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The Economic Costs of the War in Iraq

Scott Wallsten and Katrina Kosec^{*}

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^{*} Scott Wallsten is a Resident Scholar at the American Enterprise Institute and a Senior Fellow at the AEI-Brookings Joint Center for Regulatory Studies. Katrina Kosec is a Research Associate at the AEI-Brookings Joint Center. Contact author: Scott Wallsten, email: swallsten@aei.org. We thank Ted Gayer, Robert Hahn, Roger Noll, and Gregory Rosston for extremely useful comments, and Joel Wertheimer for excellent research assistance. The authors retain sole responsibility for any errors.



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Executive Summary

Government policies are routinely subjected to rigorous cost analyses. Yet one of today's most controversial and expensive policies—the ongoing war in Iraq—has not been. The \$212 billion allocated by the U.S. Treasury has been widely reported. But the real, direct economic costs include more than budgetary allocations. Other costs include lives lost, injuries, and lost civilian productivity of National Guard and Reserve troops mobilized for the conflict. The conflict, however, also has generated cost savings, especially in terms of resources no longer being used to enforce UN sanctions and people no longer being killed by Saddam Hussein's regime.

In this paper we monetize these direct costs and avoided costs of the war in Iraq, both to-date and the total expected net present value of costs through 2015. Our estimates are imprecise. The data are not of high quality and every calculation requires a number of assumptions. In addition, we do not calculate indirect effects of the conflict, such as its impact on oil prices or other macroeconomic impacts, or certain intangibles, like the benefits of a stable democratically elected government in Iraq, should one emerge. Nonetheless, our best estimates suggests that the direct economic costs to the U.S. through August 2005 are about \$255 billion, about \$40 billion to coalition partners, and \$134 billion to Iraq. These estimates suggest a global cost to date of about \$428 billion. The avoided costs, meanwhile, are about \$116 billion. We estimate that the expected total net present value of the direct costs through 2015 could be \$604 billion to the U.S., \$95 billion to coalition partners, and \$306 billion to Iraq, suggesting a global total expected net present value of about \$1 trillion. The net present value of total avoided costs, meanwhile, could be about \$429 billion.

The Economic Costs of the War in Iraq

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1. Introduction

Government policies are routinely subjected to rigorous cost analyses. These analyses are difficult, imprecise given uncertainty about the future, and controversial. Yet they are widely recognized as important tools for deciding how best to allocate society's limited resources. Despite the widespread use of cost-benefit analyses in governmental policy analysis, its tools have not been rigorously applied to one of today's most controversial public policy issues: the U.S. involvement in Iraq. U.S. budgetary allocations are widely reported, but that amount does not reflect the true economic cost of the conflict. This paper takes a small step in correcting this omission by attempting to calculate the direct costs of the conflict.

Several caveats regarding this analysis are in order. First, our estimates are necessarily imprecise. The available data are not of high quality, each calculation requires several assumptions, and the tools of cost benefit analysis are themselves controversial.¹ While we carefully note our sources and explain our assumptions in detail, we recognize that these estimates contain a great deal of error. Second, we estimate only the direct impacts that we can monetize, not indirect macroeconomic impacts.² Third, we do not calculate intangibles, such as benefits of a stable, democratic government in Iraq should one emerge, or the impact of the war on other U.S. interests and international relations. Finally, one of the biggest impacts may be how the war has affected the probability of terrorist attacks. Unfortunately, experts do not agree on whether the war has increased or decreased this probability, let alone by how much.

The implication of these caveats is that our analysis *cannot* determine whether the benefits of the war exceed the costs. The analysis simply applies tools to this problem to begin to assess the war's actual economic costs and, we hope, contribute in some small way to providing an analytical framework for the policy debate.

Recognizing the inherent imprecision, we calculate high, medium, and low estimates for costs and avoided costs, and round to the nearest billion. Table 1 presents our medium estimates

¹ See Hahn (2005) for a discussion on this controversy and arguments supporting the uses of cost-benefit analysis.

² These effects can be large. Hassett (2005) noted that bad news about Iraq could depress the economy even in the face of positive economic reports.

while Figure 1 shows the full range of estimates. Table 2 presents the estimate ranges in detail. Using our medium estimates, we conclude that the direct measured economic cost to the U.S. from March 2003 through August 2005, including incremental military and other government resources allocated to Iraq, the opportunity cost of National Guard troops' lost civilian productivity, lives lost, the costs of treating wounded soldiers and other costs of their injuries to be \$255 billion. The conflict has cost coalition partners an additional \$40 billion. Costs to Iraq itself are more difficult to calculate. Still, under assumptions described below, we estimate that the costs to Iraq are about \$134 billion. Thus, the gross global direct costs of the conflict to date appear to be \$428 billion.

Table 1
Costs of the War in Iraq
Billions of 2005 dollars
(medium estimate)

	Mar 2003 - Aug 2005	Sept 2005 - Dec 2015	Total March 2003 - 2015
Costs			
United States	255	349	603
Non-U.S. Coalition	40	55	95
Iraq	134	173	306
TOTAL	428	576	1005
Avoided Costs			
United States	32	85	117
Iraq	85	228	313
TOTAL	116	313	429

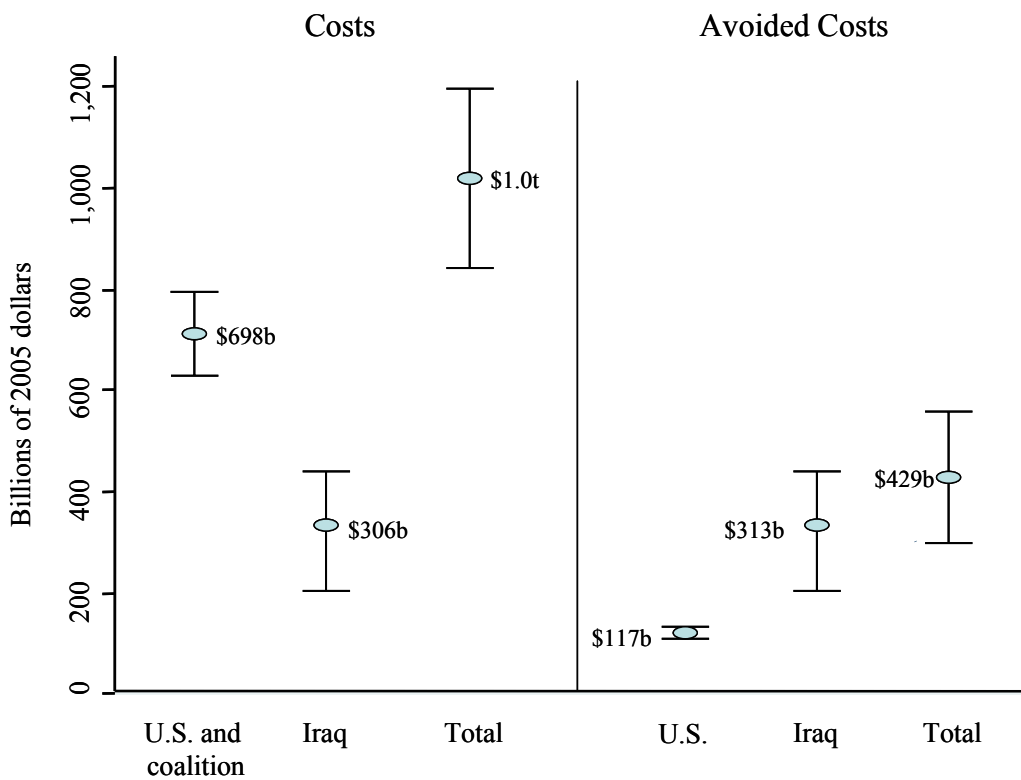
Because the conflict is not over, it is useful to estimate the total expected net present value of the conflict into the future. Using projections from the Congressional Budget Office regarding budget allocation and troops deployed in Iraq, we estimate the net present value of the conflict from 2003 through 2015 to be \$603 billion to the U.S., \$95 billion to coalition partners, and \$306 billion to Iraq, for a total expected net present value of \$1 trillion (with the estimate ranging from a low of \$820 billion to a high of \$1.2 trillion).

The main avoided costs of the war include no longer enforcing U.N. sanctions such as the “no-fly zone” in northern and southern Iraq and people no longer being murdered by Saddam

Hussein’s regime. We estimate the value of the first to be \$32 billion and the second \$85 billion to date. The net present value of these avoided costs through 2015 could be \$429 billion.

Another possible impact of the conflict is a change in the probability of future major terrorist attacks. Unfortunately, experts do not agree on whether the war has increased or decreased this probability. Clearly, whether the direct benefits of the war exceed the costs ultimately relies at least in part on the answer to that question.

Figure 1
Estimated Costs of the War in Iraq, 2003–2015



Lines show estimated range; circle indicates medium estimate.

**Table 2
Costs of War in Iraq
Billions of 2005 Dollars**

COSTS			
	Low	Mid	High
March 2003 - August 2005			
United States			
Military and other real government expenditures	212	212	212
Fatalities	9	14	19
Injuries	9	18	27
Lost wages of reserves	10	10	10
Total U.S.	240	255	269
Non-US Coalition Countries			
Military and other real government expenditures	36	36	36
Fatalities	1	1	2
Injuries	1	2	3
Total non-U.S. coalition countries	38	40	41
Iraq			
Damaged infrastructure	20	20	20
Fatalities	65	106	147
Injuries	5	8	11
Total Iraq	90	134	178
Total direct costs March 2003 - August 2005	368	428	488
September 2005 - December 2015			
United States			
Military and other real government expenditures	272	295	322
Fatalities	15	24	33
Injuries	13	29	47
Total U.S.	300	349	402
Non-US Coalition Countries			
Military and other real government expenditures	46	50	55
Fatalities	1	2	3
Injuries	1	3	4
Total non-U.S. coalition countries	49	55	62
Iraq			
Fatalities	81	131	182
Injuries	22	41	65
Total Iraq	103	173	246
Total expected NPV future costs 2005 - 2015	452	576	711
March 2003 - December 2015			
United States	540	603	672
Non-US Coalition Countries	87	95	103
Iraq	192	306	424
TOTAL EXPECTED NET PRESENT VALUE	820	1005	1199
BENEFITS (Avoided costs)			
	Low	Mid	High
March 2003 - August 2005			
Avoided containment costs (United States)	32	32	32
Avoided murders by Saddam Hussein (Iraq)	52	85	117
TOTAL avoided costs	84	116	149
September 2005 - December 2015			
Avoided containment costs (United States)	78	85	93
Avoided murders by Saddam Hussein (Iraq)	140	228	316
TOTAL expected costs avoided	219	313	409
March 2003 - December 2015			
United States	110	117	125
Iraq	192	313	433
TOTAL EXPECTED COSTS AVOIDED	302	429	558

*Note: low implies lowest estimate lifetime cost of care for injuries, a 7% discount rate, and a U.S. VSL of \$4 million in 2000 dollars.
mid implies midpoint of estimates of lifetime cost of care for injuries, a 5% discount rate, and a U.S. VSL of \$6.5 million in 2000 dollars
high implies highest estimates of lifetime cost of care for injuries, a 3% discount rate, and a U.S. VSL of \$9 million in 2000 dollars.

2. Background

There has been much discussion regarding the costs of the conflict in Iraq. Most of it has focused on budgetary allocations, currently estimated to be \$212 billion.³ The actual direct cost, however, is the opportunity cost of resources used in the conflict that cannot be used elsewhere and the welfare losses of those killed and wounded. This cost to the U.S. includes not only resources used by the government, but also lost productivity of National Guard and Reserve troops (hereafter, “Reserves”) mobilized because of the Iraqi venture not available to do their civilian jobs, the value of lives lost, and injuries. Direct global costs of the conflict also include similar costs by countries other than the U.S., including Iraq.

This paper is not the first to estimate the economic costs of a war in Iraq. Prior to the war several economists conducted prospective cost estimates.⁴ Nordhaus (2002) noted that the costs of wars are typically underestimated *ex ante*. He estimated that the net present value of the cost of prosecuting a war, rebuilding, and the resulting macroeconomic effects could range from \$100 billion to \$1.9 trillion. McKibbin and Stoeckel (2003) model the impacts on the macroeconomy and agree that the costs of a war would exceed the budgetary outlays. Davis, *et al.* (2003) compare the expected costs and benefits of a war to those of continuing the policy of “containment” (e.g., enforcing the no-fly zone in northern and southern Iraq). Assuming a moderate but steady improvement in Iraqi GDP over the following 20 years and taking into account the dramatic contraction in the Iraqi economy under Saddam Hussein, the authors conclude that the expected net benefits of a war would exceed the net benefits of containment and ultimately lead to welfare improvements.

Those papers were all written before the war began. To our knowledge, there has been no similar rigorous analysis of the costs of the war since the war began. We hope to fill that gap. The remainder of the paper explains our methods, data, assumptions, and details our results.

³ This figure includes Iraq-specific appropriations, in 2005 dollars.

⁴ Some government agencies projected fiscal costs. The Congressional Budget Office (2002) projected a cost to the U.S. Treasury of \$9-\$13 billion to deploy troops, \$6-\$9 billion a month for fighting a war, \$1-\$4 billion a month for occupying the country, and \$5-\$7 billion to return the troops to their home bases. The House Budget Democratic Committee Staff (2002) estimated that a war would cost the Treasury \$100 - \$200 billion.

3. Costs to the United States

The total direct economic costs to the U.S. of the conflict in Iraq are comprised of a number of factors. In this section we describe those factors, discuss issues involved in calculating their costs, and then attempt to estimate those costs. In some cases, expenses commonly counted as costs are, in an economic sense just pecuniary transfers, while other factors typically ignored are real economic costs.

Military and government expenditures

The most widely-reported cost of the conflict is the cost to the federal treasury as reflected in incremental budget allocations approved by Congress. These allocations have included funds for moving troops, military hardware, combat pay, reconstruction, training and equipping Iraqi security forces, and support for allies. This amount is expected to be nearly \$213 billion by September 2005.⁵ While all of these expenditures affect the federal budget, some of them are not real costs in the economic sense. Real costs are economic resources not used for other purposes. Transfers are dollars moved from one place to another but do not represent economic resources diverted to, in this case, the Iraqi venture. Transfers do have a real cost—the distortions to the economy caused by raising revenues (taxing or borrowing)—but the transfers themselves are not real economic costs.⁶

Most of the appropriations for Iraq represent real costs. Moving troops, using munitions, reconstruction, training and equipping Iraqi security forces, supporting allies, and replacing and repairing military hardware are real costs. Regular compensation for active-duty soldiers is not a cost of the war as they would be paid regardless of the conflict. Their combat pay, however, is included in the incremental budgetary allocations and is properly considered a cost of the war assuming it reflects troops' risk-adjusted opportunity cost. We are unsure if the best measure of Reservists' opportunity cost is their military pay. Paying the Reserves is costly to the Treasury, but most Reservists probably did not expect to spend so much time in combat zones away from their civilian occupations. As a result, their opportunity cost is probably better represented by

⁵ Cost is in 2005 dollars. This includes Iraq-specific appropriations from April 2003, November 2003, August 2004, and April 2005.

⁶ These costs may be substantial. Feldstein (1999) estimates that the deadweight loss of income taxes could be more than 30 percent of revenue raised.

their lost civilian productivity, not their military pay. From government expenditures, therefore, we subtract Reservists' pay, and in a section below we add back the opportunity cost of using the Reserves based on their civilian wages. Table 3 shows the economic cost of the extra budget appropriations in 2005 dollars to be \$210 billion.

Table 3
U.S. Iraq-specific appropriations
(Billions of dollars)

Date of appropriation	Nominal	2005 Dollars⁷
April 2003	57	59
November 2003	70	73
August 2004 ⁸	22	22
April 2005	59	59
Subtotal	206	213
Less reserve/guard pay	3	3
Total⁹	203	210

National Guard and reserves

Reserves play a crucial role in Iraq. In 2005, about 40 percent of the approximately 140,000 troops on active duty have been from the National Guard or Reserves¹⁰ and an additional 63,000 have been mobilized to replace active-duty troops who are now in Iraq.¹¹ The opportunity cost of using these troops is their productivity lost from the U.S. economy. If we assume that as civilians they are paid their marginal product, then their lost civilian wages reflect the economic cost of their participation in the war. Data from the Department of Defense, U.S. Census, and the Bureau of Labor Statistics allow us to estimate their lost wages. In 2005, the Congressional Budget Office published data gathered from the Department of Defense on the civilian occupations of selected reservists.¹² Combined with data from the Bureau of Labor and

⁷ Real amounts calculated using monthly GDP deflator. See Bureau of Economic Analysis (2005).

⁸ Note: Nominal and real dollar amounts are equal only because of rounding.

⁹ Differences between subtotal and total and individual appropriations are due to rounding error.

¹⁰ The Brookings Institution (2005).

¹¹ Congressional Budget Office (2005).

¹² Congressional Budget Office (2005).

Statistics on average hourly wages and hours worked in each of these occupations, we calculate the average annual salary of the typical reservist from their civilian occupation.

Table 4 shows the share of Reserve troops that work in various industries, the average hourly wages of those industries, and the average number of hours worked each week. These figures suggest that, on average, the Reserve soldiers earn about \$33,000 per year as civilians. As the table shows, these numbers imply that the opportunity cost of using Reserve troops at current levels is \$3.9 billion per year, or \$10.3 billion to date.

Table 4
Reservists' Civilian Occupations and Wages

Industry	Percent reserves in this industry	Average hourly wage, 2003 \$	Average hours worked	Average annual income, 2005 \$	Num reservists employed in these industries¹³
Management, professional, and related	33%	23.33	36.1	44,925	38,324
Sales and office Service	18%	14.41	34.35	26,403	20,904
Production, transport, and materials moving	17%	10.40	31.5	17,475	19,743
Construction	16%	14.78	37.5	29,565	18,581
Farming, forestry, and fishing	15%	18.89	39.6	39,902	17,420
	1%			20,056	1,161
Total				33,465	116,133

Lives lost

The most striking cost of the conflict is the lives lost as a result. Soldiers' deaths and the suffering of their families are reported daily, but have not been included in any analyses of the costs of the war. Monetizing life is understandably controversial—how can a dollar figure reflect the death of a child, spouse, or parent? Indeed, economic analyses do not attempt to value any particular individual's life. Instead, they assess how much individuals are willing to pay to

¹³ Includes both reserve troops stationed in Iraq and reserve troops called to duty to fill the positions of normal active-duty soldiers called to Iraq (reserve troop "backfill"). This is the average number of Reserve and National Guard troops required at any given moment (we took the average over 2003-August 2005).

reduce their risks of death and use that information to calculate a “value of a statistical life” (VSL). In policy analysis these assessments are a crucial tool for evaluating whether benefits outweigh costs and whether society’s limited resources are being deployed in an effective way. Even if analysts try to avoid this sensitive issue by not explicitly monetizing statistical lives, policies will implicitly do so anyway. For example, if a proposed policy is expected to cost \$1 billion and its benefit is to save two lives, then the policy has implicitly valued a statistical life at \$500 million. Policy makers and analysts need some way of deciding whether such a policy would be a good investment. Monetizing statistical lives by measuring how much people actually pay to reduce risks provides a coherent way of making this decision.

The process of estimating these values, however, is fraught with uncertainty and error.¹⁴ Economists use observed responses to risks to estimate how people value their own lives. As discussed above, one can evaluate what people’s actions reveal about how much they are willing to pay to reduce their risks of dying by a small amount. One common way to estimate how much people are willing to pay to mitigate risks is to evaluate the inverse question of how much more must people paid to take riskier jobs. Viscusi and Aldy (2003) review the enormous body of literature on the subject, and find that studies tend to yield values between \$4 million and \$9 million per statistical life in 2000 dollars, though Viscusi (2004) shows that estimated values can vary across industries, occupations, and individual characteristics.¹⁵

In this paper we use this range of VSL estimates from the economics literature.¹⁶ While we calculate a range for all of our estimates, here we present costs based on a VSL of \$6.5

¹⁴ Valuing statistical lives is controversial in other ways, too. For example, should age matter so that the lives of the elderly are valued differently from the lives of younger people (see, e.g., Hahn and Wallsten 2003)? Because individual’s willingness to pay is correlated with ability to pay, do these methods imply that poor people are worth less than rich people (see, e.g., Sunstein 2004)?

¹⁵ Sometimes other methods are used to calculate a value of life. Unlike the economic approach that values statistical lives (VSL), other approaches try to value individual’s lives. Tort law, for example, in most states estimates the net present value of an individual’s lost future income as compensation for wrongful death. As Posner and Sunstein (2004) note, this approach has the advantage of allowing flexible values that can differ across individuals, but has disadvantages including, for example, automatically valuing poor people less than rich people and children less than adults (because they will not begin earning money until far into the discounted future). The authors find that the average wrongful death settlement in 2001 was \$3.1 million and the median \$1.1 million. The lost-wages approach was generally used to compensate survivors of 9/11 victims. Compensation ranged from \$250,000 to \$7.1 million, and the average award was \$2.1 million per family (Posner and Sunstein 2004).

¹⁶ Most American deaths in Iraq are military, which calls into question the use of established VSL from the literature. Data on active-duty soldiers are typically excluded from VSL analyses in part because data collected by the Bureau of Labor Statistics excludes the military and in part because soldiers face atypical nonlinearities in their compensation and job risks. In particular, military service is voluntary, but once someone has volunteered he cannot generally refuse to be sent into combat. In addition, soldiers have a standard compensation schedule but receive additional imminent danger (combat) pay when sent to an area classified as a combat zone. We attempted to derive

million, the midpoint of those estimates. Between March 20, 2003 and August 25, 2005, 1,877 U.S. troops and an additional 97 U.S. contractors were killed in Iraq. We thus find the cost of lives lost, in 2005 dollars, to be \$14 billion.

Wounded

The injured and wounded represent another real cost of the war. The economic cost of these injuries is the net present value of the cost of treatment and future care plus the cost of the injury to the person wounded. None of these costs is easy to estimate.

In a *New York Times* editorial, Bilmes (2005) used disability payments and health care expenditures from the 1991 Gulf War to extrapolate an annual cost for the number of wounded in the current conflict. She then assumed these payments would be required for the next 45 years, concluding that they could ultimately reach \$1.3 trillion. Her approach, while a good start, is problematic. First, disability payments themselves are a budgetary transfer and not a real cost. To the extent that they differ from lost productivity they may over- or under-state the loss to the economy resulting from injured soldiers' inability or reduced ability to work. In addition, they are unlikely to be based on values that individuals themselves place on avoiding injuries. Second, the types of injuries sustained during the first Gulf War may be different from those sustained by troops today. Third, the calculation did not discount future expenditures. One dollar spent 45 years from now is worth much less than one dollar spent today.

We use data from the Defense Department, the Bureau of Labor Statistics, and medical journals to estimate the number of wounded, the types of injuries, and typical costs of treating those injuries. The appendix describes our methodology in detail. The cost of the injuries extends beyond the resources employed for treatment and care. It also includes the welfare loss to the wounded individual. This value, or the value of a statistical injury, can be inferred by measuring what people are actually willing to pay to reduce the risks of certain types of injuries (Viscusi and Aldy 2003).

Using these types of studies, the National Highway Traffic Safety Administration and the Centers for Disease Control Trauma research program has classified injuries by their severity

a rough method for estimating a military VSL based on combat pay and the expected probability of death in a combat zone derived from U.S. experience in Operations Desert Shield, Desert Storm, Restore Hope in Somalia, and Uphold Democracy in Haiti. Our approach yielded a military VSL of \$6.1 million, with a range of \$5.5 million to \$7.5 million, well within ranges established in the existing literature. However, our model of military VSL is not complete, and we leave it to future research to more fully derive and estimate the model.

and calibrated them to value of statistical life.¹⁷ They classify injuries as minor, moderate, serious, severe, critical, and fatal. Relative to the value of a statistical life, these injuries are 0.0020, 0.016, 0.058, 0.19, 0.76, and 1, respectively.¹⁸ We use information from the Department of Defense¹⁹ on the types of injuries sustained by soldiers, information from various medical experts on the severity of injuries,²⁰ estimates from NIH, the Neurotrauma registry, and the National Association of State Head Injury Administrators on the typical costs of rehabilitation and care for such injuries,²¹ and the VSL calibration method discussed above to derive a cost of different types of injuries.

Table 5 presents data on numbers of wounded, types of injuries, average lifetime treatment costs, and statistical value of such injuries. Based on these estimates and assuming that the lifetime cost of care numbers represent their total discounted net present value, we estimate the net present value of caring for those injured to date to be \$6.6 billion. We classify the types of injuries sustained on the scale of minor to severe and calculate the costs of those injuries calibrated to our estimated military VSL, as described above. The total cost of injuries is \$11.5 billion. Using our medium cost of care estimates, we thus estimate that the net present value of total cost of injuries to date is \$18.2 billion.

¹⁷ National Highway Traffic Safety Administration (1994).

¹⁸ Thanks to Bob Hahn for pointing me to Hahn and Tetlock (1999), which employed NHTSA's methodology for estimating costs of injuries, and for thinking through a reasonable way to measure military VSL. These estimates assume that individuals take into account the financial costs that they would bear if suffering from injuries when choosing how much to pay to reduce risks. If individuals had to bear the full cost of treatment and care, then it would be inappropriate to also add in those costs as they should be incorporated into the willingness-to-pay estimates. The studies, however, are generally conducted on data on workers or employed people likely to have health insurance. Those with comprehensive health insurance are unlikely to consider the financial costs of their care when making decisions that affect their risk of injury, making it appropriate to consider those costs separately.

¹⁹ See Mishra (2004).

²⁰ See Woodford (2005), Marchi *et al.* (1999), and Ross *et al.* (1998).

²¹ See NIH (2005), Neurotrauma Registry (2005), and National Association of State Head Injury Administrators (2005)

Table 5
Costs of Injuries, 2003-August 2005

Type of Injuries	Pct of wounded suffering injury	Number suffering this injury	Lifetime treatment costs	Value of Statistical Injury (Millions of 2005 \$)²²	Total cost (Billions of 2005 \$)
Severe head injury	20%	2824	\$600,000 to \$4.3 million	\$3.4	16.0
Amputation	6%	847	\$58,000 to \$158,000	\$0.88	0.9
Injury resulting in inability to return to duty (not including brain injury or amputation)	24%	3389	0	\$0.26	0.9
Injured, but able to return to duty	50%	7060	0	\$0.06	0.4
Total	100%	14,120			18.2

Other costs

In addition to the major economic costs discussed above, the conflict involves a number of other relatively small, but real, costs. These include:

- The cost to military families of additional armor and equipment they purchase and send directly to troops. In October 2004 an amendment included in the FY2005 National Defense Authorization Act authorized the government to reimburse families for “protective, safety, and health equipment” up to the lesser of the amount the family paid or \$1100.
- The costs to employers of finding and training temporary replacements for civilian jobs vacated by Reserves.²³

²² See Appendix for more detail.

²³ The Congressional Budget Office (2005) notes that “hiring a new employee may require significant expenditures for recruiting, administration, and training...” but does not estimate those costs.

Net present value of the cost of the conflict to the U.S.

Aggregating together the cost to date of military operations, lives lost, injuries, and lost civilian production of Guard and Reserve troops, we find that through August 2005, the war has cost the U.S. about \$255 billion.

4. Costs to Other Coalition Countries

While the United States bears a great deal of the costs, the other countries in the coalition also have real costs. We do not have good data on coalition costs. Non-US coalition troops have averaged 17% of U.S. troop levels,²⁴ most of those from the U.K. If we assume that real military costs are proportional to U.S. costs, then non-U.S. military coalition costs have been \$36 billion.

Most of the research that estimates values of statistical lives has focused on U.S. data, complicating our calculation of the cost of these deaths. Studies of VSL in other countries, however, when examined together reveal a positive correlation between national income and the value of a statistical life (Viscusi and Aldy 2003). In a meta-analysis of 49 studies, Viscusi and Aldy (2003) find an elasticity of income with respect to value of life ranging from 0.5 to 0.6. We thus take the midpoint of this estimate (0.55) and per capita income figures from coalition countries to estimate the value of non-American lives lost.

According to the Brookings Institution (2005) and Iraq Coalition Casualty Count (2005), between March 20, 2003 and August 21, 2005, at least 237 non-U.S. coalition troops and non-U.S. coalition civilians died in the conflict.²⁵ With these estimates, we use the U.S. figure of \$6.5 million (2000 dollars) per statistical life, the average income of coalition countries, and Viscusi and Aldy's (2003) elasticity estimates to calculate a value of lost non-U.S. coalition lives. Table 6 shows the data, calculations, and results. The table reveals that under these assumptions, the cost of lost lives to non-U.S. coalition members has been \$1.4 billion.

²⁴ Averaged over May 2003 to August 2005.

²⁵ The Brookings Institution offers a breakdown of these deaths by country.

Table 6
Costs of lives lost in coalition countries

Country	Total killed	2005 nominal GDP (2005 \$)	VSL relative to U.S. (using Viscusi-Aldy elasticity estimate of 0.55)	VSL (Million 2005 \$)	Total VSL loss (Millions 2005 \$)
United Kingdom	124	38098	0.950	6.7	831
Bulgaria	19	3347	0.494	3.5	66
Denmark	2	49182	1.095	7.7	15
El Salvador	2	2410	0.482	3.4	7
Estonia	2	9112	0.570	4.0	8
Hungary	2	10978	0.594	4.2	8
Italy	28	31874	0.868	6.1	172
Kazakhstan	1	3453	0.495	3.5	3
Latvia	1	6559	0.536	3.8	4
Netherlands	3	38320	0.953	6.7	20
Poland	19	8082	0.556	3.9	75
Slovakia	3	9305	0.572	4.0	12
Spain	11	27074	0.805	5.7	63
Thailand	2	2665	0.485	3.4	7
Ukraine	18	1748	0.473	3.3	60
Total					1,351

Non-U.S. coalition troops and civilians have also been wounded. We assume that the types of injuries sustained occur in the same proportion, that the costs of treatment are identical across countries, and that the value of statistical injuries has the same income elasticity as the value of statistical lives across countries (0.55). With that information combined with per capita income for each country, we can calculate the economic costs of injuries. We find that the net present value of injuries to coalition troops and civilians is \$2 billion. Thus, the net present value of costs to-date for non-US coalition countries is \$40 billion.

5. Costs to Iraq

Iraq has obviously been affected more than any other country by the conflict, and calculating the costs to that country involves by far the most uncertainties. Direct costs include

infrastructure destroyed, deaths, and injuries. The available data on all of these costs is questionable, so the calculations presented here must be considered carefully.

Infrastructure destroyed

A thorough tally of destroyed infrastructure is not publicly available, but the World Bank estimated reconstruction costs (O'Hanlon 2005; World Bank 2003). We can use these estimates as proxies for the value of destroyed infrastructure. According to these estimates, infrastructure and agriculture and water resources will require \$27.2 billion between 2004 and 2007.²⁶ The Iraq Relief and Reconstruction Fund from the United States includes about \$7 billion for infrastructure and water resources and is included in the budget allocations discussed above.²⁷ We assign the remaining \$20 billion of damaged infrastructure as a cost to Iraq.

Death and injuries

Few sources provide information on the number of Iraqis who have died. Nonetheless, sources that seem the most reliable suggest that 5,091 Iraqi military and police officers and 23,654 civilians have died since the war began.²⁸ We use the income elasticity of 0.55 from Viscusi and Aldy (2003) and Iraq's pre-war per capita income levels to derive an Iraqi VSL of about \$3.5 million.²⁹ These estimates yield a cost of loss of life to Iraq to be about \$106 billion.

Data on Iraqi injuries are even scarcer than on deaths. We assume that Iraqi troops face the same types of injuries faced by U.S. troops (and in the same proportions), that the costs of treatment in Iraq are proportional to the costs in the U.S. (where the proportion is the ratio of Iraq's pre-war GDP to U.S. GDP), and that the value of statistical injuries has the same income elasticity as the value of statistical lives across countries (0.55). With that information we can calculate the economic costs of injuries. We find that the net present value of the cost of injuries to Iraqis to date is \$8 billion.

²⁶ O'Hanlon (2005) shows that the World Bank and CPA estimated that an additional \$28 billion is required for other reconstruction efforts, including "health, education, employment creation," oil, and environment. We exclude these expenditures from our estimate because it is not clear from the report that these funds are to repair infrastructure damaged during the war.

²⁷ See U.S. Department of State (2005).

²⁸ As of August 16, 2005. See Iraq Body Count Database (2005).

²⁹ This figure is reasonably close to results of studies conducted in other developing countries. Shanmugam (1996/7) estimated a value of \$1.2 million to \$1.5 million per statistical life in India (in 2000 dollars as reported by Viscusi and Aldy 2003).

6. Expected Net Present Value of Costs

The estimates above provide the net present value of the cost of the war to-date. We are also interested in the expected costs going forward. Nobody knows how long the conflict will last, so projections regarding the future should be treated with some skepticism. Nonetheless, the Congressional Budget Office (2005) projected budget outlays and the number of troops in Iraq to 2015. To estimate an expected net present value, we assume that the death and injury rate will be the same as the average over the past two years. With that assumption, the CBO's budget and troop estimates, and a five percent discount rate, we estimate that the expected net present value of the cost of the conflict from September 2005 through 2015 could be \$349 billion to the U.S., \$55 billion to non-U.S. coalition countries, and \$173 billion to Iraq, for a global expected net present value from September 2005 through 2015 of \$576 billion.

Combining the expected net present value of future costs with the net present value of costs to-date, we estimate the net present value of the conflict from 2003 through 2015 to be \$603 billion to the U.S., \$95 billion to coalition partners, and \$306 billion to Iraq, for a total expected net present value of \$1 trillion

7. Avoided Costs

The costs outlined above are not the net incremental costs of the war. Regardless of the war's impact on future terrorism, it has also resulted in two cost savings. The main benefit to the U.S. is no longer using resources to enforce U.N. sanctions. One direct benefit to Iraq is the people not murdered by Saddam Hussein.

U.N. sanctions

Prior to the war, the U.S. was enforcing U.N. resolutions such as "no-fly" zones, sanctions, and inspections. Davis, *et al.* (2003) estimated the annual economic costs of that operation to be \$13 billion. Having avoided that cost since March 2003 yields a benefit of about \$32 billion to date.

Davis, *et al.* (2003) also estimated the expected net present value of enforcing this policy for the next three decades. The authors used a two percent discount rate and assumed a three

percent chance in any given year that the Iraqi leadership would change in a way that would allow the U.S. to cease enforcing a containment policy. We adopt the Davis, *et al.* (2003) assumption of a three percent chance of regime change in any year, but use a five percent discount rate to be consistent with other calculations in our analysis and with government recommendations regarding discounting. With the five percent discount rate, the net present value of avoiding containment costs, from March 2003 through December 2015 is \$117 billion.

Iraqi deaths under Saddam Hussein

As discussed above, many Iraqis have died as a result of the war. By all accounts, however, Saddam Hussein's regime was particularly brutal, with hundreds of thousands killed under his regime. We use the Davis, *et al.* (2003) assumption, based on a large number of other sources, of about 10,000 people dying premature deaths annually under Saddam Hussein's regime and a three percent chance of regime change each year. With those assumptions, our value of Iraqi VSL derived above, and a five percent discount rate, we estimate that removing Saddam Hussein has saved, in expected terms, 83,018 lives over the next ten years, for a net present value of \$228 billion between September 2005 and December 2015.

8. Change in Likelihood of Terrorism: Cost or Benefit?

One justification for the conflict is to reduce the risks of terrorism. Unfortunately, while supporters of the war argue that the conflict has made the world safer from terrorism, opponents counter that it has increased the risk of terrorism. The U.S. State Department tracks terrorist attacks around the world.³⁰ We reproduce this information in Table 7. These reports cannot provide enough data to answer the crucial question: would terrorism have been lower or higher without the Iraqi conflict, and what is the change in the future probability of terrorist attacks?

³⁰ U.S. Department of State (2005).

Table 7
Global terrorist attacks

Year	Number of Attacks	Killed	Wounded
2000 ³¹	423	405	791
2001 ³²	348	4655	1,080
2002 ³³	199	725	2,013
2003 ³⁴	208	625	3646
2004 ³⁵	651	1907	9300

Bram and Orr (2002) estimate that the 9/11 terrorist attacks cost between \$33 and \$36 billion.³⁶ If removing Saddam Hussein from power reduced the probability of such an attack by 10 percent in each year, this would result in expected benefits of about \$3.5 billion per year. Conversely, if the war has increased the probability of a major terrorist attack by 5 percent in each year, then this becomes an extra cost of \$3.5 billion per year. Clearly, one key determinant in whether the conflict in Iraq has a net positive or negative economic impact depends crucially on how it has affected the probability of terrorism.

9. Conclusions

In this paper we estimate the direct costs and avoided costs of the war in Iraq from three perspectives: the United States, coalition partners, and Iraq. The conflict, however, has economic implications beyond these direct impacts. The most obvious is its indirect macroeconomic impacts on the U.S. and the world. The war may influence oil prices, for example, with ripple effects through the economy. In January 2003, oil cost about \$32 per barrel but increased to around \$70 per barrel by the end of August 2005. Estimates of the conflict's macroeconomic impact to date will depend crucially on assumptions regarding how much of this increase is due to Iraq and regarding how much future changes up or down are due to Iraq.

³¹ U.S. Department of State (2001).

³² U.S. Department of State (2002).

³³ U.S. Department of State (2003).

³⁴ U.S. Department of State (2004).

³⁵ Brennan (2005).

³⁶ Davis, *et al.* (2005) believe this estimate is too low, and that the true costs probably exceeded \$50 billion.

Iraq's economy, meanwhile, was decimated by Saddam Hussein and U.N. sanctions before the war and probably nearly completely destroyed during the war. Its economy, however, as measured by GDP, has apparently begun a substantial recovery. Kamp, *et al.* (2005) note that Iraq's GDP more than doubled between August 2003 and August 2005. The war could also result in other, intangible, costs and benefits. A successful, stable, democratically elected government in Iraq could yield substantial benefits. Contrarily, some are concerned about future costs of an emerging theocracy or more severe civil conflict. We do not deal with these important questions.

In addition, even the costs that we can monetize must be considered skeptically. Good, publicly-available data are largely unavailable, each calculation requires a number of assumptions, and we push the already-controversial tools of cost-benefit analysis beyond their standard uses.

Nonetheless, this analysis is, we believe, the first to attempt to rigorously examine the direct economic costs of the war in Iraq. We estimate that through August 2005 the war has cost the U.S. \$255 billion, coalition partners \$40 billion, and Iraq \$134 billion. The costs avoided by Saddam Hussein no longer being in power are about \$116 billion. Using Congressional Budget Office estimates regarding the expected additional time U.S. troops will be in Iraq, we estimate that the expected net present value of the conflict from September 2005 through 2015 could be \$349 billion to the US, \$55 billion to coalition partners, and \$173 billion to Iraq. The net present value of avoided costs during that time is \$313 billion. We thus find that the total direct costs of the war could exceed \$1 trillion, while the costs avoided could be \$429 million.

We recognize that our estimates are incomplete and crude. Nonetheless, they show the substantial costs involved in fighting this war. Some costs are already sunk, but the analysis suggests that future costs may be significant. Hopefully policy makers and others that have better data than we have can refine our approach and assess whether the benefits justify the costs.

Appendix: Injury Value Calculation Methodology

This appendix is a detailed description of how we valued injuries to U.S. and coalition troops. In particular, it describes our estimates of the lifetime costs of injuries already incurred as well as our predictions for the remainder of 2005 through 2015. Where possible, we have used U.S. government estimates of the level of U.S. involvement in Iraq to date and in the future and conventional values of injury and lifetime care derived from economists and experts in the fields of risk analysis and medicine.

U.S. calculations, 2003 - August 2005

Not all troops injured in Iraq sustained the same types of injuries. A large number of injuries appear to be relatively mild and less costly than others. We create four categories of injuries. First, severe brain injuries afflict 20% of injured troops.³⁷ Second, about 6% of injured troops face amputations.³⁸ Statistics also show that over 50% of those wounded in Iraq are unable to return to duty.³⁹ To be conservative in our estimates, we assumed that exactly 50% of injured soldiers could not return to duty and the 26% of troops with severe brain injuries or amputations is included in this group. That leaves an additional 24% who did not receive a severe brain injury or amputation but whom are unable to return to duty. We thus assume that the 50 percent of troops who could return to duty suffered only minor to moderate injuries.

In order to quantify the severity of each of these types of injuries, we used an index commonly used by medical experts called the abbreviated injury scale (AIS), shown in Table A.1. Empirical economics research has used the AIS scale to calculate the value of statistical injuries. For example, the National Highway Transportation Safety Administration (1994) has endorsed and used the scale as a tool for trying to estimate the costs of traffic accidents. This scale categorizes injuries into five groups—minor, moderate, serious, severe, and critical. Hahn and Tetlock (1999) map injury severity into willingness to pay to avoid the injury, also shown in

³⁷ This is a highly cited statistic from the U.S. military. See, for example, Schlesinger (2003).

³⁸ Data compiled by the U.S. Senate that was part of the 2005 defense appropriations bill indicates that 6% of those wounded in Iraq have required amputations. See Mishra (2004).

³⁹ Data are from the Pentagon. See Mishra (2004).

Table A.1. Using these willingness to pay ratios as well as conventional values of statistical life,⁴⁰ we calculate a value of statistical injury for each of the main categories on the AIS scale.

Table A.1
Injuries by Type and Implied Values of Statistical Injury

Score on AIS scale	Types of injuries with this score ⁴¹	Willingness to pay to avoid injury relative to VSL	Implied Value of Statistical Injury (U.S., 2005 \$, assuming VSL of \$7.057m)
AIS 1 (minor)	Includes contusion or sprain of acromion, elbow, etc, or fracture of finger	0.002	14,115
AIS 2 (moderate)	Includes knee or ankle sprains, finger amputation, carpal, tarsal, or leg uncomplicated fractures	0.016	112,923
AIS 3 (serious)	Includes open or displaced fractures of long bones, arterial lacerations, hand or foot amputation, tendon ruptures	0.058	409,347
AIS 4 (severe)	Includes leg amputation or crush and pelvic crush, moderate to severe head injury	0.19	1,340,963
AIS 5 (critical)	Includes severe head injury	0.76	5,363,852

Because the types of injuries faced by troops in Iraq do not neatly fit into each of these categories, we specify a range of AIS scores for each injury type. This range is detailed in Table A.2. We calculate the willingness to pay to avoid each type of injury by taking the midpoints of the two AIS scores in the range.

⁴⁰ See, for example, Viscusi and Aldy (2003). Our calculations are based on a value of statistical life (U.S.) in 2000 dollars of \$6.5 million. This is the midpoint of two common values of statistical life (in 2000 dollars): \$3 million (low) and \$9 million (high). We estimated the value of each statistical injury with an assume value of statistical life of \$3 million, \$6.5 million, and \$9 million. Table A.1 and A.2 show the calculations for the case of \$6.5 million.

⁴¹ See Marchi *et al.* (1999) and Ross *et al.* (1998).

Table A.2
Injuries Experienced in Iraq and Implied Values of Statistical Injury

Score on AIS scale	Types of injuries with this score	Willingness to pay to avoid injury	Value of Statistical Life (U.S., 2005 \$)	Implied Value of Statistical Injury (U.S., 2005 \$)
Severe to Critical (AIS 4 to AIS 5)	Severe head injury	0.475	7,057,700	3,352,408
Serious to Severe (AIS 3 to AIS 4)	Amputation	0.124	7,057,700	875,155
Moderate to Serious (AIS 2 to AIS 3)	Injury resulting in inability to return to duty (does not include brain injury or amputation)	0.037	7,057,700	261,135
Minor to Moderate (AIS 1 to AIS 2)	Injured, but no brain injury or amputation and able to return to duty	0.009	7,057,700	6,3519

In addition to the lifetime costs of injury indicated by the value of statistical life figures, it was necessary to take into account the direct costs associated with each type of injury. These include lifetime costs of care. We made the conservative assumption that only those with severe brain injuries and amputations would require lifetime care. Estimates commonly used by medical experts suggest a lifetime cost of care for brain injuries ranging from \$600,000 to \$4,000,000 per person⁴² and about \$45,000 to \$57,000 for amputees⁴³ plus the cost of prosthetic limbs ranging from about \$12,500 to about \$100,000.⁴⁴

The Department of Defense periodically announces the number of troops injured in Iraq. As of August 25, 2005, that number was 14,120. Using this number and the statistics cited above, we were able to calculate the predicted lifetime cost of injuries of all types experienced by soldiers from the start of the war to the present. As of August 25th, that number stood at about \$18 billion.

⁴² See, for example, National Association of State Head Injury Administrators (2005) and Neurotrauma Registry (2005).

⁴³ See, for example, Reiber *et al.* (1995).

⁴⁴ See, for example, Sweeney (2005) and Associated Press (2004). We make the conservative assumption that the patient purchases only one prosthetic limb in their lifetime.

U.S. calculations, 2003-2015

We assume that there will be injuries as long as U.S. troops remain in Iraq. In a 2005 report, the Congressional Budget Office projected troop levels in Iraq through 2015 (see Table A.3).⁴⁵ In order to similarly calculate the costs of injuries out to 2015, we assumed that the annual injury rate (about 4.3% of all troops deployed)⁴⁶ will continue through 2015. We also assumed that injuries would occur in the same proportions as they are currently (6% are amputations, 20% are brain injuries, 24% are moderate to serious, and 50% are minor to moderate). With these assumptions, projections of the number of future troops, and our discount rates of 3, 5, and 7 percent, we are able to estimate a range of injury costs into the future. Using the midpoint figures of a 5% discount rate, a value of statistical life of \$6.5 million (in 2000 dollars), and lifetime costs of care, we estimate that the expected net present value of injuries to the U.S. from 2003-2015 is about \$48 billion.

Table A.3
U.S. troop strength projected into the future

Year	Predicted troop strength	Percent of 2005 troop strength
2006	136602	0.95
2007	107379	0.75
2008	80874	0.56
2009	56408	0.39
2010	33981	0.24
2011	33981	0.24
2012	33981	0.24
2013	33981	0.24
2014	33981	0.24
2015	33981	0.24

Coalition calculations

We were able to make similar calculations for coalition countries. We assumed that the lifetime cost of treating brain injuries and amputees is identical in the U.S. and in the coalition countries. We also assumed that only coalition countries reporting the death of at least one soldier between 2003 and August 2005 experienced any injuries of troops and that only these

⁴⁵ See Congressional Budget Office (2005).

⁴⁶ Number of troops deployed are available from several sources. See, for example, Brookings Institution (2005), which uses Department of Defense data.

countries will experience injuries to troops in the future (a conservative assumption). In addition, we assumed that coalition countries would reduce their troop strength at the same rate at which the U.S. reduces its troop strength (see Table A.3).

Viscusi and Aldy (2003) find an elasticity of income with respect to value of life ranging from 0.5 to 0.6. We can thus take the midpoint of this estimate (0.55) and per capita income figures from coalition countries to estimate the value of a statistical life in each of the coalition countries. Adding up the totals and using a value of a statistical life in the U.S. of \$6.5 million (in 2000 dollars), we found the cost of injuries to coalition countries to be about \$2 billion through August 2005. Using a 5% discount rate, the total for 2003-2015 is expected to be about \$4.5 billion.

Iraq calculations

Iraq presented unique problems because of conflicting estimates of the country's security force strength in Iraq over the last two and a half years,⁴⁷ vague estimates regarding the expected growth in security force strength, and the fact that U.S. costs for the average lifetime care of injuries is likely to be much higher than in Iraq (and this data are not readily available for Iraq). Based on a number of assumptions, we were able to resolve these issues, but inaccuracy in our assumptions could affect the accuracy of our estimates.

In general, all Iraq injury costs were computed in a similar way as the coalition costs. However, there are two main differences:

First, for the coalition countries, we assumed that their numbers of troops in Iraq decreased over time at the same rate as the number of U.S. troops are expected to decrease. For Iraq, however, the size of the security force is actually growing. By August 2005 it was at about 180,000, with a stated goal of 272,566.⁴⁸ In order to project troop size into the future, we assumed that the rate of growth in the later half of 2005 continues until the number of security forces reaches its target. We expect Iraq to reach its target by 2007. Table A.4 shows the predicted change over time in Iraqi security force strength as well as how it compares to the projected levels of U.S. troops in Iraq. We used the third column of Table A.4 as the factor by

⁴⁷ This problem is further complicated by the fact that there has been general dispute over whether to count untrained troops as troops or not.

⁴⁸ The Brookings Institution (2005).

which to multiply expected U.S. injuries over 2005-2015 in order to arrive at expected Iraqi injuries.

Table A.4
Iraqi Security Force Strength Projected into Future

Year	Troop Strength	Percent of U.S. Total
2006	265,728	1.95
2007	272,566	2.54
2008	272,566	3.37
2009	272,566	4.83
2010	272,566	8.02
2011	272,566	8.02
2012	272,566	8.02
2013	272,566	8.02
2014	272,566	8.02
2015	272,566	8.02

Second, we assume that the lifetime costs to care for severe brain injuries and amputations, in Iraq, are the U.S. costs multiplied by the ratio of Iraq's pre-war (2002) nominal GDP to the 2002 nominal GDP of the U.S.. This assumption was the best one we could think of to account for the fact that Iraqis likely spend far less than Americans on treatment and care of debilitating injuries. Iraq's nominal GDP in 2002 was about 9% of the U.S. GDP. We thus assume that whatever amount of money Americans spend on lifetime care of injuries, Iraqis with similar injuries will spend 9% of the total. Thus, because the lifetime care costs of a severe head injury in the U.S. range from \$600,000 to \$4,000,000, we expect them to range from \$54,000 to \$360,000 in Iraq. Because the lifetime cost of care of an amputation in the U.S. is \$45,000 to \$57,000, we expect it to be between \$4,100 and \$5,100 in Iraq. And because the cost of a prosthetic limb ranges from \$12,500 to \$100,000 in the U.S., we expect it to range from \$1,100 to \$9,100 in Iraq.

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