OLS	Ordinary Least Squares
QDR	Quadrennial Defense Review
R&D	Research and Development
SALT I	Strategic Arms Limitation Talks, I
SDI	Strategic Defense Initiative
TMD	Theater Missile Defense

APPENDIX II

Summary Statistics of Regressed Variables

Variable	Obs v.	Mean	Std. Dev.	Min	Max
DW-NOMINATE	100	0.00013	0.408665	-0.861	0.643
Prime Contract Awards BMD	100	\$3,790,000,000.00	\$5,660,000,000.00	\$76,300,000.00	\$28,700,000,000.00
Prime Contracts Percent Population	100	\$87,700,000.00	\$364,000,000.00	0	\$2,400,000,000.00
Armed Service	100	0.011686	0.008334	0.00331	0.047523

APPENDIX III

Description of Variables

Variable	Type	Notes	Source
d2004sv139_06_23_2004_	Dummy	Decision on Senate vote 139, 23 June 2004. "Aye" votes were supportive of refusing to fund BMD without significant testing evidence, therefore "AYE"=0.	Lexis-Nexis Congressional
d2004sv124_06_17_2004_	Dummy	Decision on Senate vote 124, 17 June 2004. Aye" votes were supportive of refusing to fund BMD without significant testing evidence, therefore "AYE"=0.	Lexis-Nexis Congressional Lexis-Nexis Congressional
d2004sv125_06_17_2004_	Dummy	Decision on Senate vote 125, 17 June 2004. The Senate agreed to Warner Amendment No. 3453 (to Amendment No.3354), to require the Secretary of Defense to prescribe and apply criteria for operational realistic testing of fieldable prototypes developed under the ballistic missile defense spiral development program. Because support for the amendment implies additional constraints on the BMD program, "AYE"=0.	
Member	Name	Last Name, First	US Congressional Record
Senate	Dummy	*=1 if Senate, 0 if No	US Congressional Record
Party	Dummy	*=1 if Republican, 0 if No	US Congressional Record
District	Reference	District Number, if Member of Congress	US Congressional Record
State	Name	State	
AD_personnel_04	Quantity	Number Active Duty Personnel in State in 2004	CPS
C_personnel_04	Quantity	Number Civilian Military Personnel in State in 2004	CPS
rng_personnel_04	Quantity	Number Reserve and National Guard in State in 2004	CPS
total_personnel_04	Quantity	Total Armed Service personnel in given state. (=Active Duty Military +Civilian +Reserve and National Guard)	Generated
amt_prime_contract_awards_04	Quantity	Total Dollar Amount of Prime Defense Contracts Awarded in State	BEA
GSP_03	Quantity	Gross State Product, 2003 (US Bureau of Economic Analysis)	BEA
percent_GSP_03	Quantity	Defense Contracts as Percentage of Overall GSP	Generated
state_pop_incmil_04	Quantity	Calculation of State Population Including Military Personnel (=total_personnel_04+state_pop_04)	Generated
state_pop_04	Quantity	State Population in 2004, from Current Population Survey	CPS
percent_population_aservice_04	Quantity	Percentage of Population in the Armed Services (=total_personnel_04/state_pop_incmil_04)	CPS
bea_gsp_fedmil_03	Quantity	Bureau of Economic Analysis Figures for State Product From Federal Military Contracts	BEA
bea_percent_GSP_03	Quantity	Defense Contracts as Percentage of Overall GSP, using only BEA Data (=bea_gsp_fedmil_03/GSP_03)	Generated
prime_contracts_bmd_fy2003	Quantity	Total Dollar Amount of Prime Defense Contracts From Ballistic Missile Defense Projects, FY2003	DOD
bmd_prime_contract_share	Quantity	The proportion of a given state's total prime contract awards that is due BMD contracts, in particular. (= prime_contracts_bmd_fy2003 / amt_defense_prime_contract_award)	Generated
dw_nominate108_1	Value	Poole-Rosenthal scores for the liberal-conservative tendencies within the 108 th congress, distributed along a normal CDF.	Keith T. Poole, Howard Rosenthal

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