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ABSTRACT

We consider three questions related to the choice between war in Iraq and a continuation of the pre-war containment policy. First, in terms of military resources, casualties and expenditures for humanitarian assistance and reconstruction, is war more or less costly for the United States than containment? Second, compared to war and forcible regime change, would a continuation of the containment policy have saved Iraqi lives? Third, is war likely to bring about an improvement or deterioration in the economic well-being of Iraqis? We address these questions from an ex ante perspective as of early 2003.

According to our analysis, pre-invasion views about the likely course of the Iraq intervention imply present value costs for the United States in the range of $100 to $870 billion. Our estimated present value cost for the containment policy is nearly $300 billion and ranges upward to $700 billion when we account for several risks stressed by national security analysts. Our analysis also indicates that war and forcible regime change will yield large improvements in the economic well-being of most Iraqis relative to their prospects under the containment policy, and that the Iraqi death toll would likely be greater under containment.

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Executive Summary

Prior to the invasion of Iraq in March 2003, the United States, Britain and their allies pursued a policy of containment authorized by the United Nations Security Council. Major elements of the policy included economic sanctions on Iraq, disarmament requirements, weapons inspections, Northern and Southern no-fly zones within Iraq, and maritime interdiction to enforce trade restrictions. Continued containment was the leading option to war and forcible regime change. We analyze these two policy options, war and containment, with attention to three questions:

- In terms of military resources, casualties and expenditures for humanitarian assistance and reconstruction, is war more or less costly for the United States than a policy of continued containment?
- Compared to war and forcible regime change, would a continuation of the containment policy have saved Iraqi lives?
- Is war likely to bring about an improvement or deterioration in the economic well-being of Iraqis?

We address these questions largely from an ex ante perspective. That is, we premise the analysis on data and facts that were known, or reasonably knowable, as of early 2003. This perspective is the one that confronts decision makers faced with the question of how to deal with "tyrants, rogue states and terrorists who threaten not only their own people but also others." In this regard, one of our goals is to show how basic economic principles and a quantitative approach can inform analyses of national security and humanitarian concerns presented by rogue states.

We rely on a variety of historical data to estimate the economic cost of U.S. military inputs – capital, labor and materials. To assess the costliness of the Iraq intervention, we then apply our cost estimates for military inputs to a wide range of scenarios for the war in Iraq and the postwar occupation. We factor in additional costs for the economic value of fatalities and casualties sustained by U.S. military personnel, lifetime medical costs for the treatment of injuries suffered by U.S. soldiers in Iraq, and U.S. outlays for humanitarian assistance and reconstruction aid.

Forcible regime change in Iraq has proved to be a costly undertaking. As of January 2006, it appears likely that the Iraq intervention will ultimately unfold along a path that implies present value costs for the United States in the range of 410 to 630 billion in 2003 dollars. These figures reflect a 2 percent annual discount rate. They capture the estimated economic costs of U.S. military resources deployed in the war and postwar occupation, the value of lost lives and injuries sustained by U.S. soldiers, the lifetime medical costs of treating injured soldiers, and U.S. outlays for humanitarian assistance and postwar reconstruction. Pre-invasion views about the likely course of the Iraq intervention imply present value costs in the range of $100 to $870 billion. Military resources devoted to postwar occupation account for more than half of the total costs except in optimistic scenarios that envision a short occupation, little postwar conflict and a smooth reconstruction effort.

The high cost of the Iraq intervention is sometimes seen as a compelling argument against the decision to forcibly overthrow the ruling order and install a new regime. This argument is deficient because it ignores the costs of alternative responses to the national security and humanitarian concerns presented by the pre-war Iraqi regime. A well-founded verdict on the Iraq intervention requires, at a minimum, an evaluation of what these alternatives would cost. We tackle this issue by assessing the costs of sticking with the pre-war containment policy.

Containment required the continuous engagement of a potent U.S. military force in southern Turkey, the Middle East and the Persian Gulf. The United States devoted roughly 28,000 troops, 30 naval vessels, 200 military aircraft and other equipment to Iraqi containment efforts prior to the pre-war buildup. We estimate the economic cost of these military resources to be about $14.5 billion per year. Based on our assessment of the likely duration of a dangerous regime in Iraq, absent external intervention, this annual flow translates into an expected present value of nearly $300 billion. Hence, containment was also a costly option for the United States, even under the favorable assumption that it would be completely effective in achieving its national security goals.

Advocates for forcible regime change in Iraq expressed several concerns about the pre-war containment policy. Some stressed an erosion of political support for the containment policy that threatened to undermine its effectiveness and lead to a much costlier conflict with Iraq in the future. Others stressed the difficulty of compelling Iraqi compliance with a rigorous process of weapons inspections and disarmament, widely seen as a critical element of containment. And others stressed the potential for Iraqi collaboration with international terrorist groups. To evaluate these concerns, we model the possibility that an effective containment policy might require the mounting of costly threats and might lead to a limited war or a full-scale regime-changing war against Iraq at a later date. We also consider the possibility that the survival of a hostile Iraqi regime raises the probability of a major terrorist attack on the United States. We draw on our empirical analysis to assess the potential costs of these contingencies, but their probabilities are especially difficult to assess with confidence.

We show that any one of these contingencies can sharply raise the expected cost of the containment policy. We also develop an integrated analysis that simultaneously captures several possible contingencies under a policy of containment. The integrated analysis focuses on three scenarios chosen to capture a range of views about the likelihood and cost of the contingencies. Factoring the contingencies into the analysis yields present value costs for the containment policy in the range of $350 to $700 billion. These large sums are in the same ballpark as the likely costs of the Iraq intervention seen from the vantage point of early 2006. Thus, even with the benefit of partial hindsight, it is difficult to gauge whether the Iraq intervention is more costly than containment.

We also consider the consequences of the war-versus containment choice in two other respects: the economic well-being of Iraqis, and the loss of Iraqi lives. Based on our analysis, we conclude that the war will lead to large improvements in the economic well-being of most Iraqis relative to their prospects under the policy of containment. This

conclusion follows from some basic observations. First, the Iraqi economy was in terrible condition before the war, and it would have remained in a sorry state under the policy of containment. Second, the regime of Saddam Hussein was an economic failure of tremendous proportions. The available evidence suggests that real income per capita fell by roughly 75 percent as a consequence of Saddam's misrule. In addition, much of Iraq's greatly diminished output was diverted to an oversized military, an apparatus of terror and repression and the relentless glorification of Saddam. Third, the removal of sanctions, the expansion of petroleum exports, large-scale reconstruction aid, and the reintegration of Iraq's economy into the world economy provide a strong basis for economic gains – even in a society with serious institutional weaknesses. If, over the course of a generation, Iraqis recover even half of the economic losses they suffered under Saddam Hussein, then they will be significantly better off in material terms as a consequence of forcible regime change.

The economic failures of the Saddam Hussein regime were not its greatest crimes. The regime brought torture, repression, displacement and death to huge numbers of Iraqis and others. We review some of the evidence in this regard, drawing heavily on work by others. All told, the regime killed or caused the deaths of more than 500,000 Iraqis. Under the policy of containment after the 1991 Gulf War, a reasonable estimate is that at least 200,000 Iraqis died prematurely at the hands of the regime or as a direct consequence of its policies, including its refusal to comply with U.N. Security Council Resolutions and its diversion of oil revenues and other resources to palaces and monuments. Had containment remained in effect, the historical record suggests that premature Iraqi deaths would have continued indefinitely at the rate of 10,000 to 30,000 per year. There is, of course, a great deal of uncertainty about the number of premature Iraqi deaths under either war or containment, but we think the weight of evidence points to a greater Iraqi death toll from a continuation of the pre-war containment policy. Perhaps the strongest reason to question this assessment is the possibility that a post-war Iraq could devolve into an extended and large-scale civil war. This possibility cannot be ruled out. What can be ruled out in light of the evidence is that the leading alternative to war involved little loss of Iraqi lives.

The question of how to deal with "tyrants, rogue states and terrorists who threaten not only their own people but also others" is a profoundly difficult one. The stakes, human and economic, are enormous. The policy options are complex and fraught with uncertainty. And sound decision-making requires a daunting range of inputs and analysis. Yet, precisely because the stakes are so high and the decisions are so difficult, it is essential to systematically evaluate alternatives as an input to decision making and the formulation of national security policy. Our study is an effort to apply a systematic approach to the evaluation of the two leading policy options on the table prior to the Iraq war.

> How can the international community best deal with tyrants, rogue states, and terrorists who threaten not only their own people but also others – and who defy the world's attempts to restrain them?—William Shawcross, *Allies: Why the West Had to Remove Saddam* (2004)

1. Introduction

Prior to the invasion of Iraq in March 2003, the United States, Britain and their allies pursued a policy of containment authorized by the United Nations Security Council. Major elements of the policy included economic sanctions on Iraq, disarmament requirements, weapons inspections, Northern and Southern no-fly zones within Iraq, and maritime interdiction to enforce trade restrictions. Continued containment was the leading option to war and forcible regime change. We analyze these two policy options, war and containment, with attention to three questions: In terms of military resources, casualties and expenditures for humanitarian assistance and reconstruction, is war more or less costly for the United States than a policy of continued containment? Compared to war and forcible regime change, would a continuation of the containment policy have saved Iraqi lives? And, is war likely to bring about an improvement or deterioration in the economic well-being of Iraqis? Our attention to these questions reflects strong and vocal concerns – before and after March 2003 – about the costs of war, the loss of life in the event of war, and the longer term effects of war on Iraqi society.

Our study is a revised and expanded version of an analytical essay that we circulated shortly before the March 2003 invasion.[1] Although the decision point for the Iraq invasion is past, we largely retain the ex ante perspective of our earlier essay. That

[1] Davis, Murphy and Topel (2003).

is, we premise the analysis on data and facts that were known, or reasonably knowable, as of early 2003. This perspective is the one that confronts decision makers faced with the question of how to deal with "tyrants, rogue states and terrorists who threaten not only their own people but also others." In this regard, one of our goals is to show how basic economic principles and a quantitative approach can inform analyses of national security and humanitarian concerns presented by rogue states.

Several important issues pertaining to the Iraq intervention are beyond the scope of our study. For example, we do not consider whether the pre-war containment policy could have been reformulated to achieve its main objectives with less harm to the Iraqi population. Nor do we evaluate the conduct of the war and ensuing occupation. Other important issues outside the scope of our analysis include the impact of war on oil prices, the broader costs and benefits of nation building in Iraq, the effects of military intervention in Iraq on other rogue states and on weapons proliferation, the war's effects on attitudes towards the United States in the rest of the world, and the implications of the war for U.S. relations with other nations. These issues merit careful attention, but we do not address them here.

In making the case for war, the U.S. and U.K. governments stressed threats posed by Iraqi weapons of mass destruction (WMD), i.e., long-range ballistic missiles and chemical, biological and nuclear weapons. As it turns out, no large WMD arsenals were discovered in Iraq after the March 2003 invasion. This development undercut the case for war in the views of many and diminished the credibility of the U.S. and U.K. governments and their intelligence agencies. Our analysis, however, does not turn on the issue of whether Iraq possessed large WMD stockpiles prior to the 2003 invasion.

Instead, we initially proceed under the assumption that containment was, and would remain, fully effective in preventing Iraq from using WMDs against the United States, its allies and their interests. This assumption serves to focus attention on the relative costs of the two policy options. We also extend our analysis to consider several costly contingencies that might arise under a continuation of the containment policy.

Several other studies assess the economic consequences of the Iraq conflict. Nordhaus (2002) projects the costs of military spending, occupation, humanitarian assistance and reconstruction. He also considers the potential effects of war on oil markets and the U.S. economy. McKibbin and Stoeckel (2003) consider war-induced effects of potentially higher oil prices and greater uncertainty on macroeconomic outcomes in the world economy. Wallsten and Kosec (2005) take up some of the same questions as our study, but from an ex post rather than ex ante perspective. We rely on their study in assessing the cost of U.S. military casualties resulting from war in Iraq. Another recent study by Bilmes and Stiglitz (2006) estimates a variety of direct and indirect costs of the Iraq war. Several reports by the U.S. Congressional Budget Office and other government agencies address the budgetary consequences of the Iraq war. We draw heavily on these reports in constructing our projections for the economic costs of war and containment.[2] Our study differs from previous work in many respects, large and small, but perhaps the most significant difference is our systematic evaluation of the two leading policy options on the table prior to the Iraq war.

[2] Broader studies of the economic costs of military conflict include Hess (2003), who investigates the empirical relationship between consumption growth and military conflict throughout the world in recent decades; and Collier et al. (2003), who document the highly detrimental effects of civil war on economic development.

We proceed as follows. Section 2 considers the U.S. military resources required to carry out a policy of containment, the economic cost of those resources, and the likely duration of a hostile Iraqi regime under containment. Section 3 considers projected U.S. costs of war in Iraq including the costs related to postwar occupation, fatalities and injuries sustained by U.S. military personnel, humanitarian assistance and reconstruction aid. Section 4 draws on the inputs developed in Sections 2 and 3 to calculate and compare U.S. costs of war and containment in present value terms. Section 5 extends the cost analysis to consider concerns related to the sustainability and effectiveness of containment and the effect of the war on the likelihood of major terrorist attacks on the United States. Section 6 builds a simple model to gauge the economic welfare of Iraqis under the containment and war options. We calibrate the model based on the economic record of the Saddam Hussein regime and assumptions about the duration of the regime under containment, the impact of war on Iraq's economy, and the path of economic development after regime change. Section 7 considers the issue of lost Iraqi lives, and Section 8 concludes.

2. U.S. Military Resources and Costs under Containment

The military aspects of the containment policy were undertaken principally by U.S. and British forces.[3] The analysis below restricts attention to the size and cost of the U.S.

[3] Seventeen countries participated in or provided logistical support to the maritime interdiction force. See "Embargo Chief Says Iran in Cahoots with Iraq Oil Smugglers" at http://www.defense.gov/news/Apr2000/n04112000_20004111.html. France initially participated in the enforcement of Iraqi no-fly zones along with the United States and Britain. France ceased participation in the Northern no-fly zone in 1996 and in the Southern no-fly zone in December 1998.

military forces engaged in the containment of Iraq, but we would welcome a comparable analysis for Britain and other countries.

2.1. Baseline Case

2.1.1. Military Resources

In September 2000 General Tommy R. Franks testified before the U.S. Senate Committee on the Armed Services as follows: "By maintaining a significant forward presence in the region, the U.S. seeks to deter and, if need be, to defeat Iraqi aggression. To this end, at any given time, some 30 naval vessels, 175 military aircraft, and between 17,000-25,000 soldiers, sailors, airmen and Marines are in the CENTCOM AOR [Area of Responsibility]."[4] In his testimony, Franks makes clear that EUCOM, which encompasses Turkey in its AOR, also played a key role in containing Iraq, particularly in the enforcement of the Northern No-Fly Zone. On this basis, we use a figure of 200 military aircraft devoted to Iraqi containment at the time of General Franks' testimony in 2000. His testimony also refers to a Maritime Interdiction Force, comprised of naval vessels from the United States and seven other countries, charged with enforcing U.N. sanctions and restricting Iraqi exports and imports. Franks does not provide figures for the military resources devoted to Iraqi containment under EUCOM or the Maritime Interdiction Force, but it is clear that his figures for troops, aircraft and naval vessels in the CENTCOM AOR comprise only a partial inventory of the full military resources deployed to contain Iraq.

A Department of Defense document on Fiscal Year (FY) 2001 budget requests for U.S. military operations in Bosnia, Kosovo, Southwest Asia and East Timor provides

[4] U.S. Senate Committee on the Armed Services (2000).

more precise information about the troops devoted to containment.[5] For operations in Southwest Asia directed toward the containment and deterrence of Iraq, the document lists "troop strength" levels (including Guard and Reserve troops) of 3,550 for Army Requirements, 15,691 for Navy Requirements, 426 for Marine Corps Requirements, 8,457 for Air Force Requirements and 40 for Defense Health Program Requirements for a total of 28,164 troops. The document also shows expenditures for Southwest Asia under Defense-Wide Requirements but does not list troops in this category. Presumably, the U.S. also undertook other surveillance and intelligence-gathering activities to contain Iraq (including CIA and State Department activities) that are not reflected in the document.

These sources make clear that containment required a potent U.S. military presence in the Southwest Asia region, including many personnel and large amounts of military hardware. In short, the U.S. devoted roughly 28,000 troops, 30 ships (including a carrier battle group), and about 200 aircraft and other equipment to containment efforts prior to the pre-war buildup. The next step in the analysis is to estimate the economic costs of these military resources. We are not aware of reports by the Department of Defense or other sources that provide economic cost figures for the full complement of military resources devoted to the containment of Iraq, so we construct our own cost estimates. We develop two methods that differ somewhat with respect to data requirements and underlying assumptions.

2.1.2. Cost Calculations: Method 1

Our first method calculates the economic cost of military resources devoted to containment as the sum of labor costs, capital costs and the cost of expended munitions.

[5] U.S. Department of Defense (2001).

Consider labor costs. In September 2002, the U.S. Congressional Budget Office (CBO) issued a document on the "Estimated Costs of a Potential Conflict with Iraq."[6] Based on the experience of U.S. Army peacekeepers in Bosnia and Kosovo, the document assigns costs of $226,000 per person-year for troops deployed in a prospective postwar occupation of Iraq.[7] We adopt this figure in calculating the labor costs of the military resources deployed in the containment of Iraq. We interpret the figure as capturing costs for compensation, personnel transport and personnel support. As explained below, we calculate capital costs and expenditures for munitions separately.

For our purposes, the CBO figure for labor costs has some problematic aspects. First, it appears to include certain capital costs such as spare parts for the operation and maintenance of equipment in theater. Second, and cutting the other way, it omits a large chunk of personnel costs, because CBO accounting practices do not include the basic pay of active-duty military personnel engaged in an overseas operation as part of the operation's cost.[8] This large omission is on the order of 40-50 thousand dollars per person-year by our estimates.[9] The CBO figure also omits the cost of military personnel

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[6] U.S. Congressional Budget Office (2002).

[7] This figure does not include the cost of heavy reconstruction after a prospective war in Iraq. See page 5 and Tables 3 and 4 in CBO (2002).

[8] See, for example, page 2 of CBO (2002).

[9] To arrive at this estimate, we divide Army personnel costs in FY 2001 by the estimated number of full-time equivalent Army personnel as of September 2000. Here are the details. As of September 30, 2000, the Army had 482,170 active-duty personnel (Table 1.1 in DoD, 2000b). The ready-reserve component of the U.S. armed forces numbers about 1.2 million persons in 2000 and 2001 (Census Bureau, 2005, Table 508). In 2000 and 2001, the annual number of active-duty days per ready reserve member is about 14 (CBO, 2005a, Figure 6). Army reserve units account for the vast majority of all active-duty days by reserve personnel (CBO, 2005a, page 3). On that basis, we attribute all active-duty days by reserve personnel to the Army, which implies 14 days times 1.2 million active-duty days by Army reserve units. Assuming that regular Army personnel work 220 days per year, the full-time equivalent Army military force as of September

who support the operation but are stationed outside the theater of operations. Finally, the CBO figure does not include the costs of compensating, supporting and training the additional troops who rotate through the theater of operations over time. These costs are large, because the number of troops required to sustain a long term overseas operation is at least three times bigger than the force in theater at a point in time.[10]

On net, the full economic cost of the personnel resources (including personnel support and transport) required to carry out the containment policy is probably larger than $226,000 per person-year. Nevertheless, we adopt this figure in constructing our first estimate for the cost of containment. To facilitate a consistent cost comparison between policy options, we use the same figure for personnel-related costs when estimating the economic cost of a postwar occupation of Iraq. Multiplying $226,000 per person-year by 28,164 military personnel in theater yields annual labor costs of $6.4 billion for the containment policy.

To estimate the capital value of the ships, planes and other military equipment engaged in the containment of Iraq, we rely on another document produced by the U.S. Congressional Budget Office (CBO), titled "Budgeting for Naval Forces."[11] According to this document, the CBO estimates that the average shipbuilding rate needed to

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2000 amounts to (14/220)(1.2 million) + .482 million =566,000. According to Table 6-22 in DoD (2000a), Army outlays for FY 2001 include $28.11 billion in personnel costs. We ignore any special pay for hazardous duty in this figure, because few U.S. military forces were actively engaged in combat operations or other hazardous duty in 2000 and 2001. Dividing 28.11 billion by the number of full-time equivalent Army personnel in September 2000 yields an annual per-person figure of $49,670 or 51,223 in 2003 dollars. If the CBO uses an 80-20 mix of regular and reserve personnel in its cost projections, then the omitted personnel costs amount to (.80)($51,233) = $40,978.

[10] See the discussion of troop rotation ratios in Appendix C of CBO (2003a). An analogous point clearly applies to military equipment, naval vessels for example, that rotate through the theater of operations over time.

[11] U.S. Congressional Budget Office (2000).

maintain a 300-ship Navy is 8.5 ships per year at a cost of $10.8 billion, which implies that the capital value of 30 "average" ships is $38.1 billion. The same document estimates annual construction costs for 148 aircraft at $10.2 billion, so the capital value of 200 "average" aircraft is about $15.3 billion.[12] In the calculations below, we scale up these figures for ships and aircraft by 6% to express them in 2003 dollars.[13] In addition, we estimate that Army, Marines and Air Force ground units required an additional $1.5 billion in military equipment in theater to carry out the containment policy.[14]

The next step is to estimate the annual costs of these capital inputs – depreciation, maintenance, fuel and other operating expenses, and the government's opportunity cost of funds tied up in capital goods. Table 1 provides estimates for the depreciation, maintenance and operating costs of military equipment. Line (1) reports straight-line depreciation rates calculated from projected equipment lifetimes. Line (2) reports estimated operations and maintenance (O&M) spending on military equipment in peacetime use, expressed as a percentage of capital value. This category captures the costs of fuel, parts and depot maintenance for military equipment at a peacetime operations tempo. To derive the estimates in line (2), we rely on the steady-state assumption that the ratio of O&M spending on military equipment to procurement spending for new capital goods is constant over time. We also assume that this ratio is the

[12] Tables 4 and 5 in U.S. Congressional Budget Office (2002).
[13] We carry out all price-level adjustments using the GDP implicit price deflator for all goods and services.
[14] Military equipment per Army personnel deployed in Iraq, Kuwait and Afghanistan is about $189,000 according to data in CBO (2005b). We apply this figure to the number of Army troops and Marines devoted to the containment policy and half this amount to the number of Air Force personnel. The result is about $1.5 billion in 2003 dollars.

same for all types of military equipment.[15] Applying these assumptions to data on military spending in CBO (2001) yields the O&M spending rates in line (2). Actual O&M spending rates are higher for military equipment stationed in theater because of a higher operations tempo. Line (3) draws on CBO (2005b) estimates of the extra depreciation and maintenance costs incurred by in-theater military equipment in Iraq, Kuwait and Afghanistan to illustrate the impact of a higher operations tempo. Summing the entries in lines (1) to (3) yields annual depreciation, maintenance and operating costs of roughly 4.5 to 5.5 percent of capital value for aircraft and naval vessels and more than 20 percent for ground equipment. These figures, reported in line (4), do not capture the extra fuel costs associated with a higher operations tempo for equipment in theater.

Line (5) of Table 1 reports the rate of depreciation, maintenance and operating costs that we apply to military equipment used in the containment policy. For Army and Marines equipment (mostly ground equipment), we use a much lower figure than line (3) based on the view that containment involved a much lower operations tempo for such equipment than engagements in Iraq, Kuwait and Afghanistan. For naval vessels and aircraft, we adjust the line (3) entries upwards to account for the missing extra fuel consumption. To account for the opportunity cost of government funds, line (6) adds two percentage points, which is consistent with the evidence below that the U.S. government faces a two percent real interest rate.

[15] The two assumptions underlying the entries in line (2) are strong ones, and we would prefer to relax them by exploiting detailed data on normal O&M spending for military equipment. Unfortunately, as noted in CBO (2001, page 2), the Department of Defense does not produce detailed breakouts for its equipment-related spending on fuel, spare parts, other consumables and depot maintenance. This lack of data precludes a more direct estimate of normal O&M costs for military equipment.

We now have in place the required elements for our first method of calculating the economic cost of the military resources devoted to the containment policy. Table 2 Panel A summarizes the calculations. Applying the real user cost of capital inputs from line (8) of Table 1 to the capital asset values derived above yields capital costs of $4.7 billion per year. Adding $6.4 billion for labor costs and $0.2 billion per year for expended munitions yields total containment costs of about $11.3 billion per year.[16]

2.1.3. Cost Calculations: Method 2

As a check on this cost figure, consider a simpler set of calculations that relies on different inputs and assumptions. First, Table 5 in CBO (2000) provides a figure of $94.7 billion as the annual cost of maintaining a 300-ship navy (excluding $10.3 billion for research and development). This figure encompasses procurement costs, operating costs, personnel costs, military construction and other items. The implied all-in cost for an average 30-ship naval force is about $9.5 billion per year, or $10.0 billion in 2003 dollars. Second, recall that naval forces (including marines) account for 16,117 out of 28,164 military personnel devoted to the containment of Iraq. Multiplying $10 billion by (28,164/16,117) yields $17.5 billion per year as the implied cost of containing Iraq.

This calculation does not adjust for differences in labor intensity among the armed services. Defense budget figures for FY 2001 imply that military personnel account for 24.4% of total costs in the Air Force, 40.4% in the Army and 28.9% in the Navy.[17] To adjust for these differences, think of the Air Force, Army and Navy as three different

[16] We regard the $0.2 billion figure for munitions as a low-end guess. According to Center for Defense Information (1998), cruise missiles and other smart munitions expended by U.S. forces during the four-day December 1998 Desert Fox operation cost $478 million to produce. Desert Fox was one of the largest operations conducted by allied forces during the containment of Iraq.

[17] U.S. Department of Defense (2000), Tables 6.18 to 6.20.

technologies for producing "military output," and assume that the value of military output per dollar of expenditure is the same across the three services. This condition must hold on the margin, if Department of Defense funds are allocated efficiently among the services. Next, divide the all-in cost estimate for the U.S. naval force devoted to the containment of Iraq ($10 billion) by the number of naval personnel (16,117). This calculation yields an all-in annual cost per person for U.S. naval forces devoted to containment of $620,463. Given this figure, and using the data on labor cost shares and number of military personnel devoted to Iraq by service, we have $\$620,463\left[(28.9/24.4)8,457+(28.9/40.4)3,590+16,117\right]=\$17.8$ billion as the estimated annual cost of containing Iraq.[18]

This figure is substantially larger than the $11.3 billion figure calculated above using Method 1. In the absence of a compelling reason to prefer one estimate over the other, we adopt the simple average of $14.5 billion 2003 dollars as our baseline figure for the estimated annual costs of containment. By way of comparison, outlays by the U.S.

[18] This calculation may also lead to a substantial understatement of containment costs. First, it does not include the costs of compensating, supporting and training the additional troops who rotate through the theater of operations over time. Second, it does not include the additional costs of constructing and maintaining naval vessels and other equipment that rotate through the theater over time. Third, the calculation rests on an implicit assumption that depreciation, maintenance and operating costs for military equipment is the same whether or not the equipment is in theater. Fourth, the calculation includes no adjustment for higher munitions expenditures in theater. Nevertheless, this calculation may also lead to an overstatement of containment costs, if the naval vessels devoted to the containment policy are less costly to build or operate than the average U.S. naval vessel. The calculation may also lead to an overstatement if containment operations facilitate the training, readiness and development of U.S. military forces, because these benefits are not netted out of the estimated costs.

Department of Defense were $344 billion in Fiscal Year 2002.[19] So $14.5 billion for the containment of Iraq amounts to about 4.2 percent of the pre-war U.S. defense budget.

2.2. Higher Containment Costs

One might reasonably argue that the $14.5 billion figure is too small for at least two reasons. First, containment efforts also drew on U.S. military resources that were stationed outside the Southwest Asia region, or that were stationed in the region only on an occasional basis for particular operations. These additional military resources helped to deter Iraq and to support and execute particular operations, but their costs are not included in the $14.5 billion figure. A noteworthy example is Operation Desert Fox, a four-day bombing campaign carried out by U.S. and British forces against Iraqi targets in December 1998. The execution of Desert Fox relied heavily on out-of-area military resources and military resources temporarily deployed to the Middle East.[20] As we discuss in Section 5, the United States also undertook large additional force deployments to the Persian Gulf region in 1994 and 1996 to deter Iraqi aggression against other states.

Second, containment efforts in 2000 and 2001 involved a level of military pressure that was insufficient to compel Iraq's full compliance with U.N. Security Council resolutions. Prior to the pre-war buildup of U.S. and British forces, Iraq had for several

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[19] See, for example, "Billions More for Defense – and We May Not Even Know It" by Robert Higgs in the *San Francisco Chronicle* on 18 January 2004, available at http://sfgate.com/cgi-bin/article.cgi?file=/c/a/2004/01/18/INGSM4A8JB1.DTL.

[20] During a press briefing shortly after the end of Desert Fox, General Anthony Zinni, Commander-in-Chief of U.S. Central Command [CENTCOM] stated that "The operation involved over 30,000 troops, and 10,000 more outside our area of responsibility who supported and alerted from bases virtually around the world…. Over 300 aircraft were involved in strike and support roles…. Over 40 ships performed strike and support roles… Thousands of ground troops deployed to protect Kuwait and to respond to any counteraction. Hundreds of our Special Operations Forces troops also deployed to carry out their assigned missions." A transcript of the press briefing is available at http://www.defenselink.mil/transcripts/1998/t12211998_t1221fox.html.

years refused to admit U.N. weapons inspectors.[21] Iraq had a long history of stalling, evading, undermining and circumventing the U.N. weapons inspection process (Pollack, 2002, chapter 3), an essential element of the containment policy.[22] Even on the brink of war, Iraq continued to resist and impede U.N. weapons inspections, often with considerable success.[23] Given this history of continual resistance to inspection and limited disarmament by the Saddam Hussein regime, an effective containment policy apparently required a larger commitment of U.S. military resources and a more aggressive posture by U.S. forces. That is, a fully effective containment policy would have cost substantially more than $14.5 billion per year.

It is not obvious how best to adjust for the incomplete effectiveness of the containment policy. It is also difficult to quantify the cost of the out-of-area military resources that contributed to containment efforts and that provided a deterrent to Iraqi

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[21] See, for example, the testimony of General Tommy R. Franks before the U.S. Senate Committee on the Armed Services on 19 September 2000: "Iraq's WMD capabilities remain a key concern. It has been more than a year and a half since UN weapons inspections last occurred in Iraq, and Saddam Hussein has thus far refused new inspections." U.N. weapons inspectors did not return to Iraq until November 2002.

[22] In his December 1998 address to the American people, shortly after U.S. and British forces commenced Operation Desert Fox, President Bill Clinton described the importance of the weapons inspection program this way: "First, without a strong inspection system, Iraq would be free to retain and begin to rebuild its chemical, biological and nuclear weapons programs in months, not years. Second, if Saddam can cripple the weapons inspection system and get away with it, he would conclude that the international community – led by the United States – has simply lost its will. He will surmise that he has free rein to rebuild his arsenal of destruction, and someday – make no mistake – he will use it again as he has in the past. Third, … If we turn our backs on his defiance, the credibility of U.S. power as a check against Saddam will be destroyed. We will not only have allowed Saddam to shatter the inspection system that controls his weapons of mass destruction program; we also will have fatally undercut the fear of force that stops Saddam from acting to gain domination in the region." A transcript of President Clinton's full address is available at http://www.cnn.com/ALLPOLITICS/stories/1998/12/16/transcripts/clinton.html.

[23] See, for example, "U.N. Withdraws U-2 Planes," *New York Times,* 12 March 2003.

aggression. As a crude adjustment for these factors, we consider a higher containment cost figure of $19.4 billion, which is one-third greater than our baseline figure. Section 5 develops an alternative approach to concerns about the containment policy.

2.3. Dual-Use Military Deployment

Another criticism of our containment cost calculations cuts the other way. The military resources that the U.S. devoted to Iraqi containment prior to March 2003 projected U.S. power in the region and functioned as forward bases in a critical and volatile part of the world. Hence, a friendlier Iraqi regime would only mitigate, not obviate, the need for the deployment of U.S. military resources to the region. According to this argument, some portion of the costs calculated above is not fully attributable to the policy of containing Iraqi.[24] This argument is logically sound, but its quantitative force is unclear. On the one hand, the United States had no major military bases and few ground forces in the Middle East prior to the Iraqi invasion of Kuwait in August 1990.[25] This fact suggests that few U.S. ground forces would be stationed in the Middle East if Iraq were governed by a stable, unthreatening regime. On the other hand, U.S. military bases in southern Turkey and a strong naval presence near the Middle East were significant features of U.S. policy long before the invasion of Kuwait. As a crude adjustment for the dual-use character of U.S. military resources deployed in the containment of Iraq, we

[24] Another argument is that U.S. forces engaged in containment activities can and will continue to carry out some of the same general training and readiness preparation that they would undertake in any event.

[25] See U.S. General Accounting Office (1991) for an overview of U.S. military activities in the Middle East during the 1980s and their costs. While the U.S. had few grounds in the Middle East prior to Iraq's invasion of Kuwait in 1990, developments in the broader Southwest Asia region provided much of the motivation for the creation of a U.S.-based Rapid Deployment Force in the early 1980s.

consider a lower containment cost figure of $9.7 billion, which is one-third smaller than our baseline figure.

2.4. Spontaneous Regime Change

Containment is necessary only so long as a dangerous regime, or a like-minded successor, remains in power. So our calculation of containment costs should account for the possibility that the pre-war Iraqi regime would peacefully evolve into a far less dangerous one. It is hard to precisely assess the probable duration of a dangerous Iraqi regime, absent war, but history offers some guidance.[26] The regime of Saddam Hussein survived a devastating war with Iran in the 1980s, a crushing military defeat in the Gulf War of 1991, twelve years of draconian sanctions, and a tremendous decline in living standards during the war with Iran and again in the 1990s under containment. These facts suggest that the regime was hard to dislodge under a policy of containment. Other highly repressive regimes, such as Cuba and North Korea, also show much staying power.

The key issue is not how long Saddam Hussein himself would continue to rule Iraq, absent external intervention. Rather, the real issue is the expected duration of a regime that presents a similar threat to the United States and others. The experience of North Korea provides a case in point. When the North Korean leader Kim Il-sung died in 1994, many doubted the ability of his son and designated successor, Kim Jong-il, to secure the reins of power. Those doubts turned out to be misplaced, and the regime continued in essentially the same repressive and hostile form. Moreover, North Korea

[26] See Bueno de Mesquita et al. (2003) for a detailed analysis of the factors that influence the survival of political leaders and regimes. In their chapter 7, they estimate survival functions and hazard rates for individual political leaders. The issue at hand for our analysis, however, is the duration of a dangerous regime in Iraq, not the survival of a particular leader. We are unaware of econometric studies that speak directly to the regime survival question.

under Kim Jong-il continued to advance its nuclear weapons program and its long-range missile delivery systems.[27] In the case of Iraq, expert accounts suggest that Saddam's sons had a firm grip on the apparatus of terror, repression and security prior to the March 2003 invasion. Pollack's (2002, chapter four) account indicates that Saddam's sons, especially Qusay, were well positioned to continue in their father's place after his death. Pollack's account also stresses that much of the regime's leadership was closely linked to Saddam by ties of family and clan. In sum, it does not appear that the continuity of the regime rested on the personal survival of Saddam Hussein.

In this light, consider an optimistic scenario in which the pre-war Iraqi regime peacefully morphs from malign to benign at an annual hazard rate of 3 percent. This assumption implies an expected duration for a hostile regime, absent external intervention, of 33 years beyond March 2003. If one dates the onset of a dangerous Iraqi regime to Saddam's assumption of the presidency in 1979, then the 3 percent hazard rate implies an expected total duration for the regime of about 57 years.[28] In comparison, the

[27] See U.S. Congressional Research Service (2003).

[28] The Iraqi Baath party took power by way of a military coup in 1968. General Ahmed Hassan al-Bakr became president and, shortly thereafter, prime minister and commander-in-chief of Iraqi military forces. At the time, Bakr was also secretary-general of the Baath party and chairman of its powerful Revolutionary Command Council. Saddam Hussein played a significant role in the coup and held considerable sway over Baath party, and later Iraqi, security forces. The early stages of Saddam's rise to power owe much to the support he received from Bakr. Saddam accumulated power and influence throughout the 1970s, eventually eliminating or overshadowing all rivals, including Bakr. In August 1979, he persuaded Bakr to step aside and to designate Saddam as his successor. See Coughlin (2005), especially chapters 3 to 5, for an account of these developments. Although Saddam's ruthlessness, propensity for violence, and fascination with military force were evident long before he achieved the presidency and undisputed power within Iraq, the nightmarish quality of the regime was not easily foretold. For most ordinary Iraqis who did not directly challenge the regime or the Baath party, the 1970s were a decade of rising prosperity. Some outside observers saw the early Baathist government as one of the most progressive regimes in the Middle East.

Soviet Union survived 69 years after its founding in 1922 until its dissolution in 1991, including more than four decades under a policy of containment by the West. The containment of North Korea has involved a large U.S. military presence on the Korean Peninsula for more than 50 years.[29] These historical facts are consistent with our assumption of a 3 percent hazard rate for peaceful regime change in Iraq.[30]

3. U.S. Military, Reconstruction and Humanitarian Costs under War

3.1. Incremental Appropriations versus Economic Costs

News reports and commentary on the economic costs of the Iraq war typically focus on incremental appropriations in government budgets. In September 2002, for example, the Democratic Caucus of the House Budget Committee (HBC) issued a report that projected a new war in Iraq would increase U.S. budget costs by $47 to $93 billion for military operations alone, not counting the costs of an extended occupation. A report issued by the Congressional Budget Office (CBO) in the same month reached similar conclusions.[31] In March 2003, the Bush Administration requested supplemental spending

[29] As of March 2003, there were 37,000 U.S. military personnel stationed in South Korea and another 45,000 in nearby Japan. See Robert Burns (AP Military Writer), "Rumsfeld: Move U.S. Troops from Korea DMZ,"AP Online, March 6, 2003, available at www.austin360.com/aas/news/ap/ap_story.html/Intl/AP.V0317.AP-US-Troops-Korea.html. The United States also relies on additional military resources to contain and deter North Korea. For example, Burns writes that "In response to recent North Korean moves to reactivate its nuclear weapons program, the Pentagon this week is sending 12 B-52 bombers and 12 B-1 bombers from U.S. bases to Guam, within striking distance of the Korean peninsula."

[30] A more sophisticated treatment of regime change would allow the hazard rate to be nonstationary and to depend on the precise character of the containment policy. We would welcome such an analysis, but it is beyond the scope of this study.

[31] See U.S. HBC (2002) and U.S. CBO (2002). The HBC and CBO have also issued several additional reports on the costs of the Iraq war since September 2002.

authority of $62.6 billion, mostly to fund U.S. war efforts in Iraq.[32] These and other budget projections and budget requests are heavily reported by the news media and widely interpreted as measuring the actual or projected economic costs of the U.S resources devoted to the Iraq war. This interpretation is incorrect.

The economic costs of military resources are appropriately measured in terms of what they cost to produce (production cost) or the value they provide in their next-best use (opportunity cost). In contrast, CBO (2002) captures only "the incremental costs of deploying a force to the Persian Gulf (the costs that would be incurred above those budgeted for routine operations)…"[33] Likewise, "All of the costs described in the [HBC (2002)] report represent incremental costs – those that would not have occurred but for the military operation."[34] These incremental budget effects fail to capture the full cost of producing the military resources deployed in the Iraq war. For example, CBO "estimates reflect only the costs of aircraft flying hours and ship steaming days above those normally provided in DoD's regular appropriations."[35] Depreciation costs and normal maintenance costs for military hardware devoted to the Iraq war are also omitted from the CBO and HBC projections, as are the costs of training U.S. military forces. The

[32] See Executive Office of the President (2003). It was widely understood at the time that additional requests for spending authority related to the Iraq war would be forthcoming. See, for example, "What Price War? It's Too Soon to Tell, But Expect Final Tab to Be High" by David Firestone in the 7 April 2003 edition of the New York Times.
[33] See the cover letter from the CBO Director to the ranking members of the House and Senate Budget Committees that accompanies the September 2002 CBO report. Similarly, the body of the report states on page 2 that "CBO's estimates represent the incremental costs that DoD [Department of Defense] could incur above the budgeted costs of routine operations. As a result, the estimate excludes items such as the basic pay of active-duty military personnel but includes the monthly pay for reservists recalled to full-time duty. Similarly, the estimates reflect only the costs of aircraft flying hours and ship steaming days above those normally provided in DoD's regular appropriations."
[34] HBC (2002), page 28.
[35] CBO (2002), page 2.

"incremental costs" in budget documents also fail to reflect opportunity costs, except under the extreme view that U.S. military resources have zero value in their next-best use. These same points apply to the incremental appropriations that the Bush administration sought and obtained from Congress in connection with the Iraq war. In short, cost measures based on budget requests and budget projections fail to capture the full economic costs of the military resources devoted to the war.

A focus on "incremental costs" also results in misleading cost comparisons across deployment scenarios. For example, the CBO and HBC reports exclude the basic pay of active-duty military personnel in their cost projections but include pay for reservists called to full-time duty. As a result, deployment scenarios that involve greater reliance on reserve troops appear costlier than otherwise identical scenarios that rely more heavily on active-duty personnel. Table 3 illustrates the point in starker fashion, drawing on CBO (2003a) cost projections for alternative options to deploy additional forces in Iraq. The CBO assigns zero "incremental costs" to option (d), which involves a withdrawal of forces from the Sinai Peninsula, Bosnia, Kosovo and Okinawa, "because the savings that would accrue from withdrawing forces from those other commitments would largely offset the costs of sustaining additional forces in Iraq." Such "savings" are true savings only if those forces generate zero benefits in their current deployment or any other alternative deployment. Put differently, it would be unwise to conclude from Table 3 that (d) is the least costly, or most desirable, option simply because it triggers the lowest incremental budgetary costs. A focus on "incremental costs" may be useful for government budgeting and planning purposes, but it does not deliver sensible measures for the economic costs of the military resources devoted to the Iraq war. By the same

logic, these "incremental costs" do not provide a sensible basis for comparing the economic costs of the military resources required under war and containment.

3.2. Measuring the Direct Economic Costs of War

We seek to measure the full production costs of the projected military resources devoted to the Iraq war and postwar occupation; any additional transport, munitions and supply costs required to prosecute the war and carry out the occupation; the projected cost of casualties incurred by U.S. military forces; and projected costs for humanitarian assistance and reconstruction aid. Our cost calculations consider the military scenarios sketched out in CBO (2002). Because this document focuses on war and its near-term aftermath, we provide additional economic cost figures for longer term occupation and peacekeeping roles by U.S. forces. We consider costs for the United States only.

With respect to military resources, we focus on production costs rather than opportunity costs for two reasons. First, a production cost approach parallels our treatment of containment costs and thereby facilitates an apples-to-apples cost comparison between the two policy options. Second, direct measurement of (historical) production costs is more straightforward and less reliant on subjective judgments than efforts to measure the opportunity costs of military resources. Nevertheless, there are potential problems with a production cost approach. For example, if a country accumulates an oversized military relative to its national security goals, then historical production costs are likely to exceed the opportunity cost of ready military resources. In this case, a production cost approach to a particular military operation would overstate its true economic cost (i.e., opportunity cost). We do not think this case applies to the United States in the wake of 9/11 and an expanding set of U.S. security concerns. More

plausibly, the U.S. military is at least temporarily undersized relative to its national security goals, in part because of the Iraq war.[36] In this situation, historical production costs may understate opportunity costs.

3.3. Initial Deployment, Major Combat, and Redeployment

Table 4 summarizes military force requirements in the major combat phase of a war in Iraq, as projected in the two war scenarios considered by CBO (2002). Both scenarios envision a much larger, more ground-intensive force than the one deployed under containment. The Heavy Air Option involves 253 thousand troops deployed in theater and 2,500 aircraft; the Heavy Ground Option involves 367 thousand troops and 1,500 aircraft. Both options involve sixty Navy battle force ships, including five carrier battle groups.

Based partly on these CBO projections, Table 5 provides estimates for the capital value of deployed military equipment during the combat phase of an Iraq war. Capital values for Naval Vessels and (fixed-wing) Aircraft are estimated by the same method as in Table 2. Capital values for ground equipment (including helicopters) reflect the recent experience of Army troops and Marines engaged in Afghanistan, Kuwait and Iraq, as detailed in notes to the table. Our estimated capital value for the military equipment required during the combat phase of a war in Iraq is $263 billion under the Heavy Ground Option and $291 billion under the Heavy Air Option.

[36] This view is consistent with news reports that U.S. Army and Marine forces have been stretched thin by an extended engagement of ground forces in the Iraq theater. Concerns about the ability of the U.S. Army to meet the force requirements of an extended occupation of Iraq also arose prior to the March 2003 invasion. For example, CBO (2002, page 5) states that "Army forces would be unable to support [normal] rotations for a prolonged 200,000-person occupation."

Table 6 reports data on the projected cost of an Iraq war by phase of engagement and type of costs. The cost figures in Table 6 reflect upward adjustments to the figures in CBO (2002) to account for basic pay of active-duty military personnel and the additional user costs of capital not captured in the CBO figures. Based on our calculations, the projected costs of the U.S. military resources devoted to an Iraq war – initial deployment, major combat, and redeployment – range from $46 to $80 billion depending on force option and duration of major combat. As also indicated in the table, our projected costs are 56 to 67 percent greater than the CBO projections for the same scenarios. Thus, our adjustments to capital and labor costs have a major impact on projected costs relative to the CBO figures.[37]

3.4. Postwar Occupation, Reconstruction Aid and Humanitarian Assistance

Table 7 summarizes several other projected costs associated with war and forcible regime change in Iraq. Panel A shows projected costs for the deployment and use of ground troops, naval forces and air forces during a postwar occupation. We construct these projections using the same approach (Method 1) as in Section 2.1.2 for containment costs. Relative to containment, however, we apply a much higher value for the user cost

[37] Despite these adjustments, the figures in Table 6 are lower than the costs implied by the methods of Section 2.1. To see this point, consider the Heavy Air Option with two months of major combat. The sum of Personnel and Personnel Support Costs, Operations Support Including Munitions, and Transport to and from Theater is $34.3 billion in this scenario according to Table 6. Applying the Method 1 cost per person-year of $226,000 – which covers personnel and their support, some operations support, and the rotation of personnel into and out of theater – yields a cost of $38.1 billion for an eight-month engagement (initial deployment, major combat, redeployment). The reasons for this discrepancy are unclear to us. Perhaps large engagements involve significant scale economies not present under containment. Or, perhaps we have overstated the costs of containment relative to those of initial deployment, major combat and redeployment. If so, and because we rely on Method 1 to compute the costs of occupation, we also overstate the cost of postwar occupation relative to the initial war phase.

of capital on ground equipment, and we allow user costs to vary with operations tempo. These assumptions capture the fact that depreciation, maintenance and operating costs are sensitive to operations tempo, as detailed in CBO (2005b). A "high" operations tempo in Table 7 is intended to reflect a postwar situation that involves a significant insurgency, whereas a "low" operations tempo is intended to reflect one that primarily involves peacekeeping operations and the maintenance of stability. Occupation scenarios with a high operations tempo also entail extra munitions costs.[38]

Table 7 does not impose any particular assumption about the level of U.S. military forces engaged during a postwar occupation of Iraq. Rather, the entries in Panels A and B provide information about projected annual costs for a given level of military resources – such as 100,000 armed forces in theater and their equipment, supplies, munitions, and so on. For example, the last row of Panel A implies that the U.S. cost is $62.8 billion per year for an occupation force of 200,000 military personnel operating at a high tempo.[39] In the analysis below, we scale the figures for occupation costs up or down in proportion to the size of the armed forces engaged, while maintaining fixed ratios of ground troops to other personnel. The figures for "Occupation costs per 100,000 armed forces in theater" in Table 7 involve a ratio of ground troops to Navy and Air Force personnel that is twice as high as in the Heavy Air Option.[40]

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[38] Panel B shows projected occupation costs based on Method 2 and using the All-in Costs per Person-Year reported in Table 2. Method 2 yields much larger costs than Method 1, as before.

[39] Relative to the projection in CBO (2002), our per-person cost figure during occupation is 39 percent greater at a high operations tempo and 26 percent greater at a low tempo.

[40] Relative to containment, the ratio of ground troops to naval personnel is more than seventy times higher in an occupation according to our calculations and projections. The ratio of ground troops to Air Force personnel is about nineteen times higher in an occupation.

The projected costs for humanitarian assistance and postwar reconstruction aid are drawn from three sources. Nordhaus (2002) projects U.S. costs for humanitarian assistance to the Iraqi people in the range of 1 to 10 billion dollars over a period of two to four years. HBC (2002) projects U.S. costs for reconstruction aid in the range of 9.2 to 18.4 billion dollars over a period of ten years. An update in HBC (2003), issued six months after the Iraq invasion, projects much higher U.S. reconstruction costs in the range of $28.3 to $73.3 billion. As of July 5, 2005, actual U.S. budget allocations for the Iraq Relief and Reconstruction Fund total about $18.4 billion, which includes more than $5 billion in allocations for security and law enforcement activities such as training and equipping Iraqi security forces. Cumulative Fund outlays amount to $6.3 billion as of June 28, 2005, largely for security services and law enforcement.[41]

3.5. U.S. Casualties

To project the cost of casualties sustained by U.S. military personnel in an Iraq war, we rely on the estimates in Wallsten and Kosec (2005). Their estimates are designed to capture the economic value of lost lives, the welfare losses suffered by injured soldiers, and the lifetime medical costs of treating injuries sustained in Iraq. In Panel D of Table 7, we report a projected cost of $6.9 billion per 1,000 U.S. fatalities. This figure, drawn from Wallsten and Kosec, reflects the midpoint estimate for the value of a statistical life in the literature reviewed by Viscusi and Aldy (2003). Based on the experience of U.S. forces through August 25, 2005, the Iraq engagement has involved 7.153 injuries per fatality. Wallsten and Kosec classify these injuries by severity and assign welfare costs based on estimates of the willingness to pay to avoid injury. They add lifetime medical

[41] U.S. Department of State (2005).

costs for injury treatment to obtain the economic cost of injuries. Their estimates imply a cost of $9.0 billion per 7,153 injuries.

3.6. War Scenarios

Table 8 describes several scenarios for an Iraq war that we consider in the present value cost analysis. The scenarios differ in key respects: length of major combat phase; duration, size and operations tempo of a postwar U.S. occupation force; fatalities and injuries sustained by U.S. forces; and U.S. outlays for humanitarian assistance and postwar reconstruction aid. For all scenarios, initial deployment commences in December 2002, major combat commences in March 2003, and redeployment of the invasion force takes three months from the end of major combat and is followed immediately by occupation. Fatalities occur at a rate proportional to troop levels during occupation, and injuries occur at the rate of 7.153 per fatality.

These scenarios capture a broad range of pre-invasion views about the likely outcome of a military intervention in Iraq.[42] Scenario 1, the most hopeful, entails a two-month major combat phase, a small-scale occupation that ends by December 2005, one thousand U.S. fatalities, and relatively modest outlays for humanitarian assistance and reconstruction aid. This scenario is consistent with the view that the Iraqi people would welcome a U.S.-led invasion force as liberators – initially and after euphoria over Saddam's overthrow wanes – and that regime change and reconstruction would proceed smoothly with little interference from terrorists, insurgents or outside powers. Scenarios 2 through 6 entail a progressively longer occupation, bigger occupation force, higher operations tempo during occupation, greater casualties, and larger outlays for

[42] See Packer (2005), especially Chapter 4, for an account of influential pre-invasion views about the likely course of a postwar occupation in Iraq.

humanitarian assistance and reconstruction. The length of the major combat phase also increases. Two variants each of Scenarios 4 and 5 differ in postwar reconstruction costs.

Scenarios 1 to 3 describe considerably more favorable outcomes than Scenarios 4 and 5, which are in turn much more favorable than Scenario 6. In particular, Scenario 6 envisions an occupation force of 200,000 U.S. military personnel in theater through September 2007 and a smaller force level through 2013, with forces engaged at a high operations tempo throughout. Scenario 6 also entails 7,000 U.S. fatalities, about 50,000 U.S. injuries, and $60 billion in undiscounted costs for humanitarian assistance and reconstruction aid. Scenario 7 describes an even worse outcome: a dangerous new regime emerges in Iraq after a long and costly occupation, and the U.S. reverts to its pre-war containment policy.

4. War Versus Containment: Direct U.S. Costs

4.1. Valuing the Policy Options

War and containment are two strategies for responding to the threats posed by a dangerous regime in Iraq. Under each strategy, the United States (and other intervening powers) incurs a stream of costs over time to produce benefits in the form of lowered threats to national security. In this respect, war and containment can be seen as alternative costly investments intended to produce a flow of future benefits. We initially assume that the two policies are equally effective in dealing with the threats posed by a dangerous regime. We also assume that at least one policy has a positive net present value. Given these assumptions, the choice between policy options reduces to present value cost comparisons. We seek to estimate the cost of establishing a stable regime in

Iraq that does not threaten the national security interests of the United States and that does not engage in large-scale oppression of its own people or others.

We calculate the present value cost of containment as

$$\sum_{i=0}^{\infty} (\text{Annual Containment Cost}) \left(1-\lambda\right)^{i} R(i), \tag{1}$$

where λ is the annual hazard rate for spontaneous regime change, and $R(i)$ is the discount factor applied to containment costs incurred *i* periods hence. We use the annual flow costs of containment reported in Table 2, and we assume that containment remains in effect until Iraq undergoes a spontaneous regime change. Similarly, we calculate the present value cost of the war scenarios in Table 8 as

$$\sum_{i=0}^{\infty} (\text{War Costs})_i R(i). \tag{2}$$

To obtain the cost of occupation and casualties for the war scenarios, we rescale the flow costs reported in Tables 6 and 7 based on force size, operations tempo and casualties.

In selecting a discount rate for the present value calculations, a sensible approach is to use the real time cost of funds facing the U.S. government. As of early 2003, the real annual yield on ten-year inflation-indexed U.S. Treasury bonds was about 2 percent.[43] We use this figure as our baseline discount rate. An alternative approach relies on expert opinions regarding the appropriate social discount rate for public policy decisions with long-lived consequences. Weitzman (2001) surveys about 2,000 professional economists on this issue and finds a mean discount rate of 4 percent. To accommodate the heterogeneity in expert opinion, he also fits a model to the survey responses and obtains a

[43] Sack and Elsasser (2004) provide evidence on the yields implied by inflation-indexed U.S. Treasury securities. It is clear from their study that the difference between yields on nominal U.S. Treasury securities and survey measures of inflationary expectations implies a lower real cost of funds and, hence, a lower discount rate than the 2 percent figure.

schedule for certainty-equivalent discount rates that declines with the time horizon – from about 4 percent for 1 to 5 years hence to 3 percent for 6 to 25 years hence and 2 percent for 26 to 75 years hence.[44]

The appropriate discount rate also depends on whether the costs incurred under a given policy are correlated with the opportunity cost of government funds in future states of the world. This opportunity cost is likely to be higher when economic growth is lower. We see no obvious reason for future costs under containment or war to be correlated with future growth in an important way, but some readers may hold a different view. Hence, we also consider higher discount rates in the calculations below, in line with the view that the costs associated with a given policy are concentrated in states of the world with a relatively high opportunity cost of government funds.

4.2. Present Value Cost Results

Table 9 reports results for the containment policy. At a 2 percent discount rate on future costs and a 3 percent annual hazard rate for regime change, the present value cost of containment is $297 billion in our baseline scenario. If effective containment requires extra military forces per the discussion in Section 2.2, the cost rises to nearly $400 billion. The precise cost also depends on the discount rate, the likelihood of spontaneous regime change, and other details. Thus our analysis does not establish a precise value for the economic cost of sticking with the containment policy. It does show that the containment policy was an expensive option for the United States under a broad range of reasonable assumptions. This conclusion holds even under the assumption, which we

[44] The recent economics literature develops several rationales for declining discount rate schedules. See Groom et al. (2004) for a review.

have maintained thus far, that containment would remain completely effective in protecting U.S. national security interests.

Table 10 reports results for the war scenarios. At a 2 percent discount rate, the cost of war ranges from $106 billion in Scenario 1 to $872 billion in Scenario 7.[45] The present value cost is $320 billion for Scenario 4(b), which involves an occupation force that declines from 200,000 troops in September 2003 to zero in October 2008, $56 billion in undiscounted costs for postwar aid, 4,000 fatalities and nearly 30,000 injuries. More generally, Table 10 shows that the duration and size of the postwar occupation have a profound effect on the overall cost of the war option. For example, the cost of Military Resources Engaged in Occupation ranges from $35 billion in Scenario 1 to $153 billion in Scenario 4 and $410 billion in Scenario 6. The intensity of postwar conflict also has a large impact on U.S. costs related to casualties and reconstruction aid.

In sum, our analysis shows that both containment and war were costly policy options for the United States. The analysis also identifies key factors that influence the cost of each policy option. For example, the expected duration of a hostile regime in Iraq, absent war, has a dramatic effect on the cost of containment. To see this point, consider our baseline containment scenario with a 2 percent discount rate and a 3 percent hazard rate for peaceful regime change. Raising the hazard rate to 5 percent lowers the cost of containment from $297 billion to $212 billion. Lowering the hazard rate to 2 percent raises the cost of containment to $371 billion. Hence, under the containment option,

[45] Table 10 is based on the Heavy Air Option in CBO (2002). The Heavy Ground Option involves an extra $11 billion to $16 billion in present value costs, depending on the length of the major combat phase.

policies or developments that promote peaceful regime change generate large economic benefits for the United States.

How costly will the Iraq intervention ultimately become for the United States, both in absolute terms and relative to containment? As of January 2006, it appears quite possible that the Iraq intervention will ultimately unfold along lines similar to Scenario 5(a), though perhaps with fewer U.S. casualties. At a 2 percent annual discount rate, the projected cost of this scenario is $414 billion (in 2003 dollars) according to our analysis. In comparison, the projected cost of containment in our baseline case is $297 billion. A somewhat more pessimistic view about the cost of effective containment and the likelihood of peaceful regime change yields containment costs similar to the $414 billion figure. Thus, despite the undeniably high cost of the Iraq intervention, our analysis indicates that containment may well have been equally costly for the United States.

It also appears possible (as of January 2006) that the Iraq intervention will unfold along lines not too different from Scenario 6, though with fewer U.S. casualties. The projected cost of Scenario 6 is $633 billion. It is hard to argue that continued containment would have involved comparable or greater expected economic costs for the United States than an intervention experience similar to Scenario 6, unless one dispenses with the assumption that containment would be fully effective in protecting U.S. national security interests. We take up that issue in Section 5.

4.3. Departures from Constant Supply Costs

In the cost calculations above, we assume constant supply costs within the relevant range for all military inputs. This assumption is less appealing when war involves an extended, intense engagement that leads to shortages of critical equipment, higher costs

of recruiting and retention, reductions in the combat effectiveness of U.S. troops, or an impaired ability to meet other national security threats. News reports of body armor shortages, under-armored transport vehicles, missed recruiting targets and large re-enlistment bonuses suggest that the Iraq engagement has been big enough and long enough to move the United States up the supply schedule for its ground forces. Cutting the other direction are static scale economies achieved by large-scale operations and dynamic scale economies that arise from learning by doing on the battle field. News accounts suggest that U.S. military experience in the Gulf War of 1991 and later in Bosnia, Kosovo and Afghanistan led to improvements in the combat effectiveness of U.S. forces. The Iraq intervention is also likely to be a source of lessons, albeit hard-won, that will improve the effectiveness of the U.S. military in potential future conflicts. Of course, opponents can also draw lessons from battle field experience. On balance, it is unclear whether these departures from constant supply costs are quantitatively significant, and which way they cut. This is a ripe area for careful research.

4.4. Nation Building and Post-Occupation Deployments

Our analysis of the war scenarios in Table 8 is designed to assess the cost of establishing a stable regime in Iraq that does not threaten the national security interests of the United States and that does not engage in large-scale oppression of its own people or others. Some advocates of the Iraq war have appealed to and argued for more ambitious goals, e.g., transforming Iraq into a beacon of liberty in the Middle East and an exemplar of market-based capitalism. These are worthy goals, but a serious effort to attain them would probably involve significant additional costs for reconstruction aid and other nation-building efforts. Achieving these goals would also yield benefits not factored into

our analysis. For these reasons, our analysis does not deliver an assessment of the more ambitious nation-building goals in connection with the Iraq intervention.

A similar point applies to the longer term costs and benefits of a U.S. strategic alliance with a new Iraqi regime. An analogy may be helpful in this regard. The United States has maintained a significant military presence in Japan for more than sixty years after the allied victory in World War II. It would be inappropriate to treat U.S. military forces stationed in Japan decades after victory as part of the cost of victory. Instead, the cost of these military forces should be weighed against their strategic benefits. Likewise, if the United States maintains a military presence in Iraq after the defeat of insurgents and the establishment of a stable, peaceful regime, it would be inappropriate to count those forces as part of the cost of war in Iraq without also factoring in their benefits.

5. Concerns about Containment and Implications for the Cost Calculus

5.1. Concerns about Containment

Many war advocates argued that the Iraqi regime posed an unacceptable security risk in a post-9/11 world. Shawcross (2004) stresses Saddam's obsession with WMDs, his demonstrated willingness to use them, and the dangers of his potential collaboration with terrorists:

> Now, in the early twenty-first century, threats have changed, and so must the responses to them. The proliferation of weapons of mass destruction, and of terrorists who stalk from the shadows and are susceptible to no kind of deterrence, alter the concept of imminent danger.
>
> … [T]here was no doubt that Saddam, alone among the dictators, had long shown an absolute obsession with obtaining such weapons [WMDs] and had actually used them. He had also refused to accede to more than a decade of international demands that he desist. There was ample reason to believe that he already possessed biological and chemical weapons capacity and that he would

> seek to restart his nuclear weapons program if he were able. He had the knowledge and the intent – he lacked only the fissile material.
>
> … [W]hether or not [Al Qaeda and Saddam] collaborated directly, the very existence of a new global terrorist network made Iraq's presumptive possession of WMD much more threatening. Theoretically it offered Saddam (and others) a way to attack the United States by proxy and perhaps without identification. Prudent policymakers could not ignore the fact that Saddam and Osama bin Laden shared a hatred of the United States. (Pages 69-70)

In fact, Saddam Hussein had a long history of harboring and supporting international terrorists when it suited his purposes.[46]

Pollack (2002, p. xxiv) stresses doubts about whether it was feasible to sustain an effective containment policy: "Perhaps the single most important reason why the United States must act soon to adopt a new policy toward Iraq is that our old policy, the policy of containment, is eroding." In support of this conclusion, Pollack points to Iraq's eviction of U.N. weapons inspectors in the fall of 1998, rising discontent in Arab countries and Muslim communities over the basing of American military forces in the Persian Gulf region, the erosion of sanctions' effectiveness over time, and declining international support for containment.[47]

A related argument for pre-emptive action in 2003 stresses the potential for a future military conflict with Iraq that would involve much higher costs. According to Pollack (2002, pp. xv-xvi):

> In the case of Iraq, if we do not act soon to topple Saddam Hussein's regime, we are likely to face a much worse conflict with Saddam down the road after he has acquired nuclear weapons and advanced conventional weapons. An invasion of Iraq in the near term, when Saddam has only a limited stockpile of weapons of mass destruction and his conventional forces remain weak, is likely to seem effortless and cost-free compared to a war with Saddam after he has crossed the nuclear threshold. Given Saddam's propensity to miscalculate, his

[46] See, for example, chapter 7 in Coughlin (2005).

[47] This assessment has not gone unchallenged. See Lopez and Cortright (2004), for example.

> penchant for aggression, and his willingness to absorb horrific punishment, it would be a terrible mistake for the United States to allow him to acquire such capabilities and risk war with a nuclear-armed Iraq…. This book argues that war with Saddam's Iraq is well nigh inevitable and that it would be far, far better for the United States to face this challenge sooner rather than later.[48]

Shawcross (2004, pp. 71-73, 93, 115-116) develops a similar argument. He applauds Israel's bombing of Iraq's Osirak nuclear reactor in 1981 because it set back Saddam's efforts to acquire nuclear weapons. He also asks whether pre-emptive action against Al Queda and the Taliban regime in Afghanistan would have prevented the 9/11 attacks.

O'Hanlon (2002c) summarizes the state of affairs this way in September 2002:

> Saddam continues to have chemical weapons in abundance and probably biological agents as well, but we have already proved we can deter him from using these weapons over the past dozen years, and there is no reason to think he has transferred either type to al-Qaida. By contrast, a nuclear weapon is something Saddam almost surely does not now have, but that he might someday acquire – and that, if ever used, could clearly dwarf 9/11 in its effects. … [L]etting Saddam get a nuclear weapon and then seeing what if anything he might do with it is a social science experiment we can live without. Simply having such a weapon could give Saddam "defensive cover" for aggression, fundamentally changing the balance of power in the region.
>
> That, in a nutshell, is the case for a pre-emptive war. Whatever one thinks of this case, it should not depend on advocates producing a "smoking gun."… Saddam is trying to get the bomb… [and] it would make more sense to fight before he had the bomb than after.

O'Hanlon also notes that "Iraq was disturbingly close – perhaps only months away – from building a nuclear weapon at the time of Desert Storm" in 1991.

But unlike Pollack and Shawcross, O'Hanlon favors containment over war. He wraps up his essay by stating that "Even a war skeptic such as me must acknowledge that

---

[48] Pollack reiterated this argument shortly before the invasion of Iraq: "The choice we have before us is we either go to war now or we will never go to war with Saddam until he chooses to use a nuclear weapon and he chooses the time and place. The question for me is not war or no war. It's a question of war now, when the costs may be significant, or war later when they may be unimaginable." See "Some of Intellectual Left's Longtime Doves Taking the Role of Hawks" by Kate Zernike, 14 March 2003 issue of the New York Times.

President Bush has a reasonable case when he describes the risk involved in Iraq's nuclear program. Rigorous inspections and disarmament would, to my mind, be an acceptable solution. But to get that outcome, we may have to threaten war, threaten it quite credibly." O'Hanlon does not spell out the dimensions or costs of a credible threat.

These arguments by Shawcross, Pollack and O'Hanlon – and related arguments by many others – partly turn on underlying views and implicit assumptions about the prospective costs of war and containment. To help evaluate these arguments, we extend our analytical framework to consider concerns related to the cost of credible threats, the effectiveness of containment, and the likelihood and cost of future conflict with Iraq under a policy of containment. In the same spirit, we also consider how the cost calculus depends on the potential impact of the war-versus-containment choice on the likelihood of major terrorist attacks on the United States.

5.2. Costly Credible Threats

There was widespread agreement prior to the Iraq invasion that an effective containment policy required a rigorous program of inspections and disarmament. So what did it take in the way of military resources to compel Iraqi compliance with an effective inspections program? What constituted a credible threat forceful enough to inspire Iraqi cooperation? Precise answers to these questions are not at hand, but the historical record offers some guidance.

Iraq repeatedly resisted the U.N. weapons inspections process, a fact evident from the many U.N. Security Council resolutions on the matter. On 1 November 1998 Iraq halted all cooperation with U.N. weapons inspectors. Four days later, U.N. Security Resolution 1205 demanded that Iraq "provide immediate, complete and unconditional

cooperation" with inspectors and warned of the threat to "international peace and security" posed by non-cooperation.[49] Later the same month, the United States aborted a missile strike on Iraq when its government agreed to cooperate with the inspections process. After the Iraqi government failed to follow through, the United States and Britain launched Operation Desert Fox, an extensive four-day aerial bombardment of Iraqi targets. The U.S. portion of the operation involved over 40,000 troops, 300 aircraft and 40 ships.[50] Despite its destructive intensity, Operation Desert Fox failed to compel the readmission of U.N. weapons inspectors to Iraq.

In fact, weapons inspectors did not return to Iraq for four long years. It is instructive to briefly recount the sequence of events leading up to their return. On 12 September 2002, President Bush addressed the United Nations, "challenging the organization to swiftly enforce its own resolutions against Iraq. If not, Bush contends, the U.S. will have no choice but to act on its own against Iraq." On 11 October 2002, the U.S. Congress authorized an attack against Iraq. On 8 November 2002, the U.N. Security Council unanimously approved resolution 1441 calling for "tough new arms inspections on Iraq and [providing] precise unambiguous definitions of what constitutes a 'material breach' of the resolution." Resolution 1441 also warned that Iraq would face "serious consequences" if it violated the resolution. By this point in time, the likelihood and prospects of an Iraq war were major sources of concern and discussion throughout the world. There was no doubt about the seriousness of the threat confronting the Iraqi

[49] www.casi.org.uk/info/scriraq.html#1990.
[50] See the press briefing by General Anthony Zinni at http://www.defenselink.mil/transcripts/1998/t12211998_t1221fox.html.

regime. In the face of this rather considerable pressure, Iraq finally relented and allowed U.N. weapons inspectors to return on 18 November 2002.[51]

This historical summary highlights two points. First, aerial bombardments on the scale of Operation Desert Fox were insufficient to compel Iraqi compliance with a rigorous inspections and disarmament regime. Second, not until the approach of a full-scale, regime-ending war did Iraq finally relent and permit the resumption of a viable inspections program. Credible threats of this sort are costly to mount.

The same point applies to the occasional extra deployments required to deter Iraqi aggression under the containment policy. For example, in October 1994 Iraqi forces began massing near the border with Kuwait. The United States responded by rapidly increasing troop levels in the Persian Gulf region to about 60,000 and by deploying another 350 military aircraft and a carrier battle group to the region. Britain also reinforced its military presence in the region. Faced with an impending attack by the United States and Britain, Iraq withdrew its forces well away from the Kuwaiti border, ending the confrontation. But two years later, in response to the mobilization of Iraqi military forces and fears of an Iraqi attack on Jordan, Kuwait or Saudi Arabia, the United States engaged in a similarly large deployment of military forces to the Persian Gulf region.[52]

[51] The timeline and quotations in this paragraph are drawn from http://www.infoplease.com/spot/iraqtimeline2.html.
[52] See chapter 3 in Pollack (2002) for brief accounts of these episodes.

In light of this historical record, consider a containment policy that relies on costly credible threats, as needed, to compel compliance with inspections and disarmament and to deter Iraqi aggression. The present value cost of containment now becomes

$$\sum_{i=0}^{\infty}\left[(\text{Annual Containment Cost}) + p\left(\text{Credible Threat Cost}\right)\right](1-\lambda)^{i} R(i), \qquad (3)$$

where p is the probability that, in any given year, effective containment requires the mounting of a credible threat. In calculating equation (3), we consider two values for the cost of a credible threat, $13.05 billion and $26.1 billion. The latter figure is the sum of deployment and redeployment costs under the Heavy Air Option (Table 6). We also use the baseline annual containment costs of $14.54 billion (Table 2), a 2 percent annual discount rate, and a 3 percent annual probability of peaceful regime change.

Figure 1 illustrates how the need for costly credible threats affects the present value cost of containment. For comparison, the figure also shows the present value cost of war under scenarios 5(a) and 6. As seen in Figure 1, the probability and cost of credible threats have important effects on the cost calculus. For example, the cost of war in scenario 5(a) exceeds the baseline containment cost by about $115 billion, but this gap vanishes if effective containment involves a 22 percent chance of mounting a high-cost threat in any given year. Similarly, war scenario 5(a) and an effective containment policy are equally costly, if there is a 44 percent chance of mounting a low-cost threat.

5.3. Limited Wars

With some probability, an effective containment policy might require a limited war against Iraq; i.e., a war that reverses or prevents some hostile action by Iraq but does not proceed to forcible regime change, occupation and reconstruction. Contingencies that might lead to limited war include Iraqi aggression against neighboring states, large-scale

slaughter of civilians by Iraqi security forces, and information that Iraq was on the verge of acquiring or building a nuclear weapon. Limited war followed by the resumption of containment implies a present value cost expression with the same form as equation (3). The cost of a limited war replaces the credible threat cost in (3), and *p* now refers to the probability of a limited war in any given year.

As illustrated in Figure 2, the prospects for limited war also have important effects on the cost calculus. In constructing Figure 2, we assume that a limited war involves the same level of military resources and U.S. casualties as Scenario 1 in Table 10 (excluding the postwar costs and casualties). Recall that Scenario 1 involves the Heavy Air Option with two months of major combat and 500 U.S. fatalities. Based on our earlier analysis, the projected cost of such an engagement is $53.3 billion.[53] Other assumptions underlying Figure 2 are the same as in Figure 1.

As seen in Figure 2, containment is as costly as war scenario 5(a) when there is a 10 percent chance of a limited war in any given year. Containment is as costly as war scenario 6 when there is a 31 percent chance of a limited war in any given year.

5.4. War and Forcible Regime Change, Now or Later?

Some argued for pre-emptive war and forcible regime change in Iraq on the grounds that war was highly probable in any event and likely to be much costlier at a later date. To assess the force of this argument, let *P* denote the probability of war and forcible regime change in the next *N* years under a policy of containment, and suppose that the undiscounted cost of a future war is *m* times the cost of an immediate war. Let p_i denote the probability of war in year *i* conditional on the survival of a dangerous Iraqi regime

[53] The sum of costs for Initial Deployment, Major Combat and Redeployment plus the cost for 500 U.S. fatalities and about 3,600 U.S. injuries.

through year $i-1$. p_i can be thought of as the conditional probability that the United States faces a war of "necessity" with Iraq in year *i.*

If $p_0 = 0$ in the initial year (2003), $p_i = p > 0$ for the next *N* years and $p_i = 0$ thereafter, the probability of a future war of necessity under a policy of containment is

$$P = p\sum_{i=1}^{N}(1-\lambda-p)^{i-1} = \frac{p\left[1-(1-\lambda-p)^{N}\right]}{\lambda+p}, \tag{4}$$

where λ is the annual hazard rate for peaceful regime change, as before. The present value cost of the containment policy now becomes

$$\begin{aligned}&\left(\text{Annual Containment Cost}\right)\left[1+\sum_{i=1}^{N}(1-\lambda-p)^{i}R(i)\right]\\&+p\left[m\left(\text{Cost of Immediate War}\right)\right]\sum_{i=1}^{N}(1-\lambda-p)^{i-1}R(i)\\&+(1-\lambda-p)^{N}\sum_{i=N+1}^{\infty}\left(\text{Annual Containment Cost}\right)(1-\lambda)^{i-N}R(i)\end{aligned} \tag{5}$$

Figure 3 applies equation (5) to illustrate how the present value cost of the containment policy varies with the probability and cost of a future war. We allow for a possible war in the next ten years, i.e., through 2013. War costs are based on scenario 5(a), and annual containment costs are set to the benchmark value in Table 9. As in Figures 1 and 2, we assume a 2 percent discount rate and a 3 percent hazard rate for peaceful regime change.

Figure 3 show that the possibility of a future war can profoundly alter the cost calculus. For example, if a future war is twice as costly as an immediate one, and the probability of such a war in the next ten years exceeds 25 percent, then containment is more costly than an immediate, pre-emptive war. If a future war is five times as costly and occurs with probability greater than 8 percent in the next ten years, then containment is more costly than immediate war. If a future war is five times as costly and occurs with

a 50 percent chance in the next ten years, then the present value expected cost of the containment policy exceeds 1.1 trillion dollars.

We think this analysis helps to understand the wide divergence of opinion about the wisdom of the Iraq war. The precise probability and cost of a future war with Iraq matter greatly for the cost of containment, but there is no sure method for assessing the probability and cost of a future war. Even modest differences of opinion about, say, the probability of a future war translate into sizable differences in the costliness of containment. From this perspective, it is unsurprising that the decision to invade Iraq in 2003 and overthrow the regime remains a matter of intense controversy.

Our analysis also highlights a problematic aspect of the oft-drawn distinction between a war of "choice" and one of "necessity". In particular, the analysis shows that a war of "choice" can be highly desirable when it forecloses the possibility of a more costly war of "necessity." This statement continues to hold when the possibility of a war of necessity is remote, provided that a future war is costly enough relative to an immediate one. In this respect, there is no clean separation between a war of choice and one of necessity. Of course, the mere possibility of a costly war of necessity at some future date does not ensure that immediate war is the best policy choice.

5.5. Future Terrorist Attacks

Views also differ widely about the likelihood that the pre-war Iraqi regime would support or facilitate a major terrorist attack against the United States. For some, this danger became a major plank in the case for war. Others dismissed the possibility of Iraqi participation in a terrorist attack against the United States. Indeed, many argued that war in Iraq raised the likelihood of a major terrorist attack against the United States.

We do not try to settle these differences of opinion. Instead, we offer brief remarks about the magnitude of the stakes.

To gauge the potential cost of a future terrorist attack, it is helpful to review the economic scale of the 9/11 attack. Bram, Orr and Rapaport (2002) estimate direct costs of the attack on the World Trade Center – "comprising earnings losses, property damage, and the cleanup and restoration of the site" – of $33 billion to $36 billion. Their calculations understate the direct costs, however, because they equate the value of lost lives to the value of foregone earnings. In fact, as common sense suggests and economic analysis shows, a lost life is worth more than foregone earnings. Murphy and Topel (2005), for example, estimate the value of a human life to be about three times earnings capacity. Tripling the Bram et al. estimate of lost earnings yields a figure of about $50 billion for the direct costs of the 9/11 attack on the World Trade Center. This figure is highly conservative as an estimate for the overall costs of 9/11, because it omits indirect costs associated with disruption to the U.S. financial system and the regional economy in the New York area. The economic costs of a future terrorist attack could be considerably larger, especially if it involves chemical weapons, biological agents or nuclear weapons.

Suppose, for example, that a dangerous Iraqi regime raises the probability of a major terrorist attack by 4 percentage points in any given year, and that the economic cost of such an attack is $100 billion. These figures imply an expected cost from (additional) terrorist attacks of $4 billion per year. Capitalizing this flow at the factor $1/(r+\lambda)$ with $r=.02$ and $\lambda=.03$ yields a present value cost of $80 billion. This is a sizable effect and potentially large enough to tilt the scale in favor of war. Of course, if war raises the

probability of a major terrorist attack on the United States, then the effect cuts in favor of the containment policy.[54]

5.6. An Integrated Treatment of Costly Threats, Wars and Terrorist Attacks

Costly threats, terrorist attacks, limited wars and a full-scale regime-changing war are possible contingencies under a policy of containment. The analysis above considers these contingencies one at a time; Table 11 considers all four at the same time. The table shows present value containment costs for three new scenarios plus a scenario with no contingencies as in Table 9. The table considers the baseline annual containment costs of $14.5 billion and lower annual costs of $9.7 billion, annual discount rates of 2 and 6 percent, and an annual hazard for peaceful regime change of 3 percent. Our discussion focuses on the baseline case with a 2 percent annual discount rate.

In the "optimistic" scenario, a hostile Iraqi regime has no effect on the likelihood of a terrorist attack, but there is a 5 percent annual chance that the United States mounts a costly threat and a 3 percent annual chance that it fights a limited war against Iraq. These contingencies apply so long as a hostile Iraqi regime persists. There is also a 5 percent chance that the United States fights a full-scale regime-changing war against Iraq at some point in the next ten years in the optimistic scenario, where the undiscounted cost of such a war is the same as for war Scenario 5(a) in Table 10. Factoring in these contingencies

[54] Peaceful regime change under a policy of containment and forcible regime change as a consequence of war need not have the same impact on the probability of a terrorist attack. Hence, to quantify the present value cost of terrorist attacks under both policy options, it is necessary to specify five parameters: the discount rate, the cost of a terrorist attack and the attack probabilities under containment, peaceful regime change and forcible regime change. One of the probabilities can be normalized to zero when calculating the net impact of the war-versus-containment choice on the present value cost of terrorist attacks.

yields a present value containment cost of $346 billion for the optimistic scenario, as compared to $297 billion when all contingencies have zero probability.

The "middle" scenario posits a greater probability of mounting a costly threat and a greater probability of engaging in a regime-changing war. Credible threats and a regime-changing war are also more costly in the middle scenario. Finally, the middle scenario posits that the annual probability of a major terrorist attack on the United States is 2 percentage points higher with a hostile Iraqi regime. The economic cost of such an attack, if it occurs, is set to $100 billion. Factoring in these contingencies yields a present value containment cost of $441 billion for the middle scenario.

The "pessimistic" scenario posits yet higher probabilities for all contingencies and higher costs for threats, terrorist attacks and regime-ending wars. Factoring in these contingencies yields a present value containment cost of $705 billion. We have designated the assumptions that underlie this large cost figure as "pessimistic", but they seem well within the range of pre-war assessments offered by some knowledgeable observers. This is not to say that these pre-war assessments were correct, but neither were they easily dismissed. For those who held such views, or even more pessimistic ones, continued containment was a highly unattractive option.

6. War versus Containment: Effects on Iraqi Economic Well-Being

6.1. The Economic Collapse under Saddam Hussein

After Saddam Hussein became President and secured his position as dictator in 1979, the Iraqi population suffered a catastrophic collapse in living standards – largely as a consequence of Saddam's rule. Nordhaus (2002, page 53) estimates that Iraq's real GDP

per capita (at 2002 prices) fell from around $9,000 in 1979 to $1,000-1,200 in 2001. The upper figure for 2001 implies a staggering 87 percent decline in per capita output. The most significant factors in the collapse were the devastating war with Iran in the 1980s, draconian economic sanctions imposed on Iraq in response to its 1990 invasion of Kuwait and its later refusals to comply with U.N. Security Council resolutions, and the destruction of Iraq's infrastructure during allied efforts to expel Iraqi forces from Kuwait in 1991. The militarization of Iraqi society, the diversion of resources to Saddam's palaces and monuments, and declines in the relative price of oil amplified the collapse in Iraqi living standards.

After 1990, lost oil revenues alone were enormous. According to Nordhaus (2002, page 53), "Under sanctions, oil production during the 1991-2002 period averaged 1.4 million bpd. Assuming Iraq could have produced 3 million bpd during this period, the revenue shortfall since the first Persian Gulf War was about $150 billion." The implied average annual revenue shortfall of $12.5 billion is 40-50 percent as large as Iraq's estimated GDP in 2001. This figure for lost oil revenues is almost certainly too low, if the comparison benchmark is a stable Iraqi economy with ready access to export markets and international oil exploration and extraction technologies. Iraq's oil production peaked at more than 3.4 million bpd in 1979 and had been trending sharply upwards since

1973.[55] Further, as Nordhaus (page 72) remarks, "Experts believe that, if restructuring operations can operate effectively, Iraq's production capacity can be raised to between 3 and 4 million bpd within two years…. Iraq has enormous reserves relative to its current production … [and] has negotiated $40 billion of contracts with Russia, China, and France to develop approximately 5 million bpd of new capacity."

Much of Iraq's greatly diminished output was diverted to an oversized military, an apparatus of terror and repression and the relentless glorification of Saddam Hussein. Pre-war Iraq employed nearly 500,000 persons in various intelligence, security and police organizations and a total of nearly 1.3 million when the armed forces and paramilitary units are included. All together, the various security organizations and military units accounted for about one quarter of employment in pre-war Iraq.[56] This militarization of Iraqi society occurred principally under Saddam Hussein – the army rose from 180,000 men in 1980 to one million men (six percent of the population) in 1988.[57] Despite the sanctions imposed on Iraq after the Gulf War, the regime "embarked upon a series of costly projects to build victory monuments and palaces for Saddam (fifty of them at last

[55] Data on Iraqi oil production are available at http://www.eia.doe.gov/emeu/international/petroleu.html#ProductionQ under the heading, "OPEC Member Countries and Total OPEC, All Months, January 1973 – Present (Thousand Barrels per Day) [xls]."

[56] Data on the number of persons in security organizations and military units are drawn from Pollack (2002, pages 116-117). Chris Foote supplied us with an unpublished table from Iraq's Ministry of Planning with employment data. The table shows total employment of 4.6 million based on a 1997 census of Iraq and projected total employment of 5.2 million in 2000.

[57] Donnelly (2004), page 4.

count), which cost Iraq as much as another $2.5 billion per year…. Many of the fifty new palaces Saddam has built for himself since the Gulf War have gold-plated faucets and artificial rivers, lakes, and waterfalls that employ pumping equipment that could have been used to address the country's desperate water and sanitation problems."[58]

The foregoing assessment based on pre-war data sources is broadly consistent with the analysis in Foote et al. (2004), four economists who worked for the Coalition Provisional Authority in Baghdad, and who had access to additional data on Iraq's economy. They estimate that real GDP per capita at constant 2002 prices fell by 60 percent from 1979 to 2001. Living standards fell much more because of two other factors under the regime's control – the militarization of Iraqi society and the diversion of output to Saddam's palaces and monuments – and because of declines in oil prices after 1979. Based on this review of the evidence, we conclude that real income per capita fell by roughly 75 percent as a consequence of Saddam's rule and the regime he established.

6.2. Assessing the Impact of War and Regime Change

To assess the impact of regime change on Iraqi economic welfare, we consider an extended transition period to a higher level of GDP per capita. During the transition, output grows by enough to recover much or all of the declines in Iraqi GDP per capita caused by Saddam's misrule. Our analysis below treats GDP per capita as a measure of living standards. However, since war and containment imply different time paths for

[58] Pollack (2002), pages 131 and 135.

GDP per capita, we carry out the analysis in terms of economic "welfare", which captures current and future levels of GDP per capita.

6.2.1. Baseline Model

Let V^T denote per capita welfare at the outset of transition, immediately after regime change. The regime change may occur spontaneously or as the result of external intervention (war). In the latter case, welfare is $V^T - W$, where W denotes the direct one-time impact of war on GDP per capita. Let V^S denote per capita welfare under the current regime assuming no external intervention.

We make the following assumptions:

(A1) Prior to regime change, GDP per capita grows at annual rate *g*.

(A2) After regime change, GDP per capita grows at rate *g* plus, during an *N*-year transition period, an additional rate *h.*

(A3) The extra component of the growth rate *h* during the transition period equals $M^{1/N} - 1,$ where *M* is a multiple of initial output (just prior to regime change) that captures the favorable long run effect of regime change on the level of GDP per capita.

(A4) Absent external intervention, there is a probability λ in any give year of spontaneous, peaceful regime change.

(A5) The discount rate applied to future income is a constant denoted by *r.*

Under these assumptions, per capita welfare at the outset of transition is

$$V^T = \sum_{i=0}^{N}\left[\frac{(1+g)(1+h)}{1+r}\right] + \frac{M(1+g)^{N+1}}{(1+r)^N(r-g)}. \qquad (6)$$

Given no external intervention, per capita welfare satisfies the following relationship:

$$V^S = 1 + \lambda\left(\frac{V^T(1+g)}{1+r}\right) + (1-\lambda)\left(\frac{V^s(1+g)}{1+r}\right). \quad (7)$$

The first term on the right side is GDP per capita at the initial output level, which we have normalized to unity. The second term is the probability of a spontaneous regime change multiplied by the present value of welfare under transition. The third term is the continuation probability for the current regime multiplied by the present value of welfare. Solving this equation for V^S yields

$$V^S = \frac{1 + r + \lambda V^T(1+g)}{\left[(1+r) - (1-\lambda)(1+g)\right]}. \quad (8)$$

Using equations (6) and (8), we can compare the effects of war and containment on Iraqi economic welfare. The ratio $\left(V^T - W\right)/V^S$ provides a convenient measure for the impact of war relative to containment. When this ratio exceeds unity, war improves Iraqi welfare relative to containment. Subtracting one from this ratio gives the impact of war on Iraqi welfare, expressed as a percentage of initial welfare.

6.2.2. Model with Foregone Growth Prior to Regime Change

The baseline model of how regime change affects Iraqi welfare is conservative in the sense that it assumes identical long term growth rates before and after regime change. An alternative model allows for slower long term growth in the absence of regime change. So consider an alternative model with growth rate g^S under the initial regime. For this model, assume that regime change brings about an *N*-year transition period to a higher level of income per capita *and* a higher long term growth rate $g \geq g^S$. In addition, assume that output growth foregone prior to regime change is never made up. In other words, the catch up process after regime change recovers the drop in output per

capita under Saddam, but it does not return the economy to its initial baseline growth path. This alternative model involves only slight modifications to the preceding equations. In particular, the *g* terms in equations (7) and (8) are replaced by g^S.

6.3. The Effect of War on Iraqi Welfare

We now use the model to project the effect of war on the average economic well-being of Iraqis. For our baseline case, we assume a 20-year transition period following regime change. We set $M = 4$ based on the evidence that Iraqi living standards declined by 75 percent or more under Saddam Hussein. Given $N = 20$ years, this choice for M implies $h = 7.18$ percent per year. As before, we assume that the probability of spontaneous regime change is 3 percent per year. We set the long-term growth rate at $g = 2$ percent per year, and we set the annual discount rate on future income flows at $r = 5$ percent. We assume that the destruction associated with war amounts to 50 percent of a year's GDP.

Plugging these values into the baseline model, we calculate that $(V^T - W)/V^S$ equals about 1.5. That is, war raises Iraqi welfare by 50 percent relative to containment in the baseline case. This is an enormous improvement in economic welfare. Table 12 quantifies the impact of war on Iraqi welfare for several alternative parameter choices. The table shows that war leads to large gains in Iraqi welfare under a wide variety of alternative parameter choices. Even in the least favorable case for war – involving higher war costs, little catch up during the transition, and a high rate of peaceful regime change – war leads to a substantial improvement in Iraqi welfare compared to a policy of containment.

Table 13 quantifies the impact of war on Iraqi welfare in the model with foregone growth prior to regime change. In contrast to the Table 12 results, we now assume that regime change, whether peaceful or forcible, raises the long term growth of GDP per capita by two percentage points. This modified model implies that war brings very large welfare gains for Iraqis, ranging from 35 to 170 percent in Table 13. War has a more favorable effect in Table 13 because regime change now has a positive effect on long term growth.

The results in Tables 12 and 13 strongly suggest that war is an economic blessing for Iraqis compared to the alternative policy of containment. How is this possible, given the obvious destructive consequences of war? The answer has two parts. First, the Iraqi economy was in terrible condition before the war, and it would have remained in a sorry state under the policy of containment. Second, as we discussed above, economic well-being underwent an extraordinary collapse under Saddam Hussein. If, over the course of a generation, Iraqis recover even half of the economic losses they suffered under Saddam Hussein, then economic welfare will rise significantly as a consequence of forcible regime change.

7. War versus Containment: Lost Iraqi Lives

This section briefly reviews evidence on Iraqi casualties in the 1991 Gulf War, the number of premature Iraqi deaths from 1991 to 2003 under the containment policy, and the broader record of war, death and repression under Saddam Hussein. Our account draws heavily on Pollack (2002) and Welch (2002). After reviewing the evidence, we

reach a rough judgment as to whether continued containment would have saved Iraqi lives compared to a policy of war and forcible regime change.

7.1. Lost Lives under Saddam Hussein

The regime of Saddam Hussein was a ghastly enterprise that brought death and torture to hundreds of thousands of Iraqis and others. Pollack recounts the following:

- 200,000 Iraqi troops killed in battle during the 1980-1988 war with Iran, and another 400,000 to 500,000 wounded. (Page 24) Iranian casualties were much greater.
- In reprisal for Kurdish assistance to the Iranians, the Iraqi regime slaughtered Kurds and destroyed their homes in 1988 and 1989. "When the campaign finally ended in 1989, some two hundred thousand Kurds were dead, roughly 1.5 million had been forcibly resettled, a huge swatch of Kurdistan had been scorched by chemical warfare, and four thousand towns had been razed." (Page 20)
- The Gulf War initiated by Saddam "probably caused no more than 10,000 to 30,000 Iraqi military casualties and another 1,000 to 5,000 civilian casualties." (Page 139)
- In 1991, after the Gulf War, "anywhere from 30,000 to 60,000 Shi'ah were killed in the suppression of the *intifadah* in the south." (Page 51)
- In 1992 and 1993, the regime drained about 4,500 square kilometers of wetlands in the south. "In so doing, [the regime] created an ecological catastrophe and destroyed the way of life of several hundred thousand Marsh

Arabs who had made their homes among the rushes and reeds for more than a millennium." (Page 125)

- In addition, perhaps 200,000 or more Iraqis died after the 1991 Gulf War and the postwar *intifadah* through some combination of sanctions and internal repressions. (Pages 138-139) More than half of the premature deaths were children under five.

The issue of child deaths under sanctions attracted much attention. Welch (2002) provides an informative discussion and a helpful assessment of conflicting claims. He cites Richard Garfield, Clinical Professor of International Nursing at Columbia University, as the most credible source for estimates of how sanctions affected mortality among Iraqi children.[59] According to Welch,

> Garfield concluded that between August 1991 and March 1998 there were at least 106,000 excess deaths of children under 5, with a 'more likely' worst-case sum of 227,000. (He recently updated the latter figure to 350,000 through this year.) Of those deaths, he estimated one quarter were 'mainly associated with the Gulf war.' The chief causes, in his view, were 'contaminated water, lack of high quality foods, inadequate breast feeding, poor weaning practices, and inadequate supplies in the curative health care system. This was the product of both a lack of some essential goods, and inadequate or inefficient use of existing essential goods.'… It seems awfully hard not to conclude that the embargo on Iraq has been ineffective (especially since 1998) and that it has, at the least, contributed to more than 100,000 deaths since 1990.

All told, the regime of Saddam Hussein killed or caused the deaths of well over half a million Iraqis. Under the policy of containment after the Gulf War, a reasonable estimate is that 200,000 or more Iraqis died prematurely at the hands of the regime or as a direct consequence of its policies – including its refusal to comply with U.N. Security

[59] See Garfield (1999a,b) for two of his original studies.

Council Resolutions and the diversion of oil revenues and other resources to construct palaces and monuments.

Despite their sobering quality, the raw numbers fail to convey the sheer horror of the regime. Pollack succinctly captures some of the horror in a gut-wrenching passage (page 123) that tells of gouging out the eyes of children to force confessions from parents and grandparents, lowering victims into huge vats of acid, cutting out the tongues of regime critics, the systematic rape of women and girls in front of male relatives, and other extreme forms of torture and abuse.

7.2. War and Containment Compared

How does the tally of human misery and repression under containment compare to the likely consequences of war? Under the policy of containment in effect after the end of the 1991 Gulf War, premature Iraqi deaths numbered at least 10,000 per year and probably two or three times as many. If we discount future lost lives at a rate of two percent per year, and assume a three percent annual hazard for spontaneous and peaceful regime change, then a continuation of the containment policy could be expected to result in another 200,000 to 600,000 dead Iraqis. In comparison, the Gulf War of 1990-91 killed as many as 35,000 Iraqis, mostly troops who died during a long and intensive aerial bombardment by the United States and its allies.[60] Iraqi troops might be expected to adopt more effective tactics in reaction to their crushing defeat in the 1991 war. Or they might be expected to fight harder in response to an invasion. Either way, a more

[60] Pollack (2002), page 139.

effective response by Iraqi military forces would prolong combat and probably lead to greater Iraqi casualties.

O'Hanlon (2002a, 2002b) looks to the 1989 U.S. invasion of Panama and the 1993 U.S. engagement in Somalia to assess the probable loss of lives in a 2003 Iraq war. Scaling up from these conflicts, he estimates that "Iraqi troop losses might be expected to be anywhere from 2,000 to 50,000, with civilian casualties in the same relative range." He stresses that a key unknown is the willingness of Iraqi troops to fight. He also cautions that Iraqi use of chemical or biological weapons against U.S. troops or its own population could substantially raise Iraqi casualties. However, even his most pessimistic projections involve fewer fatalities than the 200,000 to 600,000 expected premature deaths that we project under a continuation of the containment policy.

There is a great deal of uncertainty about the number of premature Iraqi deaths under both war and containment. We think the weight of evidence points to a greater Iraqi death toll from a continuation of the pre-war containment policy than from a policy of war and forcible regime change. Perhaps the strongest reason to question this assessment is the possibility that a post-war Iraq could devolve into an extended and large-scale civil war. This possibility cannot be ruled out. What can be ruled out in light of the evidence is that the leading alternative to war involved little loss of Iraqi lives.

8. Concluding Remarks

Forcible regime change in Iraq has proved to be a costly undertaking. As of January 2006, it appears likely that the Iraq intervention will ultimately unfold along a path that implies present value costs for the United States in the range of 410 to 630 billion in 2003 dollars. These figures reflect a 2 percent annual discount rate. They capture the estimated economic costs of U.S. military resources deployed in the war and postwar occupation, the value of lost lives and injuries sustained by U.S. soldiers, the lifetime medical costs of treating injured soldiers, and U.S. outlays for humanitarian assistance and postwar reconstruction. Pre-invasion views about the likely course of the Iraq intervention imply present value costs in the range of $100 to $870 billion. Military resources devoted to postwar occupation account for more than half the total costs except in optimistic scenarios that envision a short occupation, little postwar conflict and a smooth reconstruction effort.

The high cost of the Iraq intervention is sometimes seen as a compelling argument against the decision to forcibly overthrow the ruling order and install a new regime. This argument is deficient because it ignores the costs of alternative responses to the national security and humanitarian concerns presented by the pre-war Iraqi regime. A well-founded verdict on the Iraq intervention requires, at a minimum, an evaluation of what these alternatives would cost. We tackle this issue by assessing the costs of sticking with the pre-war containment policy.

Containment required the continuous engagement of a potent U.S. military force in southern Turkey, the Middle East and the Persian Gulf. The United States devoted roughly 28,000 troops, 30 naval vessels, 200 military aircraft and other equipment to

Iraqi containment efforts prior to the pre-war buildup. We estimate the economic cost of these military resources to be about $14.5 billion per year. Based on our assessment of the likely duration of a dangerous regime in Iraq, absent external intervention, this annual flow translates into an expected present value of nearly $300 billion. Hence, containment was also a costly option for the United States, even under the favorable assumption that it would be completely effective in achieving its national security goals.

Advocates for forcible regime change in Iraq expressed several concerns about the pre-war containment policy. Some stressed an erosion of political support for the containment policy that threatened to undermine its effectiveness and lead to a much costlier conflict with Iraq in the future. Others stressed the difficulty of compelling Iraqi compliance with a rigorous process of weapons inspections and disarmament, widely seen as a critical element of containment. And others stressed the potential for Iraqi collaboration with international terrorist groups. To evaluate these concerns, we model the possibility that an effective containment policy might require the mounting of costly threats and might lead to a limited war or a full-scale regime-changing war against Iraq at a later date. We also consider the possibility that the survival of a hostile Iraqi regime raises the probability of a major terrorist attack on the United States. We draw on our empirical analysis to assess the potential costs of these contingencies, but their probabilities are especially difficult to assess with confidence.

We show that any one of these contingencies can sharply raise the expected cost of the containment policy. We also develop an integrated analysis that simultaneously captures several possible contingencies under a policy of containment. The integrated analysis focuses on three scenarios chosen to capture a range of views about the

likelihood and cost of the contingencies. Factoring the contingencies into the analysis yields present value costs for the containment policy in the range of roughly $350 to $700 billion. These large sums are in the same ballpark as the likely costs of the Iraq intervention seen from the vantage point of early 2006. Thus, even with the benefit of partial hindsight, it is difficult to gauge whether the Iraq intervention is more costly than containment.

We also consider the consequences of the war-versus containment choice in two other respects: the economic well-being of Iraqis, and the loss of Iraqi lives. Based on our analysis, we conclude that the war will lead to large improvements in the economic well-being of most Iraqis relative to their prospects under the policy of containment. This conclusion follows from some basic observations. First, the Iraqi economy was in terrible condition before the war, and it would have remained in a sorry state under the policy of containment. Second, the regime of Saddam Hussein was an economic failure of tremendous proportions. The available evidence suggests that real income per capita fell by roughly 75 percent as a consequence of Saddam's misrule. In addition, much of Iraq's greatly diminished output was diverted to an oversized military, an apparatus of terror and repression and the relentless glorification of Saddam. Third, the removal of sanctions, the expansion of petroleum exports, large-scale reconstruction aid, and the reintegration of Iraq's economy into the world economy provide a strong basis for economic gains – even in a society with serious institutional weaknesses. If, over the course of a generation, Iraqis recover even half of the economic losses they suffered under Saddam Hussein, then they will be significantly better off in material terms as a consequence of forcible regime change.

The economic failures of the Saddam Hussein regime were not its greatest crimes. The regime brought torture, repression, displacement and death to huge numbers of Iraqis and others. We review some of the evidence in this regard, drawing heavily on work by others. All told, the regime killed or caused the deaths of more than 500,000 Iraqis. Under the policy of containment after the 1991 Gulf War, a reasonable estimate is that at least 200,000 Iraqis died prematurely at the hands of the regime or as a direct consequence of its policies, including its refusal to comply with U.N. Security Council Resolutions and its diversion of oil revenues and other resources to palaces and monuments. Had containment remained in effect, the historical record suggests that premature Iraqi deaths would have continued indefinitely at the rate of 10,000 to 30,000 per year. There is, of course, a great deal of uncertainty about the number of premature Iraqi deaths under either war or containment, but we think the weight of evidence points to a greater Iraqi death toll from a continuation of the pre-war containment policy. Perhaps the strongest reason to question this assessment is the possibility that a post-war Iraq could devolve into an extended and large-scale civil war. This possibility cannot be ruled out. What can be ruled out in light of the evidence is that the leading alternative to war involved little loss of Iraqi lives.

The question of how to deal with "tyrants, rogue states and terrorists who threaten not only their own people but also others" is a profoundly difficult one. The stakes, human and economic, are enormous. The policy options are complex and fraught with uncertainty. And sound decision-making requires a daunting range of inputs and analysis. Yet, precisely because the stakes are so high and the decisions are so difficult, it is essential to systematically evaluate alternatives as an input to decision making and

the formulation of national security policy. Our study is an effort to apply a systematic approach to the evaluation of the two leading policy options on the table prior to the Iraq war.

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Table 1. Annual User Costs of Capital for U.S. Military Equipment

	As a Percent of Capital Value				
A. Estimated Rates of Depreciation, Operating and Maintenance Costs	Army Equip-ment	Marines Equipment	Air Force Aircraft	Navy Aircraft	Navy Ships
(1) Straight-Line Depreciation	4.5	4.4	2.5 – 3.3	3.7	2.8
(2) Normal Rate of O&M Spending in Peacetime Use (Includes Fuel)	1.7	1.7	1.0 – 1.3	1.4	1.1
(3) Extra Depreciation and Maintenance Costs for In-Theater Equipment (Excludes Fuel)	16.9	14.3	0.6 – 0.8	0.5	0.5
(4) Sum of lines (1), (2) and (3)	23.1	20.5	4.0 – 5.4	5.6	4.4
B. Cost of Capital: Containment					
(5) Sum of Depreciation, Maintenance and Operating Costs Applied to the Containment Policy	12.0	12.0	7.0	7.0	5.5
(6) Opportunity Cost of Capital	2.0	2.0	2.0	2.0	2.0
(7) Real User Cost of Capital Applied to the Containment Policy – Sum of lines (5) and (6)	14.0	14.0	9.0	9.0	7.5
C. Additional Capital Cost: War					
(8) Prewar Build-Up and Postwar Redeployment	6.5+	6.5+	6.8+	6.8+	5.6+
(9) Major Combat Phase	22.2+	22.2+	7.3+	7.3+	6.1+
D. Cost of Capital: Occupation					
(10) Postwar Occupation, No Major Insurgency	16.0	16.0	8.0	8.0	7.5
(11) Postwar Occupation, Major Insurgency	24.0	24.0	9.0	9.0	7.5

Source: Authors' calculations based on data in CBO (2000), CBO (2001) and CBO (2005b, Tables 2 to 5).

Notes:

1. Except for Navy ships, straight-line depreciation rates in line (1) are based on equipment lifetimes reported in CBO (2005b). The figures are value-weighted means over different types of equipment. The straight-line depreciation rate for Navy ships is calculated as (8.5/300) based on the annual shipbuilding rate needed to sustain a 300-ship Navy, as reported in CBO (2000).

2. According to CBO (2001, page 5): "[Operations and Maintenance] O&M spending for equipment includes the costs of the parts and fuel used by military units, as well as the costs incurred in maintaining equipment at large centralized maintenance facilities called depots. Parts include what are termed 'consumables,' such as washers, filters, and gaskets, and 'depot-level reparables' (DLRs), such as spare parts, avionics, and engine components. Major overhauls at depots, which are public (DoD) or private (contractor) repair facilities, involve major inspection and repair of weapon systems; the costs for them include both material and civilian labor costs. The cost of military personnel engaged in operating and maintaining the equipment are not included in O&M spending."
3. Data from page 1 and Figure 1 of CBO (2001) indicate that O&M spending on capital goods accounts for 7.4% of defense expenditures, which amounts to 39% of procurement spending. Applying the steady-state assumption yields an O&M spending rate equal to 39% of straight-line depreciation costs. Assuming that the ratio of O&M spending on capital goods to straight-line depreciation costs is the same for all types of military equipment yields the entries in line 2.
4. The extra rate of depreciation and maintenance in line (3) is calculated as the "increase in annual depreciation" for in-theater equipment divided by the value of the equipment, as reported in CBO (2005b). These estimates are based on U.S. experience in Iraq, Kuwait and Afghanistan in recent years. For Army and Marines equipment, the extra rate of depreciation includes an annual two percent loss rate for in-theater equipment. For Navy ships, we assume that the extra rate of annual depreciation and maintenance costs amount to 0.5% of the capital value. Depreciation rates for Army and Marines equipment are much higher in theater, because the equipment is used much more intensively. For example, miles per truck in theater are ten times as high as in peacetime use. Note that line (3) does not capture extra fuel costs due to a higher operations tempo for in-theater military equipment.
5. Line (5) reports our figure for the sum of depreciation, maintenance and operating costs for the military equipment devoted to containment. For Army and Marines equipment (mostly ground equipment), we use a much lower figure than line (3), because the operating tempo of ground equipment under containment is lower than the one reflected in lines (3) and (4).
6. The opportunity cost of capital in line (6) reflects a real interest rate on government debt of two percent. See Section 4.1 in the text.
7. Lines (8) and (9) report additional user costs of capital that we apply to military equipment deployed in an Iraq war over and above the costs for operations support projected by the CBO (2002). That is, the entries in lines (8) and (9) are not intended to capture the full user cost of capital in an Iraq war. Rather, they capture the portion that, in our judgment (based principally on other CBO sources), is missing from the prewar projections in CBO (2002).
8. For Army and Marines (ground) equipment, line (8) is the sum of straight-line depreciation in line (1) and the opportunity cost of capital in line (6). For aircraft and ships, we also add the normal rate of O&M spending in line (2) less 0.3 percent for fuel usage during peacetime operations.

9. For Army and Marines (ground) equipment, line (9) is a weighted average of the Army and Marines entries in line (4), less 0.3 percentage points for fuel usage during peacetime operations. We weight the Army entry three times as heavily as the Marines entry. For aircraft and ships, line (9) is the sum of lines (4) and (6), less 0.3 percentage points for fuel usage during peacetime operations.
10. The real user cost of capital in lines (10) and (11) are educated guesses based on adjustments to line (4) for fuel consumption and operations tempo. These figures include two percentage points for the opportunity cost of capital.

Table 2. Annual Costs of U.S. Military Resources Devoted to Containment, Summary of Calculations

A. Summary of Cost Calculations – Method 1			
	Ground Equipment	Aircraft	Naval Vessels
Capital Value (Billions of 2003 Dollars)	1.5	16.2	40.4
Real User Cost of Capital in Percent Per Year From Table 1, Line (8)	14.0	9.0	7.5
Annual Capital Costs (Billions)	0.21	1.46	3.03
Number of Military Personnel in Theater		28,164	
Annual Cost Per Person (Thousands of 2003 $)		226	
Annual Labor Costs (Billions of 2003 $)		6.37	
Annual Cost of Expended Munitions (Billions of 2003 $)		0.2	
Capital, Labor and Munitions Costs (Billions of 2003 $)		11.26	

B. Summary of Cost Calculations – Method 2			
	Number of Personnel In Theater	All-in Costs Per Person-Year (2003 $)	Total Costs (Billions of 2003 $)
Navy (30 ships)	16,117	620,463	10.00
Air Force	8,457	734,893	6.21
Army	3,590	443,846	1.59
All Forces			17.81

C. Annual Containment Cost Figures Used in Policy Comparison	
Baseline case – average of Method 1 and Method 2 cost	14.54
Higher costs, to account for extra forces – one-third higher than baseline case	19.38
Lower costs, to account for dual-use nature of deployment – one-third lower than baseline case	9.69

Source: CBO (2000, 2002) and authors' calculations using data, estimates and assumptions described in the text and Table 1.

Table 3. Incremental Budgetary Costs under Alternative Deployment Options for Extra Troops in Iraq

Deployment Option	Extra Forces for Use in Iraq	Incremental Budgetary Costs (Billions of 2004 $)	
		Upfront	Annual
(a) Create two new Army divisions	18,000 – 23,000 (after 3-5 years)	18.0 – 19.4	9.5 – 10.1
(b) Eliminate rapid reaction requirement and (c) use Army National Guard units	18,000 – 23,000	N.A.	3.6 – 4.2
(d) Withdraw forces from the Sinai Peninsula, Bosnia, Kosovo, and Okinawa	9,000 – 11,000	"… could have significant diplomatic and political consequences,…[but] this action would probably not result in substantial incremental costs, because the savings that would accrue from withdrawing forces from those other commitments would largely offset the costs of sustaining additional forces in Iraq."	

Source: "An Analysis of the U.S. Military's Ability to Sustain an Occupation of Iraq," United States Congressional Budget Office, September 2003.

Table 4: Summary of Projected Military Force Requirements for War in Iraq, Major Combat Phase, Two CBO Scenarios

	Heavy Ground Option	*Heavy Air Option*
	Personnel in Theater, Thousands	
Army	213	93
Marines	45	25
Navy	63	63
Air Force	34	60
Special Ops	12	12
Total Personnel	367	253
	Heavy Ground Equipment	
Tanks	800	300
	Naval Forces	
Carrier Battle Groups	5	5
Amphibious Ready Groups	1	1
Surface Action Groups	1	1
Total Navy Battle Force Ships	60	60
	Aircraft	
Attack and Transport Helicopters	800	500
Marine Air Wings	1	1
Navy Carrier Air Wings	5	5
Air Force Fighter Wings	5 1/3 wings 384 combat planes	10 wings 720 combat planes
Air Force Bombers	72	72
Total Aircraft	1,500	2,500

Source: "Estimated Costs of a Potential Conflict with Iraq," United States Congressional Budget Office, September 2002.

Notes:

1. According to CBO (2002), each Air Force tactical fighter wing "represents a force with sufficient aircraft to ensure that 72 combat planes can be sustained and supported." CBO (2002) does not report exact figures for the number of combat aircraft in Marine Air Wings and Navy Carrier Air Wings.
2. It is unclear whether helicopters are included in the CBO figures for "total aircraft." Moseley (2003) reports that 1,666 U.S. aircraft (excluding helicopters) actually participated in Operation Iraqi Freedom, including some aircraft that supported operations but did not deploy into theater. The 1,666 figure includes 655 fighters and 51 air force bombers.

Table 5. Estimated Capital Values of Deployed Military Equipment During War in Iraq, Two CBO Scenarios, Billions of 2003 Dollars

	Ground Equipment, Including Helicopters	Aircraft	Naval Vessels	All Equipment
Heavy Ground Option	72.3	109.6	80.8	262.7
Heavy Air Option	27.9	182.6	80.8	291.4

Source: Authors' calculations based on data in CBO (2000, 2002, 2005b).

Notes:

1. Capital values for Aircraft and Naval Vessels are estimated by applying the method described in Section 2.1.2 of the text to the force requirements listed in Table 4. For this purpose, we assume that the figure for "Total Aircraft" reported in Table 4 is exclusive of helicopters.
2. Capital values for All Equipment are based on the recent experience of U.S. ground troops. According to Table 2 in CBO (2005b), Army equipment use in theater in Afghanistan, Kuwait and Iraq during 2005 has a capital value of 31.34 billion 2005 dollars for 100,000 to 150,000 troops. Using the midpoint value for number of troops and deflating by 5 percent to express in 2003 dollars yields $238,781 for the value of "Ground Equipment, Including Helicopters" per Army personnel in theater. Similar calculations using data in Table 3 of CBO (2005b) yield $154,286 per Marines personnel. (In computing this figure, we exclude the value of fighters and tanker aircraft operated by the Marines, because they are included under "Aircraft.") We multiply the per person equipment values by the corresponding number of Army and Marines personnel listed in Table 4 to obtain the capital value of "Ground Equipment, Including Helicopters." For Special Operations personnel, we use the per-person equipment value for Marines.

Table 6: Estimated Costs of a Projected War in Iraq in Billions of 2003 Dollars: Initial Deployment, Major Combat Phase, and Redeployment

A. Heavy Ground Option: Costs by Type and Phase of Engagement				
	Initial Deployment (Three Months)	First Month of Combat	Each Additional Month Of Combat	Redeployment (Three Months)
Personnel and Personnel Support	7.7	2.5	2.5	7.7
Operations Support, Including Munitions	5.4	7.1	5.4	1.5
Transport to and from Theater	2.8	0.7	0.7	1.5
Additional Capital Costs	4.2	2.4	2.4	2.9
Sum	20.1	12.8	11.1	13.6
B. Heavy Air Option: Costs by Type and Phase of Engagement				
	Deployment (Three Months)	First Month of Combat	Each Additional Month Of Combat	Redeployment (Three Months)
Personnel and Personnel Support	5.3	1.8	1.8	5.3
Operations Support, Including Munitions	4.2	6.2	4.7	1.1
Transport to and from Theater	1.9	0.5	0.5	1.0
Additional Capital Costs	4.7	2.0	2.0	2.6
Sum	16.1	10.5	9.0	10.0
C. Undiscounted Total Costs of Initial Deployment, War and Redeployment				
		From Panels A and B	CBO (2002) Projections	Ratio of A and B to CBO (2002)
Heavy Ground Option	Two Months	57.5	36.3	1.58
	Three Months	68.6	43.6	1.57
	Four Months	79.6	50.9	1.56
Heavy Air Option	Two Months	45.6	27.3	1.67
	Three Months	54.6	33.4	1.63
	Four Months	63.6	39.5	1.61

Sources: CBO (2002) and authors' calculations.

Notes:

1. For "Personnel and Personnel Support", we adjust the corresponding entries in Tables 3 and 4 of CBO (2002) by adding an estimate for the basic pay of active-duty military personnel. The adjustment equals the number of projected active-duty military personnel in CBO (2002, Table 2) multiplied by $51,223/12 per month. See footnote 8 in the text for our derivation of the average basic pay figure per full-time equivalent military personnel.
2. According to CBO (2002, Tables 3 and 4), "Operations Support" includes "all incremental costs related to the operation and maintenance of air, land, and sea forces involved in the Persian Gulf. It includes costs associated with the incremental increase in flying hours and steaming days, such as costs for increased fuel consumption and repair parts. Operations support also include the costs of equipping and maintaining ground troops and purchasing equipment, as well as costs associated with command, control, communications, and intelligence. In addition, the category covers force reconstitution, which includes the replacement of munitions stocks and repair or replacement of damaged equipment, and the incremental cost of increased depot maintenance for items such as aircraft, tanks, and ships."
3. "Additional Capital Costs" are computed by applying the entries in lines (8) and (9) of Table 1 to the Capital Value estimates in Table 5. We assume that all equipment is engaged for three months during the deployment phase, that naval vessels and ground equipment are engaged for three months during the redeployment phase, and that aircraft are engaged for one month during the redeployment phase.

Table 7: Estimated Costs of a Projected War in Iraq in Billions of 2003 Dollars: Postwar Occupation, Casualties, Reconstruction and Humanitarian Assistance

A. Postwar Occupation Costs – Method 1	Operations Tempo	2003 $, Billions	Time Frame
Per 100,000 Ground Troops in Theater, Including Capital Costs on Ground Equipment	Low	26.4	Annual
	High	29.3	Annual
Naval Forces, one-fifth of force level during major combat phase (12 ships, 6,276 personnel)	Low	2.6	Annual
	High	2.6	Annual
Air Forces, one-fifth of force level under Heavy Ground Option (300 aircraft, 12,686 personnel)	Low	4.8	Annual
	High	5.4	Annual
Total occupation costs for ground troops, naval forces and air forces (118,962 armed forces)	Low	33.9	Annual
	High	37.3	Annual
Occupation costs per 100,000 armed forces in theater	Low	28.5	Annual
	High	31.4	Annual
B. Postwar Occupation Costs – Method 2			
Occupation costs per 100,000 armed forces in theater	NA	48.4	Annual
C. Reconstruction Aid and Humanitarian Assistance	2003 $, Billions	Time Frame	
Humanitarian Assistance	1 – 10	Over 2 – 4 years	
Reconstruction Aid Per HBC (2002)	9.2 – 18.4	Over 10 years	
Reconstruction Aid Per HBC (2003)	28.3 – 73.3	Over 10 years	
D. Cost of U.S. Casualties	2003 $, Billions		
Per 1,000 U.S. Fatalities	6.9		
Per 7,153 U.S. Injuries	9.0		

Sources: HBC (2002, 2003), Nordhaus (2002), Viscusi and Aldy (2003), Wallsten and Kosec (2005) and authors' calculations.

Notes:

1. Panel A: Postwar occupation costs for Ground Troops in Theater are the sum of labor costs per person from Table 2 Panel A ($226,000 per person year) plus capital costs. Drawing on Table 5, we use a capital value of $238,781 per person for ground equipment. We apply a user cost of capital of 16 percent per year from Table 1 line (11) at a low operations tempo and 24 percent at a high operations tempo. In the high op-tempo case, we add another $10,000 per person year for munitions.
2. Panel A: Postwar occupation costs for Naval Forces are the sum of capital costs for naval vessels and labor costs for naval personnel. Applying the same figure for capital value per ship as in Table 2 and a user cost of capital of 7.5 percent per year yields annual capital costs of $1.2 billion. Appling the same ratio of naval personnel to naval vessels as in Section 2.1 for the containment policy, and using

a figure $226,000 per year for personnel yields annual labor costs of $1.4 billion. Summing the capital and labor costs yields $2.6 billion.

3. Panel A: Postwar occupation costs for Air Forces are the sum of capital costs for fixed-wing aircraft and labor costs for Air Force personnel. Applying the same figure for capital value per aircraft as in Table 2 and the user cost figures for aircraft from lines (10) and (11) of Table 1 yields annual capital costs of $1.9 – 2.2 billion, depending on operations tempo. Applying the same ratio of Air Force personnel to fixed-wing aircraft as in Section 2.1 for the containment policy, and using a figure $226,000 per year for personnel yields annual labor costs of $2.9 billion. We sum the capital and labor costs to derive the figures reported in the table, adding another $300 million for munitions under a high operations tempo.
4. Panel A: "Occupation costs per 100,000 armed forces in theater" are calculated as "Total occupation costs" divided by 118,962 armed forces.
5. Panel B: "Occupation costs per 100,000 armed forces in theater" are calculated using the All-in Costs per Person-Year for Army, Navy and Air Force personnel reported in Panel B of Table 2. The force composition (ground troops, naval personnel, air force personnel) is the same as in Panel A.
6. Panel C: The projected cost range for Humanitarian Assistance is from Nordhaus (2002, page 67), and the projected cost ranges for Reconstruction Aid are from U.S. House Budget Committee (2002, page 22) and (2003, page 2).
7. Panel D: The figure of $6.9 million per fatality is the midpoint value of a statistical life in the studies reviewed by Viscusi and Aldy (2003), as reported in Wallsten and Kosec (2005) and adjusted to 2003 dollars. Based on experience through August 25, 2005 for U.S. military personnel and contractors, the Iraq engagement has involved 7.153 injuries per fatality. Wallsten and Kosec classify these injuries by severity into several categories and assign welfare costs based on estimates of the willingness to pay to avoid injury. They add lifetime medical costs for injury treatment to obtain the economic cost of injuries, discounting future medical costs at 5 percent annual rate.

Table 8: Alternative Scenarios for a Projected War in Iraq

Scenarios, Ordered by Costliness	Length of Major Combat Phase	Size of Occupation Force, Duration, and Operations Tempo	U.S. Fatalities		Undiscounted Cost of Humanitarian Assistance	Undiscounted Cost of Reconstruction Aid
			Major Combat	Occupation		
(1) Short war, occupation of two and one-third years, little post-war conflict	2 months	100,000 troops initially, declining linearly to zero in January 2006, low op tempo	500	500	$1 billion over 2 years	$9.2 billion over 5 years
(2) Short war, three-year occupation, greater post-war conflict	2 months	150,000 troops initially, declining linearly to zero in September 2006, high op tempo through December 2004	500	1,000	$2 billion over 3 years	$12 billion over 5 years
(3) Medium war, three-year occupation, small insurgency	3 months	150,000 troops initially, declining linearly to zero in October 2006, high op tempo through September 2005	800	2000	$4 billion over 3 years	$15 billion over 5 years
(4) Medium war, five-year occupation, larger insurgency; two reconstruction cost levels	3 months	200,000 troops initially, then declining linearly to zero in October 2008, high op tempo through September 2006	1,000	3,000	$6 billion over 4 years	(a) $30 billion over 7 years (b) $50 billon over 10 years
(5) Same as (4) except for bigger occupation force and more casualties; two reconstruction cost levels	3 months	200,000 troops through October 2006, then declining linearly to zero in October 2008, high op tempo through September 2006	1,000	4,000	$6 billion over 4 years	(a) $40 billion over 7 years (b) $75 billon over 10 years
(6) Longer war, ten-year occupation, major insurgency	4 months	200,000 troops for four years, then declining linearly to zero in November 2013, high op tempo	2,000	5,000	$10 billion over 4 years	$50 billion over 10 years
(7) Same as (6) but regime change fails and containment resumes in 2014 at baseline cost level in Table 2, Panel C.						

Common assumptions for Table 8 scenarios:

1. Initial deployment commences in December 2002, major combat commences in March 2002, and redeployment concludes three months after the end of major combat.
2. Costs of initial deployment, major combat and redeployment of forces engaged in major combat as specified in Table 6.
3. Occupation force levels and costs commence immediately following redeployment phase. For example, if the major combat phase lasts two months, then post-war occupation costs commence in August 2003.
4. Fixed ratio of ground troops to Navy and Air Force personnel during occupation phase, as specified in Panel A of Table 7.
5. Occupation costs as specified in Panel A of Table 7.
6. Fatalities occur at a constant rate during the major combat phase, and they occur at a rate proportional to the number of troops in theater during the occupation phase.
7. Cost of fatalities and injuries as specified in Panel D of Table 7, with a fixed ratio of 7.153 injuries per fatality.
8. Humanitarian assistance and reconstruction aid dispensed at a constant level over the indicated time frame.

Table 9: Present Value Cost of Military Resources Required for Continued Containment, as of 2003

Containment Scenario	Annual Cost Based on Average of Method 1 and 2	*Present Value Cost, Billions of 2003 Dollars*			
		Exponential Discounting, Annual Discount Rate			Gamma discounting with $\mu = .04$ and $\sigma = .03$
		.02	.04	.06	
Baseline Case	14.54	297	216	171	247
Extra forces and higher costs	19.38	395	288	228	329
Dual-use deployment and lower costs	9.69	198	144	114	164

Source: Authors' calculations and sources listed in Table 2.

Notes:

1. Annual costs are computed as the average of the Method 1 and Method 2 cost calculations summarized in Table 2. Relying on Method 1 only yields annual and present value cost figures that are 22.5 percent smaller.
2. The present value cost of containment is calculated according to equation (1) with $\lambda = .03$ and exponential or gamma discounting, as indicated. λ is the annual hazard rate of spontaneous transition from a dangerous to a benign regime in Iraq.
3. Under exponential discounting, $R(i) = (1+r)^{-i}$ for $i = 0, 1, 2, \ldots$. Under gamma discounting, $R(i) = \left[1 + i\sigma^2 / \mu\right]^{-z}$, where $z = (\mu / \sigma)^2$. The gamma discounting parameters are drawn from Weitzman (2001). The implied effective discount rate is 4 percent per year initially and declines for more distant years.
4. The impact of expected regime duration can be read from Table 8 by recognizing that, to a close approximation, the present value cost of containment under exponential discounting depends on the sum of the hazard rate and the discount rate. For example, the present value cost of containment at a hazard rate of .03 and a discount rate of .04 is nearly the same as the present value cost at a hazard rate of .05 and a discount rate of .02.

Table 10: Present Value Cost of War in Iraq as of 2003, Alternative Scenarios

	Present Value Cost at 2% Annual Discount Rate, Billions of 2003 Dollars				
Scenario	Total	Initial Deployment, Major Combat, Redeployment	Military Resources Engaged in Occupation	U.S. Fatalities And Injuries	Reconstruction Aid And Humanitarian Assistance
1	106	45.4	34.6	15.8	9.8
2	152	45.4	70.2	23.3	13.5
3	187	54.3	71.4	43.3	18.3
4(a)	302	54.3	152.6	61.2	34.1
4(b)	320	54.3	152.6	61.2	51.6
5(a)	414	54.3	239.7	75.9	43.5
5(b)	445	54.3	239.7	75.9	74.5
6	633	63.3	409.5	105.0	55.5
7	872	63.3	409.5	105.0	55.5
	Present Value Cost at a 6% Annual Discount Rate, Billions of 2003 Dollars				
Scenario	Total	Initial Deployment, Major Combat, Redeployment	Military Resources Engaged in Occupation	U.S. Fatalities And Injuries	Reconstruction Aid And Humanitarian Assistance
1	103	45.1	32.9	15.8	9.2
2	146	45.1	66.2	22.3	12.6
3	179	53.9	67.0	41.3	17.2
4(a)	284	53.9	140.0	57.2	30.9
4(b)	296	53.9	140.0	57.2	44.5
5(a)	380	53.9	216.7	69.9	39.3
5(b)	404	53.9	216.7	69.9	64.0
6	552	62.6	347.4	93.5	48.2
7	642	62.6	347.4	93.5	48.2

Source: Authors' calculations.

Notes:

1. See Table 8 for scenario descriptions and assumptions.
2. The table shows present value costs for the Heavy Air Option. The present value costs of Initial Deployment, Major Combat and Redeployment are about $11 billion to $16 billion higher for the Heavy Ground Option.
3. Present value calculations use a monthly time unit and exponential discounting.

Table 11: Present Value Cost of Containment Allowing for Costly Credible Threats, Terrorist Attacks and Future Wars, Billions of 2003 Dollars

Contingencies		No Con-tingencies	Optimistic Scenario	Middle Scenario	Pessimistic Scenario
Costly Credible Threats	Annual probability of mounting threat	0	.05	.10	.15
	Cost of mounting threat	--	13.05	26.1	26.1
Limited Wars	Annual probability of fighting limited war	0	.03	.03	.05
	Cost of fighting	--	53.3	53.3	53.3
Terrorist Attacks	Annual probability, relative to case with a peaceful Iraqi regime	0	0	.02	.05
	Economic cost of attack	--	--	100	250
Regime-Changing War	Probability of war in next ten years	0	.05	.10	.15
	Cost, multiple of costs for war scenario 5(a)	--	1	1.5	2
Present Value Cost of Containment					
Baseline, $14.54 billion per year plus contingencies at a 2% discount rate		297	346	441	705
Lower costs of $9.69 billion per year plus contingencies at 2% discount rate		198	251	351	620
$14.54 billion per year plus contingencies at a 6% discount rate		171	205	269	437
$9.69 billion per year plus contingencies at 6% discount rate		114	150	216	386

Source: Authors' calculations

Note: The present value calculations are carried out using an expanded version of equation (5) in the text with $\lambda = .03$. Regime change, whether peaceful or forcible, eliminates the possibility of additional threats or wars and reduces the (relative) probability of terrorist attacks to zero.

Table 12: Impact of War on Iraqi Economic Welfare, Baseline Model

Scenario Description	War Cost, Years of GDP	*g,* Long term output growth rate	*M,* Catch Up As Multiple Of Initial GDP	λ, Annual Probability Of Peaceful Regime Change	Impact of War on Iraqi Welfare As Percent of Initial Welfare
Baseline Case	0.5	.02	4	.03	49.8
Slow long-run growth	0.5	0	4	.03	62.8
Higher War Cost	1	.02	4	.03	49.0
Less Catch Up After Regime Change	0.5	.02	2	.03	25.1
More Catch Up After Regime Change	0.5	.02	7	.03	65.6
Higher Rate of Peaceful Regime Change	0.5	.02	4	.07	24.5
Lower Rate of Peaceful Regime Change	0.5	.02	4	.02	66.8
Highly Unfavorable Case for War	1	.02	2	.07	12.2
Highly Favorable Case for War	0.25	.02	7	.02	91.5

Note: All calculations use exponential discounting with an annual discount rate of $r = .05$ on future income. The effective discount rate under containment, inclusive of the regime change probability, is $r + \lambda$.

Table 13: Impact of War on Iraqi Economic Welfare, Model with Foregone Growth

Scenario Description	War Cost, Years of GDP	*M,* Catch Up As Multiple Of Initial GDP	λ, Annual Probability Of Peaceful Regime Change	Impact of War on Iraqi Welfare As Percent of Initial Welfare
Baseline Case	0.5	4	.03	100.7
Higher War Cost	1	4	.03	99.8
Less Catch Up After Regime Change	0.5	2	.03	67.3
More Catch Up After Regime Change	0.5	7	.03	122.3
Higher Rate of Peaceful Regime Change	0.5	4	.07	49.9
Lower Rate of Peaceful Regime Change	0.5	4	.02	134.8
Highly Unfavorable Case for War	1	2	.07	35.0
Highly Favorable Case for War	0.25	7	.02	170.0

Note: All calculations use a long term growth rate after regime change of $g = .02,$ a long term growth rate prior to regime change of $g^S = 0,$ and an annual discount rate on future income flows of $r = .05..$ The effective discount rate under containment, inclusive of the regime change probability, is $r + \lambda.$

Figure 1: Present Value Cost of War Compared to Containment with Costly Credible Threats, Billions of 2003 Dollars

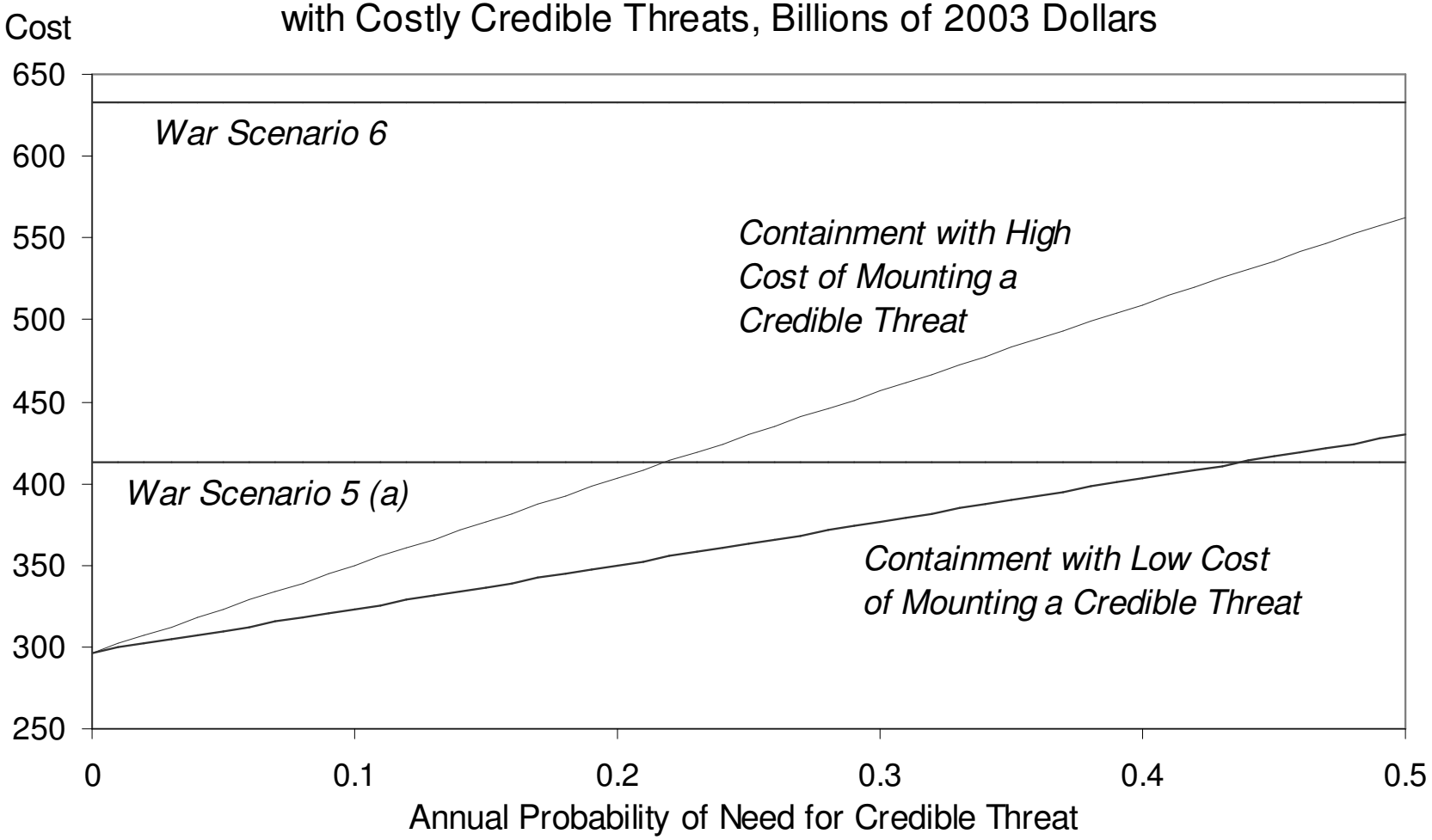

Figure 2: Present Value Cost of War Compared to Containment with Possibility of a Limited War, Billions of 2003 Dollars

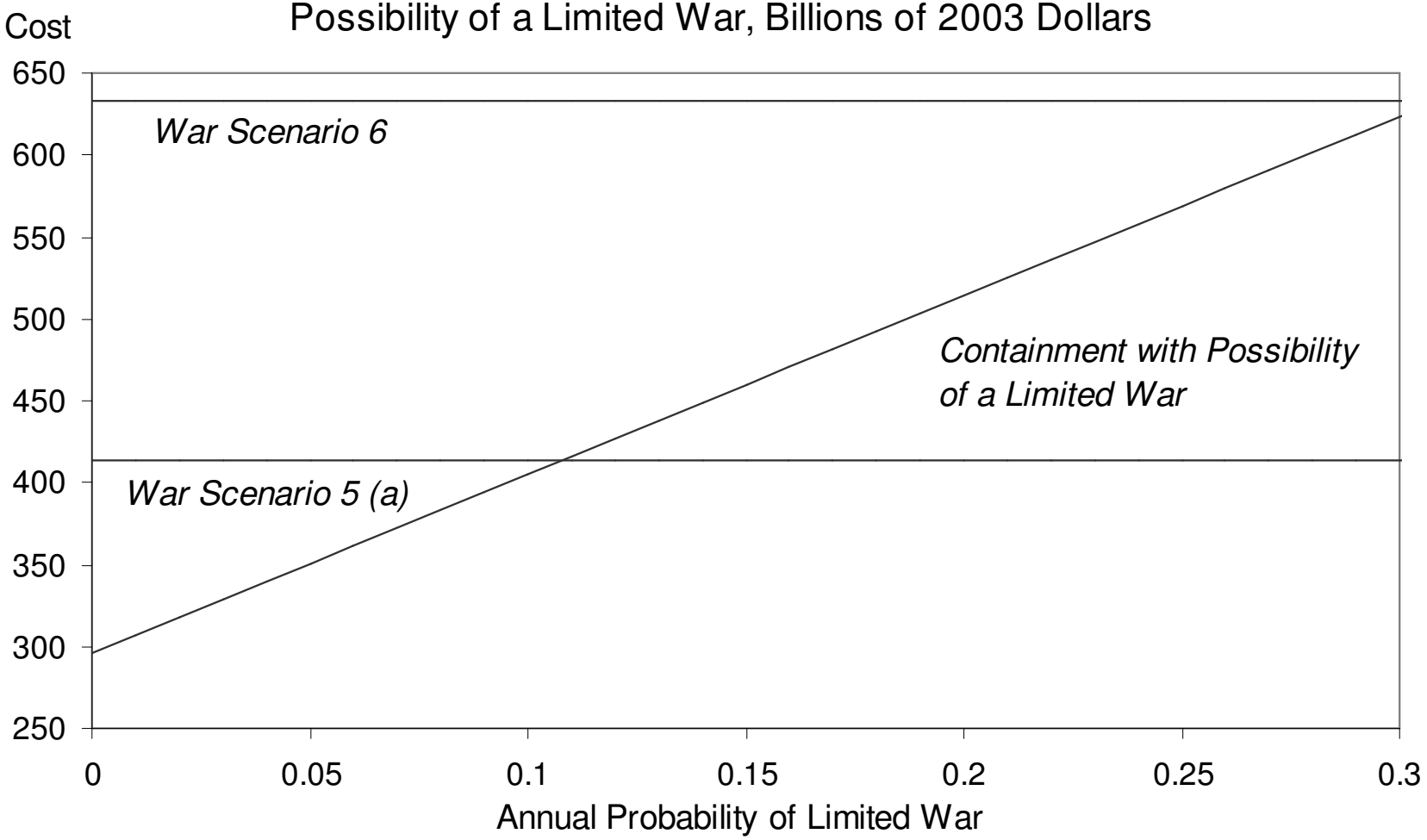

Figure 3: Present Value Cost of Immediate War Compared to Containment With Possibility of a Future War, Billions of 2003 Dollars