

AFTER THE CRASH: COMPENSATION AND ECONOMIC LOSS
FOLLOWING AVIATION ACCIDENTS*

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In the 1980s, the debate about the costs and benefits of the tort system for compensating personal injuries became cover-story material. The key participants in what has not always been a very restrained exchange are many insurers, businesses, professional organizations, and some government officials on one hand, and consumer advocates, trial lawyers, and other government officials on the other. The insurance industry and its supporters in the business and professional communities have blamed the perceived insurance crisis on a "capricious expansion of the civil justice system." This expansion, they claimed, made it impossible for insurers to predict the losses that they would have to pay. On the other side, critics of the insurance industry, primarily plaintiff attorneys and consumer advocates, have strongly contested insurers' statements about the tort system. They claimed that there was no dramatic increase in the amount of litigation, that jury awards were basically stable, and that the costs of the system were worth the benefits.

Unfortunately, the debate over these issues has suffered from lack of evidence. There is little comprehensive, accurate data on the loss actually involved. There are many studies of how the tort system compensates, but invariably these studies lack a measure of the loss involved or, at best, they measure loss crudely. Without such data, the debate has operated largely on general impressions and anecdotal evidence.

The study on which this paper is based represents the first systematic research on the relationship between compensation paid and plaintiff's economic loss for a large number of cases and a particular type of litigation. Our study has gathered data that permit analysis of adequacy of compensation in 25 major air accident cases. These accidents resulted in 2228 deaths, but our analysis was limited to those 2113 passengers for which we could compute losses.[1] Table 1 shows the distribution of these 2113 deaths across the 25 major airline crashes. The data cover 88 percent of the aviation deaths that occurred between 1970 and 1984 involving major U.S. airlines. For these cases, we have information on the details of the accidents; the size of the awards; the costs of litigation; the demographic and economic characteristics of the decedents, claimants, and defendants; and other facts pertinent to the litigation.

OBJECTIVES OF THE TORT SYSTEM

The tort system has a number of aims, but two stand out: deterrence, and the adequacy and equity of compensation. Many people feel quite strongly that the tort system should deter harmful

[1]Our survey excluded accidents that involved aircraft with fewer than sixty seats or that resulted in fewer than five deaths. Thirty cases were excluded because these cases were not closed when our data collection stopped in May 1986. Eighty cases were excluded because we did not have information in either age or sex, which are critical variables for computing loss.

Table 1

U.S. AIRLINE MAJOR ACCIDENT LIST: 1970-1984

Accid. No.	Date	Airline	Location	Dead
1	11-14-70	Southern	Kenova, WV	59
2	11-27-70	Capitol	Anchorage, AK	46
3	6-6-71	Air West	Duarte, CA	44
4	9-4-71	Alaska	Juneau, AK	104
5	12-8-72	United	Chicago, IL	19
6	12-20-72	No. Central	Chicago, IL	10
7	12-29-72	Eastern	Miami, FL	93
8	7-23-73	Pan Am	Tahiti	68
9	7-31-73	Delta	Boston, MA	82
10	12-17-73	Pan Am	Rome	20
11	1-31-74	Pan Am	Pago Pago	83
12	4-22-74	Pan Am	Bali	91
13	9-8-74	TWA	Ionian Sea	76
14	9-11-74	Eastern	Charlotte, NC	70
15	12-1-74	TWA	Mt. Weather, VA	65
16	6-24-75	Eastern	New York, NY	106
17	4-27-76	American	St. Thomas, V.I.	35
18	3-27-77	Pan Am	Tenerife	324
19	4-4-77	Southern	New Hope, GA	69
20	9-25-78	PSA	San Diego, CA	135
21	12-28-78	United	Portland, OR	7
22	5-25-79	American	Chicago, IL	258
23	10-31-79	Western	Mexico City	61
24	1-13-82	Air Florida	Washington, DC	74
25	7-9-82	Pan Am	New Orleans, LA	114
Total				2113

behavior (such as the manufacture of unsafe products) while not inhibiting socially desirable behavior (such as producing vaccines). To satisfy this objective, tortfeasors in some form should pay the

full cost of the harm they inflict. By doing so, they are given the right economic signals to treat any harm they may do to others as a cost to themselves.

Others argue just as vehemently that the primary goal of the tort system is to compensate for injuries, and to do so adequately and fairly. Adequate compensation requires that compensation be proportional to loss, and fair compensation that similarly-situated individuals receive the same amount.

Reflecting that aim, in most of the states, the mandated form of compensation is *loss to survivors*. Under this principle, tortfeasors are required to compensate survivors for the financial and, often, other kinds of loss suffered because of a wrongful death. Under loss-to-survivors statutes, damages are awarded for the present value of probable contributions which the deceased would have made to his survivors had he lived. Although this was originally interpreted as allowing compensation only for pecuniary damages, the definition of pecuniary eventually became quite broad. In most jurisdictions, it now includes loss of consortium, loss of services, and loss of nature, training, and guidance of children.

Whatever the concept of pecuniary loss, the central character of loss to survivor statutes is that the decedents' own expenses or consumption are not included in the loss. However, this common principle in loss-to-survivor statutes is belied by the considerable variation in judicial interpretation of these statutes. Each state has its own set of statutes, precedents, and judicial interpretation.

Compounding this variation across states is the question of which state has jurisdiction. Until the middle of this century, the settled rule in wrongful death was that the law of the state where the death occurred (the *lex loci* rule) would apply. Today, it is often a critical issue of dispute whether the substantive law governs in the state of death, residence of decedents, the domicile of claimants or place of manufacture.

For our purposes, this confusion is further compounded by legal restrictions applicable to some of the aviation sample. Besides state laws^[2], international treaties such as the Warsaw Convention and the Montreal Agreement potentially limit the maximum compensation for decedents flying with international tickets. For example, the current limit set by the Montreal Agreement is \$75,000 for each decedent. However, these limits only apply to the airlines in the case. If other defendants (i.e. aircraft manufacturers, government) are liable, even if only in part, in principle there are no compensation caps for those flying on international tickets.

To evaluate the deterrence and equity objectives, we developed a methodology to obtain economic loss benchmarks to compare with compensation. That methodology and the economic loss measures it

[2]Today, no state law limits total compensation in aviation deaths, although some states do limit payments for non-pecuniary loss. In the early years of our sample of accidents, some states maintained limits on the size of the awards. In particular, two states where crashes occurred--West Virginia and Massachusetts--had caps on recovery. Evaluated in March 1986 dollars, the cap in Massachusetts was \$441,032 and \$308,034 in West Virginia when accidents occurred.

produced are reasons our work is unusual. By comparing loss and compensation, we can meaningfully ask the question of whether the compensation reflects the real loss involved. At the same time, by comparing cases with the same loss, this is one of the few studies that can tell us how compensation varies with other circumstances involved in the case. These circumstances include the kinds of people involved, the rules of the game, and the often-debated issue of whether compensation is changing over time.

MEASURING ECONOMIC LOSS

Our first task was to develop a methodology to compute economic loss. We did so because in many respects existing practices are seriously deficient. Instead of a generally-accepted procedure, inconsistency prevails in the methods actually applied in the courts. The actual economic expert evaluations made for these cases were also of little help. Such evaluations were only available for ten percent of the deaths, and the actual assumptions invoked varied widely. Not surprisingly, the assumptions often reflected the vested interests of the different parties in the litigation.

Nor did we try to replicate the computation of economic loss that may have been required by any particular state law. That would be an impossible task since, as we said above, we do not know with certainty what state law would have governed in each case. In these circumstances, the most useful approach was to return to first principles, the general goals the statutes aimed to achieve. The

question we always asked was whether our method led to full and fair and adequate compensation and whether it would sufficiently deter harmful behavior.

Our loss measure also captures economic loss only. Many courts allow damages for such non-pecuniary items as loss of consortium and mental anguish. Because these non-economic values are difficult to measure, we placed them beyond the scope of our project and did not include them in our calculation of loss. However, the compensation actually paid does include payments for this non-economic loss. Fortunately, we were able to indirectly separate total compensation into an amount paid for economic loss and an amount paid for non-pecuniary loss.

For each of the two policy objectives, an economic loss benchmark was needed to compare to compensation. We called the deterrence benchmark "full economic loss." Full economic loss is the discounted value of the decedent's labor market earnings and his non-market or household services.[3] Think of it as the now lost productive output associated with the decedent.

The second economic loss principle--and the mandated form of compensation in most states--is loss to survivors. With this principle, our point of view shifts from how much the defendants should pay--the emphasis in deterrence--to how much the victims should receive. Under loss to survivor statutes, damages are awarded

[3] Full economic loss mirrors the death damages principle in a few states, including Georgia, the site of one of our crashes.

for the value of the likely contributions the deceased would have made to his survivors had he lived.

There are seven major elements involved in calculating loss.[4] Because full economic loss involves present and future market and non-market incomes, to compute it we needed to know the first five elements listed in Table 2. Base-year incomes refer to what decedents would have earned in the first year they worked if the accident had not occurred.[5] As we shall show in a moment, many of those who die in air crashes earned very high incomes indeed. But it is not only their earnings at the time of death that concerns us. We also want to know how rapidly their salaries would grow and how likely they were to work in the future (what we call their "worklife discount" in this Table). To forecast this future, new, and hopefully better models of estimating salary growth and predicting future worklife expectancies were developed.

People engage in productive activities outside the formal labor market, with home repairs, cooking, shopping, and caring for children being but a few examples. Although the resulting goods and services are not exchanged in a formal market, they have loss value and should be counted equally with the decedent's foregone market salaries in

[4]A full description of the King-Smith methodology for computing economic loss is contained in Computing Economic Loss in Cases of Wrongful Death, Elizabeth King and James P. Smith, R-3551-1988.

[5]For seventy-five percent of the working decedents, we knew their incomes when they died. For the remainder, we imputed their incomes based on their other known characteristics.

Table 2

SEVEN ELEMENTS OF LOSS

Full Economic Loss

Base Year Incomes
Salary Growth
Worklife Discounts
Non-market Loss
Discount Rates

Loss to Survivors

Offset for Personal Consumption
Taxes

loss calculations. To compute this non-market loss, we had to estimate how much time the decedents would spend in household work now and in the future.

Because much of the economic loss takes place in the future, a discount rate to express these future economic losses in terms of their current worth was selected. Based on our review of the literature and the guidelines by the Supreme Court, we used a real (i.e. inflation adjusted) interest rate of 2.75 percent.[6]

[6]In a landmark case (Jones and Laughlin, Steel Corporation vs. Pfeifer) the Court held that it would not revoke a trial court decision if it adopts "a rate between one and three percent."

Estimating loss to survivors involved two adjustments to our calculation of full economic loss. First, our estimate of the decedent's unique personal consumption had to be subtracted because this part of his income would not have gone to his survivors anyway.[7] Second, taxes must be considered because survivors would only have benefitted from the decedents after-tax income. In addition, survivors must pay taxes on any interest earned on the compensation award.[8]

LOSS AND COMPENSATION

What levels of economic loss did our methodology produce? As Table 3 shows, average lost productive output across all decedents, what we call full economic loss, was over \$1,400,000.[9] The financial loss suffered by the survivors was about \$748,000. These sums are considerable, but averages hide important differences among these decedents in the losses incurred.

[7]To obtain such estimates, we used the familiar household equivalence scales that compute income amounts that equate families of different sizes in terms of their overall well-being.

[8]The compensation award itself cannot legally be taxed. However, because we must provide an award large enough to pay future tax liabilities, introducing taxes often increases the size of the award. This is especially true for younger decedents.

[9]Throughout this paper, all dollar amounts are expressed in 1986 dollars.

Table 3

ECONOMIC LOSS AND COMPENSATION RECEIVED

	Compensation Received	Full Economic Loss(1)	Loss to Survivors(2)	Recovery Rates (1)	Recovery Rates (2)
All	363,680	1,403,354	748,777	25.9	48.6
Men	458,792	1,794,447	1,054,256	25.6	43.5
Women	218,395	805,966	282,154	28.8	77.4
U.S. Citizen	396,774	1,449,237	786,952	27.4	50.4
Foreigner	182,924	1,152,780	540,273	15.9	33.9

Full economic loss was more than two million dollars for 17 percent of the cases, but less than one in ten cases had a full loss less than \$250,000. Loss to survivors exhibits a similar spread. More than a quarter with losses less than \$100,000, while one in ten decedents had a loss to survivors of more than \$2,000,000.

What accounts for this spread? To explain it, we give you a brief economic profile of these air crash victims. Compared to the average American, many victims of these crashes are among the economic elite. For example, 72 percent of the adult men had professional or executive-level jobs, compared to only 20 percent of the male workforce. The mean income of these working men was over \$70,000, twice the comparable U.S. average. This high average income, however, should not obscure the considerable diversity among

these decedents in their ability to earn. For example, in their first year of work after the accident, eight percent of male decedents would earn less than \$10,000, while one in twenty had a paycheck greater than \$175,000.

With this as background, let's turn to the issue of what drives compensation in aviation accidents. How closely did average compensation match economic loss? The disparity is large indeed. Compared to a mean compensation of \$363,000, we have seen that the average full economic loss was over one million, four hundred thousand dollars and mean loss to survivors was almost three-quarters of a million dollars. To put it another way, these results imply a recovery rate of twenty-five cents on the dollar for full economic loss and fifty cents on the dollar for loss to survivors.

Our comparisons indicate that compensation falls far short of economic loss. While compensation does not match loss dollar for dollar, compensation does vary systematically with loss. In fact, economic loss was hands down the most important factor determining compensation. This relation between compensation and loss shows that differences in compensation alone tell us little about whether the tort system is fair or how it may be changing. While frequently made with compensation data alone, those judgments require that we know both loss and compensation, a match that makes our study unusual.

The demographic characteristic selected to illustrate our point is sex. As Table 3 indicates, the relatives of male decedents received more than twice as much as the beneficiaries of a deceased

woman did. However, this sex disparity in compensation, large as it is, does not represent discriminatory treatment if the losses of men were also correspondingly higher than those of women. This difference in compensation was indeed matched by a similar order of magnitude disparity in full economic loss, which is two and a half times larger for men. Male decedents have larger full economic losses than women for essentially three reasons: compared to women, the men earned twice as much for every year they worked (\$62,000 compared to \$23,000); the men would have worked 25 percent more years over the rest of their lives; and male salaries would have increased by one percent more each year.

Sex differences are even larger for loss to survivors, reflecting the still different reasons some men and women fly. Table 3 demonstrates that loss to survivors for male victims was about one million dollars; almost four times the female victim value of \$282,000. While attesting to the underlying human tragedy of these accidents, the reason for this sex difference is not hard to explain. Two-thirds of the married female passengers died together with their spouses--twice the male rate. In computing loss to survivors, the personal consumption of both dead spouses was subtracted from full loss.

These systematic patterns should not hide the fact that a good deal of the association of loss with compensation is not one for one. To illustrate this point, let me start with the great diversity that exists in compensation. Figure 1 displays the percent distribution

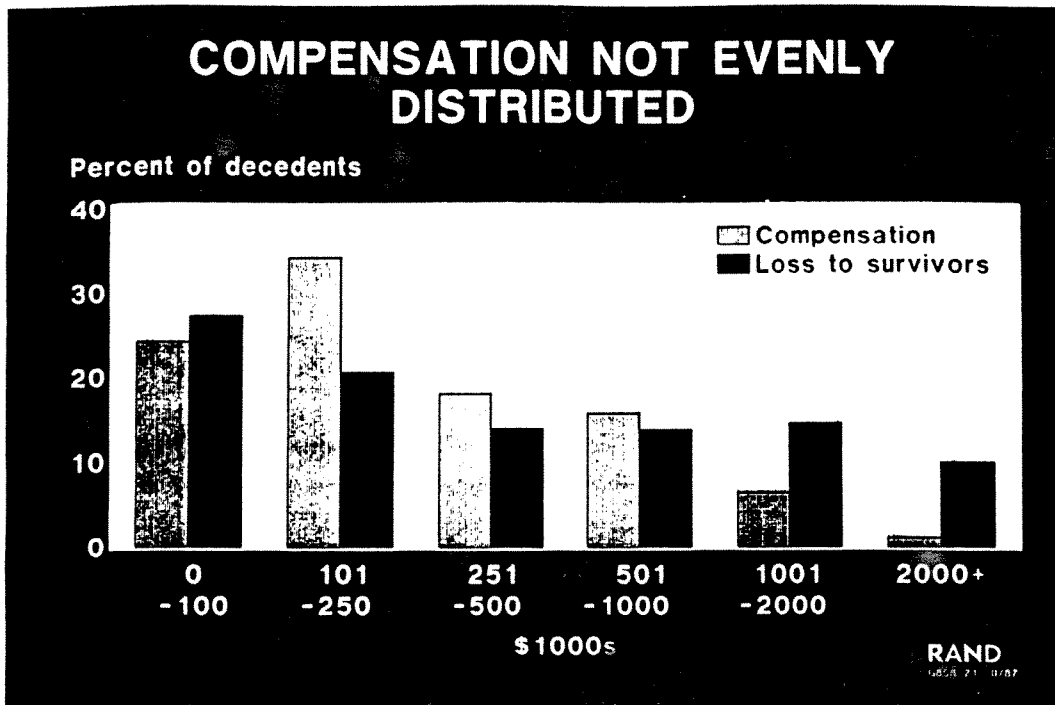


Fig. 1 -- Compensation Distribution

of compensation alongside that of loss to survivors. Although the mean compensation was \$363,000, about a quarter of the sample received less than \$100,000. At the other end of the scale, about seven percent were given compensation awards larger than \$1 million.

These high awards and their diversity tend to make news, with the implication that compensation is inequitable and, for some cases, excessive. However, as Figure 1 indicates, the spread in compensation is far less than the spread in loss to the survivors. For example, one in every four decedents had a loss to survivors above one million dollars--three times the number with compensation

above that figure. Similarly, one in ten experience a loss of at least two million dollars, compared to one in a hundred with compensation above that amount. In light of the considerable variation in salaries, this dispersion in economic loss is not surprising.

The greater range in loss does suggest that rather than being "too diverse" and excessive, compensation in aviation accidents is not sufficiently diverse to equitably compensate survivors.

This greater variation in loss relative to compensation implies another pattern that has become commonplace in studies of the damages paid within the tort system--a pronounced decline in the recovery rates as the size of loss increases. This pattern is illustrated in Figure 2. For decedents with low economic losses, recovery rates actually exceed one. Thereafter, recovery rates decline rapidly, reaching a value of 67 percent at the median and falling to only a quarter when loss exceeds two million dollars.[10]

OTHER DETERMINANTS OF COMPENSATION

While economic loss is critical, it is by no means the only factor at work in fixing compensation. First of all, plaintiffs have choices on how far to pursue a case. With their lawyers, they must decide whether to file a lawsuit, and two-thirds of them did so. Somewhat later, a decision on whether to go to trial may arise, and

[10]A note of caution about the apparently high recovery rates at low losses: Remember we have limited loss to economic loss while compensation includes payments for non-pecuniary loss.

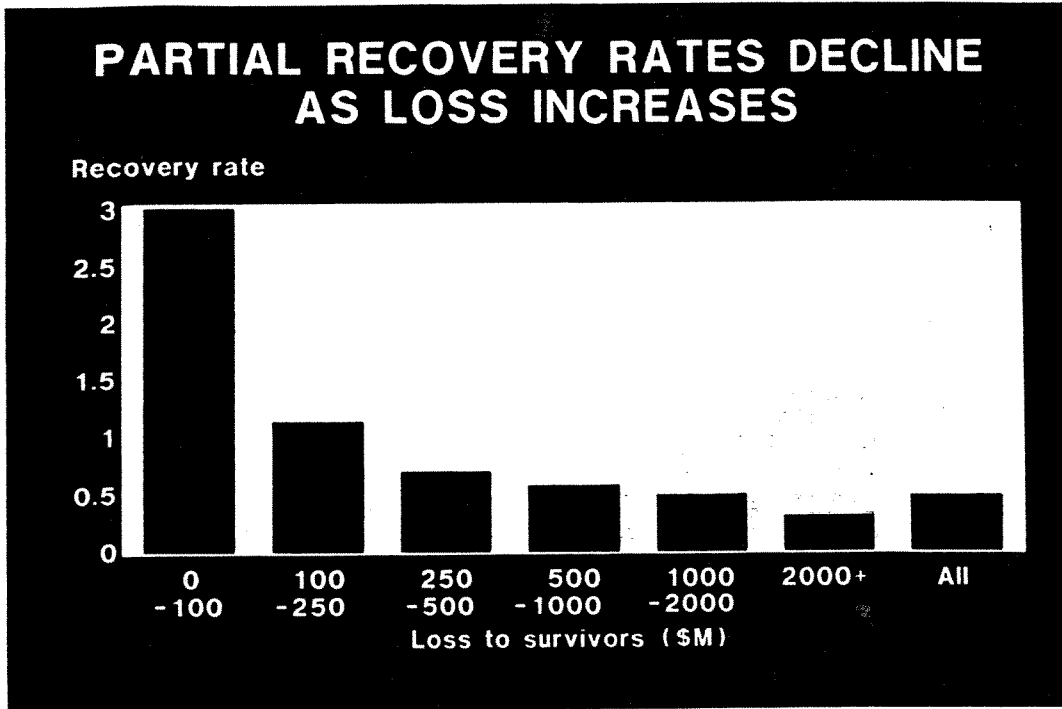


Fig. 2 -- Partial Recovery Rates

one in twelve plaintiffs did opt for a trial. Such decisions may well alter compensation. For example, if we compare decedents with losses of \$748,000, recovery rates rise from 46 percent for those who did not file a suit to 74 percent for those plaintiffs who go to trial. Even after we subtract the payments made to lawyers, recovery rates are highest for those plaintiffs involved in a trial.

Our multivariate statistical analysis uncovered many other factors that significantly affected compensation. These variables identify who the decedents, plaintiffs, and defendants were; the type of accident that occurred; and some rules placing limits on recovery.

In describing the impact of these factors, the association that emerges is independent of the loss involved. Through the magic of multivariate analysis, people can be compared with the same economic loss. To make these comparisons concrete, we shall compare decedents with the same economic loss to survivors, the sample mean of \$748,000.

Given space constraints, it is not possible to discuss every variable that mattered. Instead, we will select one from each of the major groupings: the decedents, the plaintiffs, the defendants, and recovery caps. The ones selected are meant to illustrate that compensation varies widely, even for people who suffered the same economic loss, and to isolate some important policy issues.

The first grouping concerns the decedents themselves, and from that list of variables, foreign citizenship is the one we will highlight. Figure 3 illustrates our predictions of the differences in compensation paid for otherwise identical American and foreign passengers. In awarding damages, foreigners are not treated on a par with American citizens. Controlling for loss, Americans are paid 50 percent more than foreign citizens. As this figure indicates, this citizenship difference cannot be explained by treaty caps. Even when we compare passengers who were not flying on international tickets, foreign deaths were compensated at a much lower rate than American deaths. In this case for an identical loss of \$748,000, relatives of foreign victims receive \$130,000 less. If equity implies treating similarly harmed individuals alike, the tort system doesn't achieve that objective in this case.

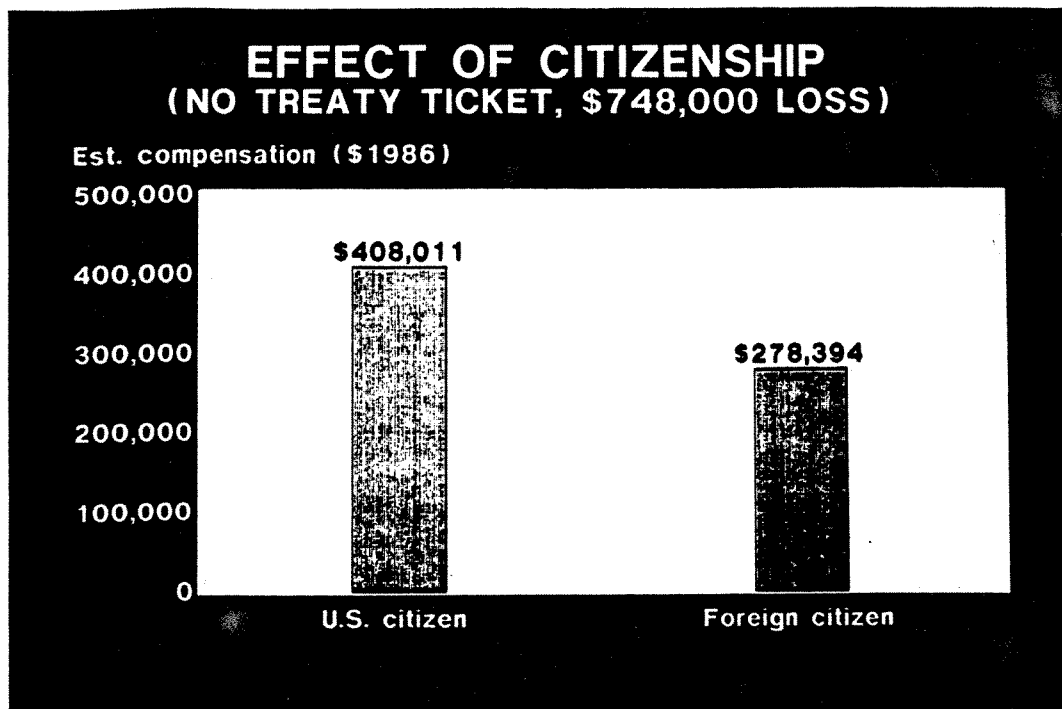


Fig. 3 -- Effect of Citizenship

Who the plaintiffs are also matters. To illustrate that dependence, compare compensation in cases where there was a surviving spouse to cases where there wasn't. Remember that since economic loss is held constant in these simulations, the extra financial needs of the surviving spouse are already accounted for.

Our results indicate that compensation paid is almost \$150,000 larger when there is a surviving spouse (see Figure 4). Since economic loss is controlled for, this added compensation reflects payment for non-economic loss. The closer the relationship between the plaintiff and the deceased, the greater the odds that a plaintiff

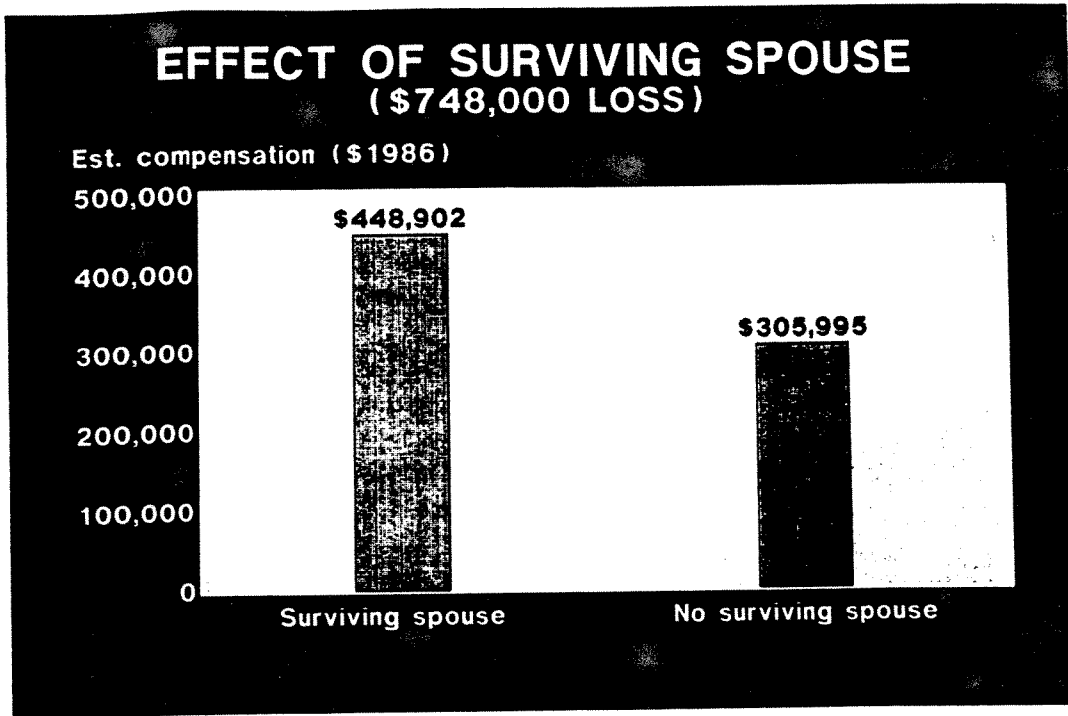


Fig. 4 -- Effect of Surviving Spouse

will receive payments for such non-economic losses as loss of consortium and mental anguish.

Based on that observation, we were able to separate out compensation paid for non-economic loss from that paid for economic loss. According to our estimates, compensation for economic loss was \$235,000, roughly two-thirds of total compensation paid.

In setting their bargaining position, defendants care as much about the total compensatory damages they must pay in an accident as about what they must pay for an individual claim. To illustrate this effect, we show how compensation paid to an identical decedent (one

with a loss of \$748,000) changes depending on who dies with him in the crash and how many fellow victims there were. Even for identical individuals, average compensation was lower in large accidents.

To show the magnitude of this effect, Figure 5 illustrates the difference in compensation for large and small crashes for a victim whose own individual loss stays constant at \$748,000. If the crash was small--and for our purposes we shall define small as 100 victims with a per-person loss of one-half million dollars--expected compensation equals \$376,000. However, if the crash was large--200 deaths with a per-passenger loss of one million dollars--compensation for the identical individual is only \$300,000. One

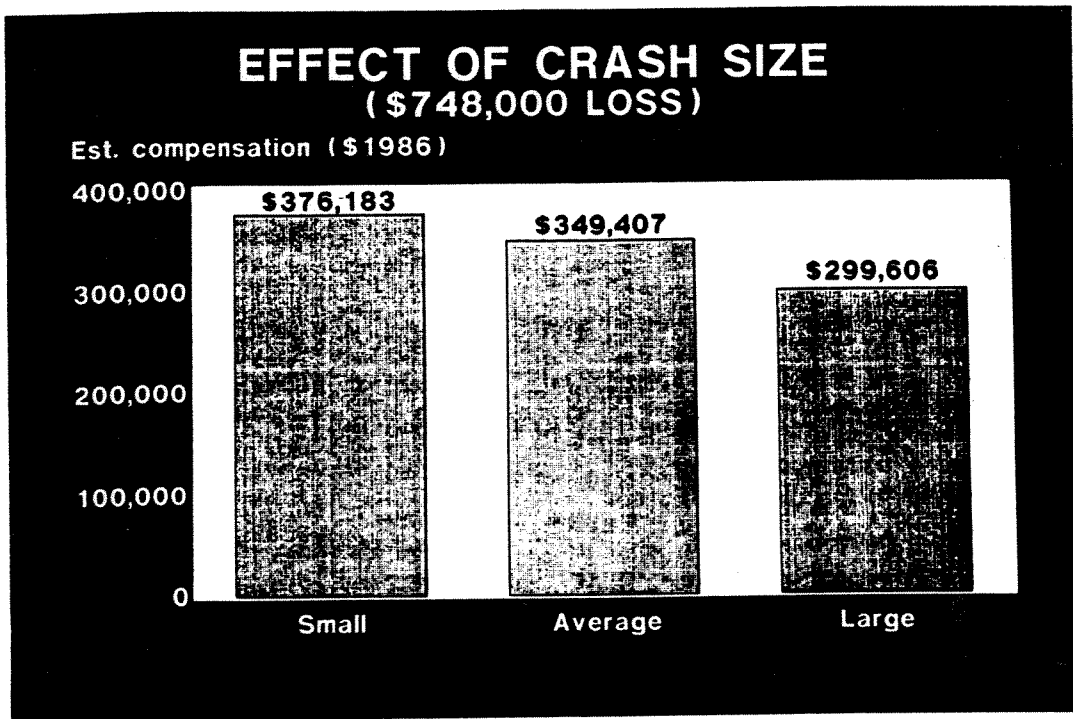


Fig. 5 -- Effect of Crash Size

possible reason for this dependence is that defendants take a tougher stand on individual cases when the total potential losses they face are large.

One unique aspect of aviation accidents is the prevalence of caps on allowable recovery, especially the potentially strict international treaty caps. The Montreal Agreement limits the airline's liability for internationally ticketed passengers to \$75,000. Since these limits only apply to airlines, the cap is not effective when other defendants are liable.

Figure 6 shows that the potential effects of these caps were

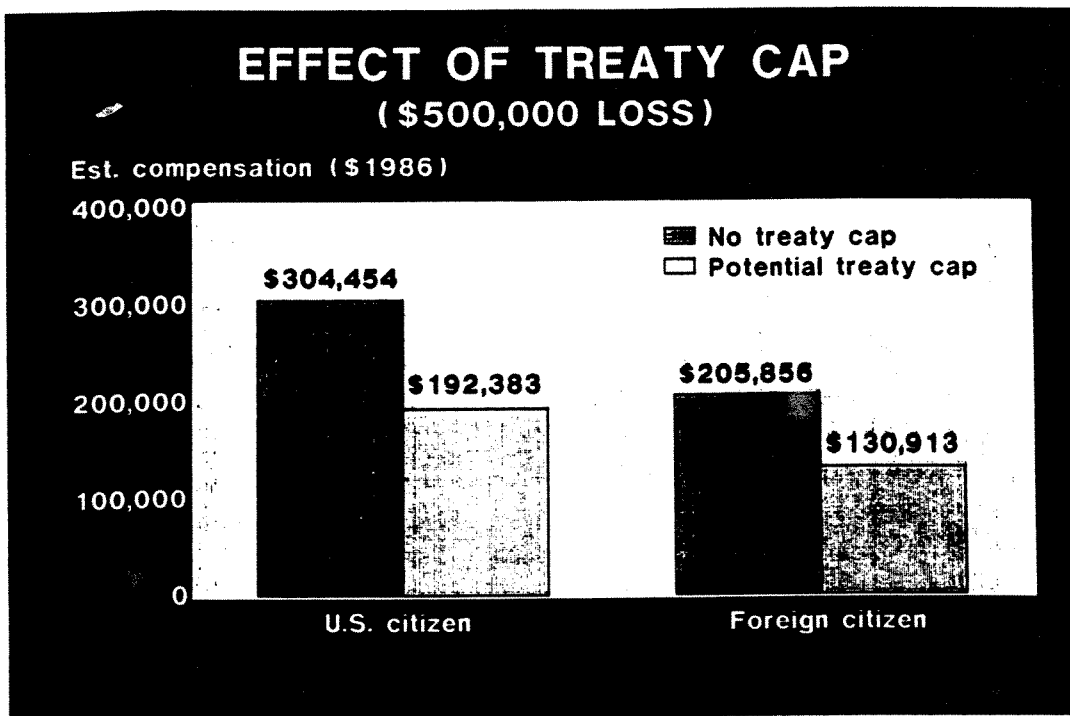


Fig. 6 -- Effect of Treaty Cap

large for otherwise identical decedents, reducing compensation for comparable American and foreign citizens by more than a third. In addition, because these limits are expressed in constant nominal dollars, their bite is far larger today than it was 10 and 15 years ago when many of the crashes in our sample occurred. If the tort system aims at equity, these limits imposed by international treaties run against that objective.

To conclude this paper, we will return to the two policy issues that are its theme: Is the compensation paid in airline accidents fair and adequate, and does it significantly add to incentives for safety?

DETERRENCE

How much incentive does the tort system provide to deter harmful behavior? We achieve the proper amount of deterrence (or equivalently the right amount of airline safety) when tortfeasors in *some form* pay the full value of the lost life.[11] Compensation paid by the tort system is less than what is needed for the tort system by itself to provide full deterrence. On average, defendants pay 26 cents for every dollar of full economic loss inflicted.

[11] Airline accidents represent the special case in deterrence when defendants should pay the full cost. When the probability of an accident is not affected by the actions of the victim, total societal costs are minimized by holding the defendants liable for the full harm inflicted. More generally, when the victim can affect the likelihood of events, it would not be optimal for defendants to pay the full cost.

The shortfall is even greater if the theoretically more appropriate value of life is used as our benchmark. Because the courts have shied away from the value of life approach, we relied on the more conservative earnings-based benchmark to evaluate deterrence. Full economic loss understates, and substantially so, the true cost of a death or the value of life. Understandably, people place a higher value on their lives and those of their relatives than the amount of money they can earn. Taking our best estimate of the value of life of \$5.3 million, compensation to airline victims is less than seven percent of the true cost of a death.[12] That is, for every dollar of true cost, defendants are paying only seven cents.[13]

[12]This estimate is the average of these summarized in Viscusi's review of the literature (Viscusi, 1987).

[13]There are two standard objections that have little practical standing in this case. The first is that the transactions costs to defendants of using the tort system add to the deterrence incentive. However, the total defendant transactions costs were only \$111 million, a sum that is small compared with the \$11 billion of lost human life. Adding defense litigation expenses adds one penny per dollar to the deterrent effect if a value of life measure is used and two cents per dollar if the expanded human-capital approach is used.

The second objection is that the cost of replacing the aircraft hull adds to the safety incentive. While this is true, to obtain the full cost of the loss, the value of the aircraft hull also must be added to the value of human life. For example, if all the planes in this study were 747s (with a replacement cost of \$100 million), the total value of the lost aircraft would be \$2.5 billion. In absolute terms, adding in the airplane hull replacement is a wash--the \$2.5 billion lost is just offset by the \$2.5 billion payment.

We must be careful in considering the implications of this conclusion. The tort system does not operate in a vacuum; there are other mechanisms in place that have a major role to play in making the skies safe. For example, market forces and regulatory agencies also provide incentives for safety. Regulatory agencies are in place with the stated mission of insuring airline safety. Commercial airline traffic is subject to substantial regulatory oversight in this country. The primary agency responsible is the Federal Aviation Administration (FAA) which "administers air traffic control, certifies aircraft and crew, and conducts extensive basic research on air safety" (Chalk, 1987). The FAA has a number of powers. These range from issuing warnings and imposing fines, to decertification of aircraft or crews. In practice, the fines are limited to \$1,000 an offense, so that the force of this penalty is questionable. Given this modest amount, the publicity associated with any fine is likely to be more important as a deterrent than the monetary value of the fine.

The FAA also relies on an extensive monitoring program. The FAA inspectors are assigned to scheduled air carriers to determine if new testing, design alternatives, or manufacturing changes are warranted. The most severe regulatory penalty available is the decertification of aircraft. However, only once during the period covered by air crashes, (the 1979 DC-10 crash in Chicago) did the agency exercise its power to decertify an aircraft.

Airlines that engage in unsafe practices may eventually lose customers, a cost as real as the compensatory damages they have to pay in accidents. For example, Chalk (1987) used a sample of 76 U.S. airline accidents over the period 1966 to 1981. Within this sample, he identified 19 accidents that may have been the manufacturer's fault. The lost equity value suffered by stockholders of the airplane manufacturing companies in these accidents averaged \$21.3 million per crash. As a result, to manufacturers the total cost across all 19 crashes was \$405 million.

Using a similar empirical procedure, Mitchell and Maloney (1988) investigated the stock market changes in the equity values of the airlines following air crashes. They examined 56 crashes during the years 1964-1979. These crashes were divided into two groups: crashes caused by pilot error and those in which the carrier was not at fault. Crashes that are the responsibility of the carrier, for example (pilot error), will cause consumers to shift demand to other carriers and the value of the stock on the airline should fall after the accident. Mitchell and Maloney report that the average value of the airline equity fell by \$7.3 million after a crash.

Market forces do provide important deterrent effects following air crashes. Whether these financial incentives induced by the market are sufficient is beyond the scope of our work. The question this study can answer unambiguously is that the present system of compensation does not by itself add any significant financial incentives for safety commensurate with the full cost of accidents.

Our discussion of regulation and markets as alternative methods of providing deterrence for airline crashes should heighten concern when these alternative methods are not applicable. For many torts involving wrongful death (such as automobile accidents), the parties involved are strangers who have no other involvement with each other. In such cases, markets are not an alternative, and there is no regulatory agency responsible. For such accidents, the deterrence function of the tort system has a heavy burden, one that our study indicates it may not be able to bear alone. Since the procedures for calculating damages for wrongful death are the same in these other torts, the problems with inadequate compensation for deterrence may be especially acute there.

EQUITY OF COMPENSATION

Is compensation then adequate and fair? Here, too, reality falls short of the ideal. For every dollar of economic loss they suffered, survivors got only 49 cents. Since these relatives suffered non-economic losses as well, the true recovery rate on all losses were even smaller. Plaintiffs must also pay their lawyers, who on average are paid one dollar of every five dollars of compensation. The net recovery rates--what victims actually had to replace their loss after paying their lawyers--was only 39 percent.

If compensation fails an adequacy test, it does little better on the equity scale. For example, the average compensation paid for the average loss of \$748,000 was \$363,000. But we estimate that one in three decedents with an average loss of \$748,000 involved a compensation greater than \$750,000 or less than \$175,000. Similarly-harmed decedents are not treated the same. Vertical equity also does not exist, since as we have seen recovery rates declined with the size of the loss.

WHY IS COMPENSATION SO LOW?

Why is there less than full recovery for victims of airline crashes? We don't claim to have a full answer to that question. But we believe that there are five reasons that go some of the way toward explaining these low recovery rates.

First, for a variety of reasons, the tort system seems reluctant to apply its stated rules when they imply large awards. Our finding of declining recovery rates with the size of the loss is actually a very common one across many studies of tort damages, ranging from product liability to automobile injuries.[14] Because losses in airline crashes are large, perhaps we should not be surprised that recovery is less than full in these air crashes.

[14]Viscusi (1986), and Canard (1964), among others, report that recovery rates decline with the size of the award.

Second, as we have seen, compensation in aviation accidents is artificially limited by caps placed on recovery. These state and international treaty caps reduced total compensation by ten percent below what it would have been if the caps had not been in place. If the U.S. tort system aims to insure that similarly harmed individuals receive the same compensation, these international tickets run counter to that objective. Two-thirds of the international tickets were held by Americans. It is difficult to understand the rationale for so artificially limiting compensation.

Third, plaintiffs are probably risk averse. Settlement negotiation may be, and litigation often is, a very uncertain business. Because plaintiffs are less accustomed to dealing with large sums, they are probably more risk averse than defendants. In addition, defendants can average their risks across many plaintiffs. If plaintiffs are more risk averse, they will accept a certain lower payment (and one that is less than full recovery) rather than pursue a larger expected payment that may have substantial risks attached. Risk aversion is consistent with less than full recovery, and with the decline in recovery rates for losses.

Fourth, there is an evolving trend toward broader definitions of economic loss and compensation in economics, in the statutory provisions, and in judicial interpretation of those statutes. This recent liberalization builds on a more-than-century-long trend during which damages in wrongful death have become more inclusive. Our

principles in computing loss correspond to the logical endpoint of this evolution. However, not all courts have accepted this broader definition, and not all the cases in our sample reflect it. This disparity in principles governing loss makes our recovery rates lower.

Fifth, in a number of instances, experts used methods to calculate loss that were analytically incorrect and, on net, served to reduce the size of the award. When confronted with opposing arguments on difficult issues like salary growth, judges have often closed the debate by ruling that the question was "too speculative." The problem with the "too speculative" label is that, in practice, it often implied that zero was the correct answer.[15]

A remarkably small number of actors are involved in aviation cases. For the defendants, a lead insurer handles litigation, leaving the principal defendants--airlines and aircraft manufacturers--out of the main operational decision making. On the plaintiff side, a specialized attorney's bar has evolved that handles many cases. For example, we identified 14 plaintiff attorneys who handled forty five percent of all lawsuits. In addition, airline

[15]A good example of this problem was some court rulings on the treatment of inflation, particularly in the late 1970s when double digit inflation and nominal interest rates were commonplace. Some courts refused to adjust discount rates based on expected future inflation on the grounds that estimates of future inflation were too 'speculative.' They would also disallow future salary growth for the same reason. Unfortunately, the same courts allowed the use of nominal interest rates to discount these nominal rates already include a 'speculation' about inflation.

cases in federal courts often make use of multi-district litigation, a procedure where federal courts are authorized to transfer cases pending in different federal district courts to one district for consolidated pre-trial proceedings.[16] This small number of actors has the advantage that these individuals are knowledgeable about the complexities of the process (and each other), and it economizes on action costs. However, it also institutionalizes conservatism about the methods used to calculate damages. Since each side has a vested interest in the results, any suggestion for change is met with understandable skepticism. As a result, it becomes very difficult to alter methods even when the application of sound economic principles requires it.

If these arguments have merit, one implication is that compensation should have risen over time, even for decedents with the same economic loss. To address this question, Figure 7 shows trends in compensation over time for our typical decedent, one whose loss was \$748,000. For deaths equivalent in their loss, compensation has indeed risen across the years of these accidents, especially so during the last four years of the data. Compared to its initial level of \$306,000, compensation rose to \$441,000 by 1979-82. To put it another way, plaintiffs were recovering 59 cents on the dollar in our final crashes, compared to 41 cents on the dollar in the initial crashes that make up our sample.

[16]The most famous example in aviation accidents is Judge Pierson Hall of the Central District of California. Within a ten year period, ten aviation accidents involving hundreds of individual cases were sent to Judge Hall.

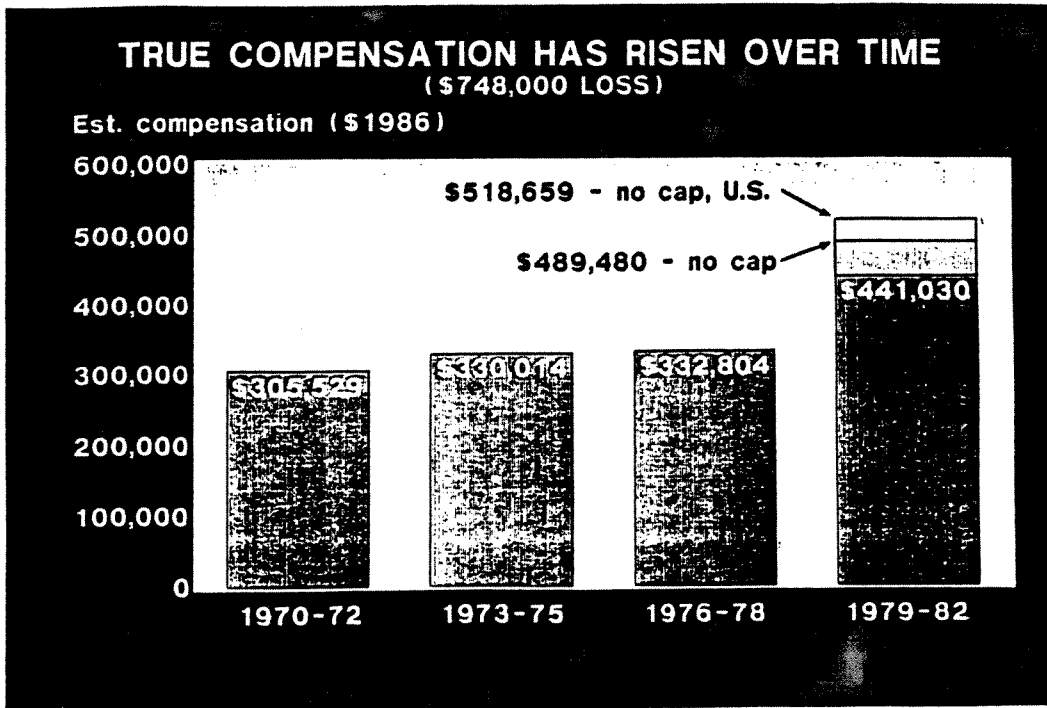


Fig. 7 -- True Compensation

What would compensation have been in these final years if there were no recovery caps and no foreign citizens, two factors which we now know lowered compensation? Eliminating caps on recovery would raise compensation another ten percent to \$489,000; and assuming that all passengers were Americans, compensation would rise to \$519,000. That is, our end-point recovery rate for the death of an American, not limited by a cap, was 69 cents on the dollar.

These numbers are also important because they add some necessary perspective to the debate. There is a tendency to evaluate the performance of the tort system as if it were a non-evolving fixed

system. These numbers indicate that this is simply not the case. Even for people who suffered the same loss, compensation and recovery rates have risen dramatically. Indeed, earlier studies comparing compensation and loss in automobile injuries during the 1960s produced recovery rates of 30 percent, much lower than even our initial values in these aviation accidents.

Our bottom line conclusions regarding whether compensation paid is adequate, fair or contributes significantly to deterrence are not affected by the time period. However, we are clearly taking snapshots of a system in rapid flux. Moreover, our end-point recovery rates refer to events of more than five years ago. We can only speculate on what recovery rates may be today, but if the strong trends we uncovered persisted, recovery rates may be moving towards more equitable and adequate standards.

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